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Needle and Syringe Programs and HIV-Related Risk Behaviors Among Men Who Inject Drugs: A Multilevel Analysis of Two Cities in Iran

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Abstract

Background Many studies have found significant differences in HIV risk at the community and socioeconomic levels. However, few have considered variations in needle and syringe program (Jin et al., Oral Dis. 1;22(7):609–19) coverage and other community characteristics on HIV risk behaviors among people who inject drugs (PWIDs). Our objective was to study the relationship between individual factors and city-level characteristics (such as the city's coverage of harm reduction programs) on HIV risk behavior among PWID residing in two cities in Iran.

Methods The study was conducted from March to August 2016 in Tehran and Kermanshah provinces. One thousand PWID were recruited by a convenience sampling recruitment at local NSP Drop-in Centers (DIC) and through "snowball sampling" (i.e., using peers to refer participants to the study). We first examined associations between individual-level variables and HIV risk behaviors in bivariate analysis using the chi-square or Fisher's exact tests, as appropriate. Next, multi-level models were constructed to determine the amount of variability in HIV risk behavior that could be accounted for by individual- and community-level characteristics. Variables with p value < 0.2 were included in the multiple logistic regression model.

Results The results of the multilevel modeling showed that 32% of the variability in HIV risk behaviors among PWID could be explained by factors that differed between the two cities. When individual factors including higher HIV knowledge, access to NSP, higher HIV risk perception, and methamphetamine use were all included in the final model, 22% of the variability in HIV risk behaviors could be explained to city-level variables.

Conclusion Findings suggest that expanding the accessibility (i.e., hours and venues) and community-level coverage of NSP services by establishing programs where PWID congregate might reduce HIV risk behavior among PWID.

Keywords Needle and syringe programs · Risk behaviors · Injection drugs · Multilevel analysis · Iran

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Introduction

People who inject drugs (PWID) are vulnerable to blood borne infections in Iran due to both injection-related and sexual risk behaviors [1–4]. In Iran, injection drug use is one of the major public health problems in recent decades [5]. According to a 2013 Harm Reduction International Report, there are estimated to be 170,000 to 230,000 PWID in Iran [2, 6, 7]. In a recent study, the prevalence of HIV infection was estimated to be 15% among PWID [8, 9]. The study indicated that 50% and 25% of PWID reported lifetime and recent needle and syringe sharing, respectively [8]. However, another study showed that more than two-thirds of the PWID reported access to needle and syringe programs [10, 11]. Although illicit opioid use has historically been the most common class of substance injected by PWID in Iran, methamphetamine is increasingly common, particularly among PWID in Kermanshah, a province in Western Iran [12]. Based on data from Iran's Center for Communicable Disease Control report, 65% of diagnosed HIV infection cases have occurred via shared injection practices [13]. In addition, unprotected sexual contacts were reported as relatively common in this population [14]. A national survey in 2010 showed that more than 60% of PWID reported unprotected sex during their last sexual encounter [15]. This pattern of overlapping sexual and injection risks allows for the spread of HIV infection among both injecting and non-injecting networks [16, 17]. A recent study of female partners of PWID reported HIV prevalence to be as high as 2.8% [18].

Approaches to HIV risk reduction among PWID include HIV testing and counseling programs, street-based outreach conducted by peer educators, community-level interventions to change injecting norms, providing condom for safe sex and needle syringe programs (NSPs) to provide sterile injection equipment [19]. In 2002, the first NSPs were established in Iran [6]. NSPs occur within Drop-in Centers (DICs) and by street outreach teams to work with those having difficulty accessing such services. National data in Iran has demonstrated that, possibly due to financial and human resource limitations, coverage is much lower than desirable, and has not yet reached the levels required to prevent HIV transmission among PWID in many jurisdictions [19, 20]. According to the present national guidelines, DICs are required to make sterile needles and syringe services available and provide psychoeducation about safer injecting practices and overdose prevention behaviors. They also supply condoms and safe sex training materials. The clients are persuaded to frequently visit the sites. People who self-report injecting drugs are provided safe injection kits, consisting of 3–4 syringes, 3–4 extra needles, pure water vials, and alcohol pads.

