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Patterns of HIV Risks and Related Factors among People Who Inject Drugs in Kermanshah, Iran: A Latent Class Analysis

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Conflict of interests

AN participated in the planning and implementation of harm reduction programs in Ministry of Health. All other authors had no conflicts of interest to be declared.

Authors' contributions

AM and MN helped in study concept and design. MN and HSH helped in analysis and interpretation of data. MN and AM drafted the manuscript. AN, PH, BM, HSH, AM, MV helped in critical revision of the manuscript.

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Abstract

The objective of this study was to explore patterns of drug use and sexual risk behaviors among people who inject drugs (PWID) in Iran. We surveyed 500 PWID in Kermanshah concerning demographic characteristics, sexual risk behaviors, and drug-related risk behaviors in the month prior to study. We used latent class analysis (LCA) to establish a baseline model of risk profiles and to identify the optimal number of latent classes, and we used ordinal regression to identify factors associated with class membership. Three classes of multiple HIV risk were identified. The probability of membership in the high risk class was 0.33, compared to 0.26 and 0.40 for the low and moderate risk classes, respectively. Compared to members in the lowest-risk class (reference group), the highest-risk class members had higher odds of being homeless (OR = 4.5, CI: 1.44–8.22; $p = 0.001$) in past 12 months. Members of the high risk class had lower odds of regularly visiting a needle and syringe program as compared to the lowest-risk class members (AOR = 0.42, CI: 0.2–0.81; p = 0.01). Findings show that sexual and drug-related HIV risk clusters among PWID in Iran, and emphasize the importance of developing targeted prevention and harm reduction programs for all domains of risk behaviors, both sexual and drug-use-related.

Keywords

snowball sampling; sexual risk behaviors; people who inject drugs; Latent Class Analysis; drug-related risk behaviors

Based on national reports, there are approximately 170,000–230,000 people who inject drugs (PWID) in Iran (Nazari et al. 2016). Among PWID, drug injection behaviors like needle and syringe sharing, paraphernalia sharing, and unprotected sexual behaviors are the most common risk factors for HIV transmission (Rahimi-Movaghar et al. 2012). A national survey in 2010 showed that almost 60% of PWID reported unprotected sex and 40% had reported needle sharing in the past month (Khajehkazemi et al. 2013). Many studies conducted around the world suggest there is association between drug and sexual practices and risk of HIV in PWID (Alipour et al. 2010; Strathdee et al. 2012). However, few studies have examined concurrent patterns and the clustering of needle/syringe sharing and sexual behaviors among PWID in the Middle East, including in Iran (Marshall et al. 2011; McCoy et al. 2004).

Previous studies on risk behaviors among PWID often focus on injecting and sexual risk separately and identify factors that influence these behaviors (Neaigus et al. 2013). Most studies have used traditional analysis methods, such as logistic regression, to identify risk factors associated with HIV infection (Des Jarlais and Semaan 2008; Santibanez et al. 2006). Although variable-centered methods such as logistic regression have been important to explore risk behaviors associated with HIV infection, these techniques might overlook true heterogeneity in this population (Noor et al. 2014).

Statistical methods such as latent class analysis (LCA) have been used to characterize patterns and the spectrum of drug use and sexual risk behaviors in PWID (Lynskey et al. 2006). Latent class analysis (LCA) is a form of cluster analysis that, as an inductive technique, identifies unobservable subgroups (i.e., latent) profiles or classes of individuals with shared characteristics (Monga et al. 2007). LCA methods provide multiple observed indicators to identify subgroups of PWID that have distinct HIV risk patterns, while simultaneously examining covariates associated with these patterns (Monga et al. 2007). Unlike traditional regression methods, LCA does not assume linearity, normal distribution, or homogeneity of variance(Noor et al. 2014) . This method has been applied in other studies relevant to drug use, sexual behavior and mental health disorders (Lynskey et al. 2006; Monga et al. 2007; Noor et al. 2014). Previous studies have used latent class analysis (LCA) to describe patterns (or “classes”) of multiple HIV risk among PWID. For example, in a study of over 500 PWID in Houston, Texas, Noor et al. (2014) showed that people in the highest risk class had the highest prevalence of both risky drug-use behaviors and risky sexual behaviors (Noor et al. 2014).