In spite of the fact that harm reduction programs may help to stabilize the HIV epidemic among PWID in Iran, risk behaviors such as needle/syringe sharing remain common among PWID [8]. Theoretically, expanding the coverage of NSP at the city level may broadly reduce HIV risk behaviors, regardless of the direct participation of the individual people who use drugs in the program. For example, when NSP coverage is high, PWID attitudes towards harm reduction program may be more positive, and they may also support each other more in reducing their risks [19, 21]. Previous research has demonstrated that the structural "risk environment" plays an important role in shaping HIV transmission risk, either directly or indirectly [22]. Most previous literature involving PWID in Iran has focused on the association between HIV risk behavior and individual-level factors, while the effect of city-level characteristics on HIV risk behavior has received limited attention. To address this knowledge gap, we conducted a multi-level analysis to examine whether structural characteristics (i.e., NSP coverage) were associated with individual risk behavior, such as syringe sharing and unprotected sex, among male PWID in Iran. We hypothesize, when coverage is high, PWID attitude towards harm reduction program will be more positive, and they will also support each other more in reducing their risks [19, 21]. Rhodes et al. [22] study demonstrated that the structural environmental change could play an important role in shaping HIV transmission risk, either directly or indirectly. Based on review of literature, an ecological conceptual model theory was used. SEM is theory-based, a framework for understanding the multiple levels of a social system and interactions between individuals and environment within this system. As many studies showed, HIV infection can result from interactions among personal behavioral, social, and structural factors (i.e., coverage of harm reduction) [23].

We used a multi-level model not only to include individual-level determinants, but also to control for city-level determinants. Our objective was to study the relationship between the individual, other city-level characteristics (such as the city's coverage of harm reduction programs), and HIV risk behavior among PWIDs in Iran.

Methods

The study was conducted from March to August 2016 in Tehran and Kermanshah provinces. Kermanshah is the first city in which NSPs were implemented, and was the first jurisdiction to report an HIV diagnosis due to injecting drug use in 1996. Tehran is the capital of Iran and the largest city in the country with a unique cultural environment and political context.

In response to the high prevalence of HIV among PWID, harm reduction services have been launched all over the country, including Kermanshah and Tehran city, since 2002. Despite implementation of harm reduction programs, including NSPs and OMTs, the prevalence of HIV among PWID is still high in the cities. HIV prevalence among PWID in Tehran is 15.2% [24] and the rate among PWID in Kermanshah is also 15% [25].

For this study, PWIDs were recruited by convenience sampling recruitment at local DICs and through "snowball sampling" (i.e., using peers to refer participants to the study). Study participants were required to be at least 18 years of age, had injected drugs at least monthly during the last 6 months, and were able to provide informed consent to complete the interview. Ethics approval was obtained from the Ethics Committee of The University of Social Welfare and Rehabilitation (USWR).

Trained interviewers administered the questionnaire. Eight experts in the conduct of behavioral surveys, epidemiology, and harm reduction evaluated and approved the content validity of questionnaire. The reliability of the questionnaire was evaluated by asking ten participants to complete the survey twice with a two-week time period. The total intra-class correlation was computed 0.87, which denotes the suitable range of reliability that could be accepted [26].

The questionnaire included modules on socio-demographic characteristics: age (years), marital status, education level, province of residence (Tehran province or Kermanshah province), age at initiation of drug use, and duration of drug use (number of years). Risky injecting behaviors included frequency of injection, receptive syringe sharing (i.e., using a syringe after it has been used by someone else), distributive syringe sharing (i.e., giving someone else a syringe after you have used it), equipment sharing (i.e., sharing equipment such as filters or spoons while preparing a drug for injection), sexual behaviors, HIV testing, knowledge of HIV, and participation in needle and syringe programs.

HIV/AIDS knowledge was measured with an 8-item set of questions covering basic knowledge of HIV/AIDS. Participants could answer with one of three possible responses to each knowledge statement: "yes," "no," or "I don't know". A correct answer was coded as 1; an incorrect answer coded as 0. "Do not know" responses were considered as incorrect. The sum of the number of correct responses to the eight statements served as the score for the knowledge level in the analysis [21]. HIV risk perception, measured using this question, "How likely are you to become infected with HIV?", was queried on a five-point scale from 0 (no risk) to 5 (high risk). Responses were dichotomized into two categories: a score ≤ 2 was considered as low to no risk and ≥ 3 was considered as high risk [21, 27].

Individual-level exposure to NSP services in the past year was assessed with the question: "Have you received free syringes from NSPs during the last 6 months?" the answers were coded as "1 = yes" and "0 = no". All other behavioral questions referred to the 6 months prior to completing the interview. The primary city-level variable was coverage of NSPs, which was calculated by dividing the number of injections reported by participants by the total number of syringes distributed by the city DICs [19].

Our primary outcomes of interest were HIV risk behaviors, which included two combined components: receptive syringe sharing (RSS) and unprotected sex. The RSS variable was derived from a survey question that asked participants: "In the past 6 months, with how many people did you use a needle after they injected with it?" The responses were dichotomized into any receptive sharing in the last 6 months (yes vs. no). The unprotected sex variable was derived from survey questions that asked participants about engaging in sex with a partner without using a condom in the last 6 months (including causal or commercial partners).

We first examined associations between individual variables and HIV risk behaviors in bivariate analysis using the chi-square or Fisher's exact tests, as appropriate. Variables with p value < 0.2 were included in a multiple logistic regression model. We controlled for a number of sociodemographic characteristics in our adjusted models, specifically education, marital, and employment status. We reported the adjusted odds ratio (aOR) point estimate and 95% confidence interval (95% CI) as the effect measure. Lastly, a multilevel logistic regression was performed to take account of the heterogeneity of HIV risk at the city level. The multi-level models were constructed in five steps: the null model included only HIV risk as the outcome and city-level NSP coverage variable as the independent variable, model 1 added HIV knowledge, model 2 included individual-level access to NSP variable, model 3 added HIV risk perception, model 4 added methamphetamine use, and model 5 added HIV status awareness. Interclass correlation coefficients [28] were used to explore the magnitude of variation of HIV risk behaviors in PWIDs at the city level. The level of significance used in the multilevel analysis was 0.05. We used STATA v. 11 for all analyses.

Results

All 1000 PWID who were screened as eligible based on an initial screening test consented to participate in the study. Among them, 40 were excluded from the final analysis because of an incomplete questionnaire, leaving 960 eligible participants for this analysis. Characteristics of the study population by city are shown in Table 1. PWID in the two cities reported differences in HIV risk behavior, including receptive syringe sharing, distributed syringe sharing, and unprotected sex (Table 1). In addition, city-level NSP coverage was higher in Tehran as compared to Kermanshah city (0.82 vs. 0.78).

Table 2 describes the bivariate and multivariate logistic analyses of variables associated with injection and sexual-related HIV risk behavior among male PWID. Variables with a p value < 0.2 were included in a final multivariable model. In the final multivariable model, factors independently associated with recent engagement in HIV risk behavior were lower level of education (AOR = 0.52, 95% CI 0.20–0.75), homelessness (aOR = 1.91, 95% CI 1.35–2.71), HIV status awareness

Table 1 Population characteristics and risk profile of male people who inject drugs in Tehran and Kermanshah, 2016