The primary objective of this study was to explore classes and patterns of concurrent drug use and sexual behaviors. Second, we sought to examine factors associated with specific patterns of multiple HIV risk in PWID in Iran. Examining behavioral heterogeneity and clustering in PWID is important to implement and develop more effective strategies to reduce HIV risk among PWID, and is a fundamental step toward reducing high-risk behaviors in PWID.

Methods

Using snowball sampling techniques, we recruited 500 PWID in Kermanshah (in the western part of Iran) between September and December 2014 in a cross-sectional survey. The study population and data collection procedures have been described previously . Briefly, participants were aged over 18 years, had reported injecting drug use in the past month, had been residing in Kermanshah for a minimum of 1 month, were able to speak and comprehend Farsi enough to respond to the survey questions, and were able to provide informed consent to complete the interview. Study procedures were approved by the kerman medical university Institutional review Board.

The questionnaire included modules on socio-demographic characteristics, sexual behaviors, HIV testing, participation in harm reduction programs, frequency of injection, injection-related risk behaviors such as sharing of syringes/needles, number of injecting partners they have shared syringes/needles, and number of sex partners they had over the 12 month prior to the interview. Receptive syringe sharing (RSS) was defined as injecting with a syringe after someone else has already used it. The unprotected sex variable was derived from survey questions which asked participants about engaging in sex without using a condom in the last 12 months (with both commercial sex work and causal partners). The responses were dichotomized to ‘‘any unprotected sex in the last 12 months” (yes vs. no).

We used LCA to establish a baseline model of risk profiles encompassing five items of drug and sexual behavior measures. Drug use related items were: RSS, sharing paraphernalia (i.e.,

cookers, cotton filters, and rinse water) and sharing with >2 injecting partners. Sexual behaviors included >2 sex partners and unprotected (condom less) sex. We began with a two-class model and successively increased the number of classes by one, fitting a new LCA model to the data at each step until the best data fit was identified. The models were fit with an increasing number of class sizes until the lowest sample-adjusted BIC value was reached. The number of classes was selected according to standard goodness-of-fit indices. Fit indices were the likelihood ratio test statistic G2 and three information criteria, including: the Akaike information criteria (AIC), Bayesian information criterion (BIC) and consistent AIC (CAIC). Lower values of AIC, BIC and CAIC indicated a better fitted model (Noor et al. 2014). After identification of the latent classes and optimal number of latent classes, we used ordinal logistic model regression to identify factors associated with class membership. Variables significant (at $p < 0.2$) in bivariate analyses were considered for inclusion in the multivariate analysis. The final models included variables that were significant at $p < 0.05$. We reported adjusted odds ratios (AOR) 95% confidence interval (CI) from this model. All data analysis was performed using Stata 11.

Results

Participants ranged in age from 18 to 68 years (median = 28 years; SD = 7.6.85 years). The mean, SD and median durations of injection drug use were 6.0 ± 4.6 and 3.2 (IQR, 3.6–11.1) years, respectively. The mean and SD age of first drug use were 21.4 ± 5.6 and (IQR, 20.6–26.1). The majority of respondents were single (73%), and 90% had monthly income less than 150 USD. In the last 12 months, 38% (CI: 18.3%–51.2%) reported engaging in multiple HIV risk (Table 1). Twenty-one per cent of PWID aged under 30 had multiple HIV risks, significantly higher than older ones. Also 31% of those who reported being homeless had multiple HIV risks. Twenty-five per cent of single people were found to have engaged in HIV risk behaviors.