	Tehran ($n = 500$) \	Kermanshah ($n = 460$) n (%),	
	n(%)	n(%)	p value
Age			0.55
< 30	160(32)	130(28)	
30–40	240(48)	200(44)	
> 40	100(20)	130(28)	
Education			0.02
< 6 years	320(64)	270(59)	
≥ 6 years	180(36)	160(41)	
Marital status			0.65
Never married	120(24)	250(54)	
Married	200(40)	180(39)	
Separated/divorced/widow	180(36)	30(7)	
Occupation			0.32
Unemployed	390(78)	400 (87)	
Employed	110(22)	60(13)	
Current housing status			0.05
Stable housing	340 (68)	350 (76)	
Homeless	160(32)	110(24)	
Age at first drug use (year)			0.03
< 25	350(70)	409 (89)	
≥ 25 years	150(30)	51(11)	
Age at first drug injection			0.55
< 25	300(60)	273 (59)	
≥ 25 years	200(40)	187(41)	
Number injection per day			0.25
< 3	290(58)	280(61)	
≥ 3	210(42)	180(39)	
Individual variables			
HIV testing			0.4
Yes	310(62)	300(65)	
No	190(38)	160(35)	
NSP utilization			0.33
Yes	360(72)	360(78)	
No	140(28)	100(22)	
HIV status awareness			0.04
Yes	380(76)	280(61)	
No	120(24)	180(39)	
HIV status (self-report)			0.4
Positive	60(12)	83(18)	
Negative	325 (65)	276(60)	
HIV-unknown	115(24)	101(22)	
City-level variable			
NSP coverage)%)	82	78	0.04
Risk behavior variables			
Receptive syringe sharing: n(%)	75 (15)	124 (27)	0.03
Distributive sharing: n(%)	125 (25)	147 (32)	0.04
Unprotected sex: n(%)	150 (30)	170 (37)	0.3

(aOR 1.32, 95% CI 1.21–2.23), level of HIV-related knowledge (aOR = 0.55, 95% CI 0.22–0. 72), and higher perceived risk of HIV infection (aOR = 2.78, 95% CI 1.15–5.21). There was a statistically significant relationship between recent NSP access and HIV risk among PWID. Specifically, the odds of HIV risk were lower

Table 2 Crude (COR) and adjusted odds ratios (AOR) of risk factors associated with past 6-month engagement in HIV risk behavior among male PWID, Tehran and Kermanshah, 2016

Characteristics	Bivariate COR (95% CI)[a]	*p* value	Multivariate AOR (95% CI)[b]	*p* value
Age (year)				
< 30	1 (reference)		1 (reference)	
30–39	1.09 (0.92–1.32)	0.42	1.04 (0.78–1.82)	0.33
40+	1.22 (1.03–1.42)	0.01	0.54 (0.38–1.52)	0.41
Level of education				
< 6 years	1 (reference)		1 (reference)	
≥ 6 years	0.61 (0.22–0.88)	0.01	0.52 (0.20–0.75)	0.02
Marital status				
Never married	1 (reference)		1 (reference)	
Married	1.12 (1.03–1.32)	0.01	1.12 (1.06–1.32)	0.02
Separated/divorced/widow	1.31 (1.11–2.74)	0.04	1.34 (1.13–2.74)	0.03
Employment status				
Unemployed	1 (reference)		1 (reference)	
Employed	2.3(1.36–3.23)	0.03	1.81(.23–2.43)	0.41
Living status				
Stable housing	1 (reference)		1 (reference)	
Homeless	2.32 (1.37–3.2)	0.01	1.91 (1.35–2.71)	0.01
Primary drug of use in last month				
Others	1 (reference)			
Methamphetamine	3.01 (0.81–10.72)	0.44		
Heroin	1.31 (0.91–1.82)	0.61		
Age of drug use initiation (year)				
≥ 25 years	1 (reference)			
< 25	0.91 (0.72–1.22)	0.32		
HIV status awareness				
No	1 (reference)		1 (reference)	
Yes	1.22 (1.11–1.42)	0.03	1.32 (1.21–2. 23)	0.02
Age of first drug injection				
< 25 years	1 (reference)			
≥ 25 years	0.81 (0.32–2.04)	0.51		
Current drug most often injected		0.01		0.02
Heroin	1 (reference)		1 (reference)	
Methamphetamine	1.92 (1.41–4.82)		1.7 (1.21–4.35)	
NSP utilization				
No	1 (reference)		1 (reference)	
Yes	0.63 (0.41–0.88)	0.001	0.62 (0.25–0.87)	0.01
HIV knowledge (score)	0.43 (0.17–0.72)	0.001	0.55(0. 22–0. 72)	0.01
Perceived HIV risk				
No risk	1 (reference)		1 (reference)	
Very high	2.41 (1.18–4.71)	0.02	2.78 (1.15–5.21)	0.01

[a] COR: crude odds ratio

[b] AOR: adjusted odds ratio

in those who had utilized an NSP (aOR = 0.62, 95% CI 0.25–0.87). Drugs used most commonly in the last month, age of drug initiation, and age of first drug injection did not show any significant association with HIV risk.

The results of the multilevel modeling are shown in Table 3. In model 0, the ICC was 0.32 (95% CI 0.04–0.63), indicating that 32% of the variability in HIV risk behaviors among PWID could be explained from factors that differed between the two cities. In the final model, when individual factors including

Table 3 Crude and adjusted odds ratio in multilevel regression analysis of factors associated with injection risky behaviors among PWID ($N = 960$)

	Crude OR (CI 95%)	Adjusted OR (CI 95%)
HIV knowledge (score)	0.30 (0.18–0.64)	0.45 (0.11–0.76)
NSP utilization	0.55 (0.20–0.82)	0.67 (0.14–0.87)
HIV risk perception	1.13 (1.02–4.25)	2.40 (2.12–4.42)
Methamphetamine use	1.21(1.02–5.06)	1.12 (1.01–4.07)
HIV status awareness	0.23 (0.11–0.32)	0.48 (0.13–5.12)
City-level variable		0.67 0.27–0.67
ICC in null model	0.40 (95% CI 0.11–0.70)	
ICC in full model (model 5)	0.33 (95% CI 0. 1–0.76)	

All models were adjusted for level of education, marital, and employment status

higher HIV knowledge, NSP utilization, high HIV risk perception, and methamphetamine use were all included in the final model, most of the variation in HIV risk behavior was at the individual level, but there were also some variation at community level as indicated by significant city-level variable random variance. The ICC value after controlling for individual- and community-level factors was about 22%, which was the proportion of total unexplained variability in HIV risk behavior that could be attributed to unobserved *City-level* effects. Results of the final multilevel model showed that the odds of HIV risk behavior were lower among PWID who had recently utilized NSPs (aOR = 0.50, CI 95% 0.26–0.91) (Table 4). In the final model, city-level NSP coverage was variably found to be significantly associated with HIV risk behavior (aOR = 0.55, CI 95%: 0.34–0.87). Specifically, living in a city with a higher proportion of NSP coverage was associated with reduced odds of HIV risk behavior.

Discussion

We identified several individual determinants that were associated with engagement in sexual and injection-related HIV risk behaviors among PWID, even after adjusting for city-level correlates in a multi-level model. These variables included: HIV risk perception, low HIV knowledge, methamphetamine use, and NSP utilization. We also found considerable variation in HIV risk behaviors between the two cities. Notably, the value of the adjusted odds ratio in the multilevel model showed that there was a significant and substantial protective association between city-level NSP coverage and HIV risk behaviors.

Consistent with previous findings in both international and national settings, our study indicated that PWID who reported increased access to needle and syringe programs were less likely to report HIV risk behavior. For example, Vazirian et al. found that the rate of syringe sharing in the past month among PWIDs who obtained more than seven syringes per week was two to three times lower than those who received less in Tehran [6, 15, 19, 29]. We also found that higher HIV knowledge was associated with lower odds of HIV risk behaviors. Another research has found inverse associations between higher HIV/AIDS knowledge and HIV-related risk behaviors, which is consistent with the results of this study [30, 31].