Table 2 shows the estimated unconditional probability of each class and the proportion of each class reporting each risk behavior. The unconditional probability of membership in the high-risk class was 0.33. This means that this subgroup comprised 33% of the sample participants. Low and moderate risk classes included 26% and 40% of the sample, respectively. The high-risk class reported a high-probability of needle/syringe sharing, having more than 2 sharing partners, and unprotected sex. A majority of the high risk class also reported sharing drug preparation equipment. The moderate risk class (40% of participants) showed a response pattern that reflected high probabilities of sharing drug paraphernalia and moderate probabilities of other risk behaviors. Finally, a low-risk class (26% of respondents) reported low probabilities of injecting risk behaviors and sexual risk behaviors. The low risk subgroup had a low probability of sharing needle and sharing equipment. The probability of reporting unprotected sex with a partner was low (0.13) at last sex.

In bivariate analyses, covariates including age, income, education level, age at first drug use, age at first drug injection and being homeless were significantly associated with class membership. These variables were entered into the multivariable regression model. In Table 3, the adjusted odds ratios (AOR) for class membership are reported. Compared to the

lowest-risk class (reference group) members, the highest-risk class members had higher odds of being homeless (OR = 4.5, CI: 1.4–8.2; p = 0.001) in past 12 months. Having a primary school education level also predicted membership in the highest-risk class. Also, being younger than 25 years at injecting drug initiation, predicted membership in the high risk class (AOR = 3.5, CI: 1.2–7.42; p = 0.002). Members of high class had also higher odds of use of methamphetamine (p=0.04): use of methamphetamine was 3.65 times more likely among participants in the high-risk class, as compared to participants low risk class, AOR =3.7 (CI 1.7–7.6). Finally, membership in the high risk class had lower odds of regularly visiting (at least weekly) an NSP as compared to the lowest-risk class members (AOR =0.4, CI: 0.2–.8; p = 0.01). Similar results were observed when comparing the moderate risk class to persons in the lowest risk class, although the effect estimates tended not to be as strong. For example, persons in the moderate risk class were 2.6 times the odds of being homeless (CI: 1.4–5.7) compared to the low risk class.

Discussion

The most notable finding of this LCA was that PWID represent a heterogeneous group regarding sexual and injecting risk behaviors for HIV. In our LCA, patterns of drug-using and sexual risk behaviors were classified into three distinct multiple HIV risk classes. Overall, results of LCA showed that 34%, 40% and 26% of the PWID fell into the high-risk class, medium-risk class and low risk class, respectively. PWIDs in the highest risk subgroup had the highest prevalence of risky drug-use behaviors and sexual behaviors. The lowest-risk class members had less risky drug and sexual behaviors.

Low education was associated with higher risk among PWID. Low income was also associated with class membership and multiple HIV risk. Specifically, PWID with less education and with less income were more likely to belong to the highest-risk class, compared to either the medium-risk class or the lowest-risk class. Homeless PWID were more likely have multiple HIV risk and most likely to belong to the high risk subgroup. These findings are in line with previous research that has identified lower socioeconomic status, lack of social support, and homelessness as associated with HIV risks in PWID (Salazar et al. 2007; Marshall et al. 2011). These relationships are likely due to the fact that low income, education, and homelessness produce unsafe sexual and injecting behavior as result of a need for drugs, housing, and economical resources.

We also observed that PWID who used methamphetamine were more likely to belong to members of the highest-risk class than members of the lowest-risk class. This is similar to findings showing amphetamine-type stimulants use increases the odds of involvement in high risk behaviors, particularly risky sexual behaviors (Kral et al. 2001; Molitor et al. 1999). Methamphetamine use is a new phenomenon in Iran and thus merits further research on prevalence and geographical distribution due to its strong association with HIV transmission (Mehrjerdi and Noroozi 2013).

PWID who reported regular visits to needle and syringe programs were less likely to belong to the moderate and highest-risk classes. These findings suggest that regular utilization of needle and syringe programs can reduce HIV risks among PWID in Iran. This is consistent

with findings from other studies showing that reductions in sexual and injection-related risk behaviors are related to increasing access to NSPs (Cao and Treloar 2006; Vazirian et al. 2005; Noroozi et al. 2016).

One limitation of this study is the cross sectional design which does not enable us to directly investigate the causal relationships between variables of interest and membership in multiple HIV risks classes. Furthermore, our data were based on participant self-report and may therefore be subject to recall and social desirability bias (Latkin and Vlahov 1998). Third, the sample is not random and was recruited using snowball sampling techniques, which may have biased the sample because of the size of participants' social networks and homophily in recruitment patterns. Caution is necessary in generalizing the results to all PWIDs living in Iran.

The high prevalence of PWID in the "high-risk" class raises an alarm for the health authorities in Iran to design and implement effective and timely interventions to prevent HIV transmission among this population and to their partners. These findings emphasize the importance of having targeted prevention programs for all domains of risk behaviors, both sexual and drug-use-related. These interventions should focus on PWID who are homeless, with low income and low education. Increasing the hours and locations of sterile syringe sources to places with high concentrations of homeless PWID is warranted so as to encourage more frequent and consistent utilization of NSPs.

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Table 1

Population characteristics and risk profile for people who inject drugs in samples of PWID, Kermanshah, western Iran 2014 (n=500)

Variable	N (Percent)
Age (yr)	
<30	220 (44)
30–39	150(30)
≥40	130 (26)
Education	
Primary or below(under of grade 6)	370 (73)
Diploma and high(up to grade 6)	130 (27)
Monthly income	
less than 150 US$	450 (90)
150 US$ or more	80 (10)
Age of first injecting drug use	
<25 years	310 (62)
≥25 years	190 (38)
Age of first drug use (yr)	
<25 years	420(84)
≥25 years	80 (16)
Needle/syringe sharing in past month	141 (28)
Borrowing or lending paraphernalia in past month	327 (67)
Unprotected sex in past month	162 (33)
Mean number of injecting partners (SD)	2.43 (1.4)

Table 2

Goodness-of-Fit Indices Comparing Class Models of Pattern of multiple HIV risks

Class	AIC	BIC	CAIC	G^2
2	3294.6	3358.5	1420	1322
3	2553.2	2300	1189	1279
4	2652.2	2537	1237	1100
5	3492.5	2402	1204	980

Note: Akaike information criteria (AIC), Bayesian information criterion (BIC), and consistent AIC (CAIC)

Table 3

latent class probability and conditional probability of the 3-class model

	Latent Class (Unconditional probability of each class)		
Behaviors	**Low risk (0.26) N=130**	**Moderate risk (0.40) N=200**	**High risk (0.34) N=170**
Having needle sharing	0.12	0.30	0.54
Sharing drug preparation	0.30	0.82	0.78
Presence of sharing partner>2	0.15	0.45	0.60
Presence of sexual partner>2	0.10	0.33	0.42
Unprotected sex	0.13	0.47	0.63

Table 4

adjusted odds ratio for risk behaviors of PWID, Kermanshah, Iran 2015.

Variable	Class of risk behaviors*	
	Moderate AOR**(CI)	High risk AOR(CI)
Age(>30)	1.23(0.62–2.35)	1.7(0.42–2.83)
Education (<high school)	4.38 (2.72–10.62)	4.38 (2.72–10.62)
Monthly income(<150)	3.0 (1.7, 5.5)	3.7 (1.7, 5.8)
Homeless	2.6 (1.4, 5.7)	4.5(1.44–8.22)
Methamphetamine use	3.2 (1.74–6.52)	3.65 (1.74–7.64)
Age at first drug injection, (<25) year	2.7(1.8–6.87)	3.5(1.2–7.42)
Regular Visit to Needle and Syringe Program	0.50 (0.23–92)	0.41(0.20–0.81)

*Reference group: low risk class

**Odds Ratio and 95% Confidence Interval