Although the effect of needle and syringe programs in reducing HIV risk behaviors among PWID has been shown in previous research [20], the results of multilevel model showed that the program coverage in the province, independent of other individual-level factors such as awareness, could reduce risky behaviors, including syringe sharing and unprotected sex. One of the reasons for this may be the influence of NSP coverage on PWID social networks. Social networks are important sources of influence on HIV risk behaviors, including needle and syringe sharing, among PWID. Social network members may include drug partners, friends, neighbors, or

Table 4 Crude and adjusted odds ratio in multilevel regression analysis of factors associated with sexual risky behaviors among PWID ($N = 960$)

	Crude OR (CI 95%)	Adjusted OR (CI 95%)
HIV knowledge (score)	0.24 (0.12–0.84)	0.21 (0.10–0.90)
NSP utilization	0.65 (0.13–0.76)	0.52 (0.12–0.84)
HIV risk perception	2.03 (1.56–4.35)	1.2 (1.11–5.21)
Methamphetamine use	2.44 (1.00–4.46)	2.12 (1.02–4.17)
HIV status awareness	0.57 (0.11–0.75)	0.22 (0.40–5.72)
City-level variable		0.62 0.14–0.91
ICC in null model	0.28 (95% CI 0.01–0.77)	
ICC in full model (model 5)	0.20 (95% CI 0.01–0.67)	

coworkers [32]. Social networks can facilitate reduced risk behaviors of network members through social influence, social engagement, and social support [33]. It is possible that increased NSP coverage at the city-level helps support these positive processes in PWID social networks.

Similar to another study [34], the findings of our study indicates that PWID were capable of evaluating their perceived risk of HIV infection, which reveals that they were conscious about their individual HIV risk factors. High-risk perception among PWID had a significant association with high-risk behaviors, including unprotected sex and having multiple sexual partners. This finding corroborates the evidence from Kenya that reported the odds of having risky sexual behaviors was more than triple among men and women who had high HIV risk perception [35].

Our findings also suggest that methamphetamine use increases risk for HIV risk behaviors. There are studies on association between methamphetamine use and HIV risk among PWID [36, 37], although few have been conducted in Iran. Some studies indicated that methamphetamine use can lead to an elevated risk for HIV infection [38–40]. Further research should investigate the trends and patterns of, as well as the harms associated with, methamphetamine use among PWID in Iran. Interestingly, our findings contrast with earlier researches in Vietnam that showed that methamphetamine use among PWIDs can increase injection risk behaviors [41]. Feelemyer et al. showed that there are associations between methamphetamine use and sexual risk behaviors but did not find any associations between methamphetamine use and injection risk behaviors among PWID [41]. A study in Australia showed that methamphetamine use can increase odds of injection risk behaviors (needle and other injecting equipment sharing) [42].

Several limitations to our study must also be noted. First, the cross-sectional design does not allow for us to directly investigate the causal relationships between the variables of interest and the primary outcomes. Second, the sample is not random, and caution is thereby necessary in generalizing the results to all PWID living in Iran. Third, the behaviors were self-reported, and thus some under-reporting of particularly stigmatized behaviors (such as syringe sharing) is possible.

The results of this study could be useful for health care policymakers and public health officials in Iran. Our results suggest that increasing the number of distributed syringes, expanding the accessibility (i.e., hours and venues) and coverage of NSP services, and establishing NSP services where PWID congregate may reduce HIV risk behaviors among PWID. Our finding proved that using multilevel modeling can elucidate that individual and social factors on behaviors that are associated to HIV in Iranian context. Also, the exploration of the structural environment and other multilevel factors that contribute to excessive HIV/AIDS disease burden are important points of intervention to change policies, establish new HIV prevention strategies such as needle and syringe programs, and develop evidence to inform the distribution of services and resources for high-risk population (i.e., PWIDs). Such comprehensive intervention packages have been shown to be effective in developed settings such as San Francisco and Montreal, where the risk of HIV transmission among PWID has been shown to decrease over time with the scaling up of NSP services [43].

Conclusion

Study findings suggest that expanding accessibility (hours and venues) and coverage of NSP services by establishing NSP services where PWID congregate can reduce HIV risk behavior among PWID.

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Compliance with Ethical Standards

Conflict of Interests All authors have no conflicts of interest to be declared.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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