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Social and structural determinants of health associated with drug use patterns among female sex workers in Iran: A latent class analysis

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Abstract

Background: Female sex workers (FSWs) experience adversities regarding social determinants of health (SDH) and behavioural factors including illicit drug use. This study aimed to assess the clustered impact of SDH on illicit drug use among FSWs in Iran.

Methods: We surveyed 1,347 FSWs in 13 major cities in 2015. Latent class analysis was conducted to identify distinct classes of five measured SDH including low education, unemployment, unstable housing, last-year incarceration and sexual violence. We examined the association of these classes with five illicit drug use patterns using multivariable generalized linear model with Poisson family and log link, and reported adjusted prevalence ratios (aPR) and their 95% confidence intervals (CI).

Results: We identified five SDH classes: Class 1: no SDH adversities; Class 2: mainly unemployment; Class 3: low education and unemployment; Class 4: sexual violence and unemployment; and Class 5: multiple SDH adversities. The prevalence of last-month drug use ranged from 7.0% in Class 1 to 53.3% in Class 5. Compared to FSWs in Class 1, those in Class 2 (aPR: 2.47, 95% CI: 1.15, 5.27), Class 3 (aPR: 3.69, 95% CI: 1.62, 8.36), Class 4 (aPR: 4.49, 95%

CI: 1.71, 11.78) and Class 5 (aPR: 6.35, 95% CI: 2.42, 16.69) were more likely to report last-month drug use. The same patterns were observed for specific drugs of opium use, crystal methamphetamine use, and heroin-crack use, as well as poly-drug use.

Conclusion: Socio-structural determinants are clustered together and elevate the likelihood of illicit drug use among FSWs. Our findings highlighted the significance of assessing and addressing such key determinants of health in drug use harm reduction programs targeting FSWs.

Keywords

Female sex workers; Social determinants of health; Drug use; Latent class analysis; Iran

Introduction

Substance use, in particular illicit drug use, is prevalent among female sex workers (FSWs) worldwide. For example, studies on FSWs have reported high rates of injecting drug use in two Mexico–U.S. border cities (Strathdee, et al., 2008), any illicit drug use in India (Medhi, et al., 2012), and crystal methamphetamine use in Canada (Shannon, et al., 2011). Studies of FSWs in Iran have also demonstrated a high prevalence of illicit drug use (Shokoohi, Karamouzian, et al., 2019), including recent use of crystal methamphetamine use (Shokoohi, et al., 2018), and lifetime illicit drug injection (Karamouzian, et al., 2017).

Increased vulnerability to substance use among FSWs has been associated with social and structural adversities. For example, increased rates of crystal methamphetamine and illicit opioid use among FSWs in Canada have been associated with homelessness, experiencing physical or sexual violence, and police harassment or arrest(Argento, Chettiar, Nguyen, Montaner, & Shannon, 2015; Shannon, et al., 2011). Similarly, in the context of Iran, housing instability, history of being a victim of sexual violence, history of recent incarceration, and lower educational levels have been reported to be significantly associated with the elevated risk of illicit drug use (Shokoohi, Karamouzian, et al., 2019; Shokoohi, et al., 2018).

Indeed, a growing body of evidence suggests that FSWs experience greater adversities with respect to their multiple social and structural determinants of health (Strathdee, et al., 2015), collectively called as the social determinants of health (CSDH, 2008; Marmot, Friel, Bell, Houweling, & Taylor, 2008). The World Health Organization defines the social determinants of health (SDH) as the social and physical environments/conditions "in which people are born, grow, live, work, and age" (CSDH, 2008), and that are crucial for understanding health and health care for marginalized populations. Such socio-structural determinants are particularly salient for FSW, who are consistently exposed to stressors that can negatively impact their health, such as homelessness, incarceration, and experiencing sexual and physical violence (Deering, et al., 2014; Duff, Deering, Gibson, Tyndall, & Shannon, 2011; Reed, Gupta, Biradavolu, Devireddy, & Blankenship, 2010; Socias, et al., 2015). Socio-structural determinants are complex and inter-related, with the experience of one adversity impacting on the experience of other adversities. For example, FSWs who report experiencing sexual violence are at increased risk of homelessness (Duff, et al., 2011),homelessness itself increases the likelihood of incarceration (Socias, et al., 2015) and

economic insecurity among FSWs increases the likelihood of physical violence (Reed, et al., 2010).

As highlighted in the literature (Mimiaga, et al., 2015), a methodological caveat of social and behavioural research is that investigators commonly treat social and structural factors such as incarceration or housing status as separate independent indicators, meaning these variables are modelled as independent variables predicting subsequent outcomes. However, the interconnectedness and overlap across the socio-structural determinants make it difficult to analyse them independently, suggesting using statistical approaches that take the dependency of these determinants into account (Masyn, Henderson, & Greenbaum, 2010). Latent class analysis (LCA) is one such approach and aims to provide a framework for measuring categorical latent measurements. LCA is guided by latent class theory, which assumes that responses to a set of variables can define an underlying grouping variable, or latent class, such that all people "fall into one and only one of the groups" (Lanza & Collins, 2006). Informed by a latent class theory, all individuals can be divided into several "mutually exclusive and exhaustive latent classes" on the basis of a set of correlated but categorical latent variables (Collins & Lanza, 2010; Goodman, 1974).LCA is a data reduction, model-based approach that helps identify homogenous clusters of individuals within a heterogonous population. LCA posits that the *observed* categorical indicators in a population are clustered within an *unobserved* categorical variable in which each category implies a latent/unobserved class. The literature underscores the implications of this statistical approach in addressing methodological challenges arising from subgroup analysis, such as a high type I error rate, low statistical power, and limitations in assessing higher-order interactions (Lanza & Rhoades, 2013).

We carried out this study first to identify latent subgroups of social determinants among FSWs in Iran based on a set of measured covariates, and then explored the association of the identified latent classes with the pattern of illicit drug use. Informed by a social determinants of health framework (Solar & Irwin, 2010), we tested two hypotheses. First, we hypothesized that social determinants have the potential to overlap and cluster together due to their high inter-correlation. This hypothesis was tested using an LCA aiming to identify substantively unique and meaningful clusters (classes) of FSWs who have a similar pattern in their experiences on categorically measured SDH. Following the same framework, we then hypothesized that the classes identified in the first objective may associate with risk-taking behaviours including certain patterns of illicit drug use. Understanding how the SDH clusters associate with the pattern of drug use could allow for more targeted prevention programs (Lanza & Collins, 2006).

Methods

Study design

Data were obtained from the second integrated bio-behavioural surveillance survey in Iran which was implemented between January and August 2015. This cross-sectional survey was carried out to measure the prevalence of HIV and other sexually transmitted infections (STIs) as well as sexual and behavioural practices of FSWs in Iran. Overall, 1,347 FSWs from 13 major cities across the country participated in this survey (Shokoohi, et al., 2018;

Shokoohi, et al., 2017). In brief, FSWs were recruited from both health care facilities that targeted vulnerable women, including FSW, as well as street hot spots for sex work. Inclusion criteria were: being 18 years old, having had penetrative sex in exchange for money, goods, drugs, or other services with at least two clients in the previous 12 months, and living/working in the city where the survey was done. Trained female interviewers conducted face-to-face interviews with FSWs (~ one hour) in the study sites using a structured questionnaire. Verbal consent was obtained from all participants. Interviews for FSWs recruited from both health care facilities and street hot spots were conducted in a private room by a trained female interviewer. Participants were compensated for their time and participation in the interview (70,000 Iranian Rials equivalent to ~2 US dollar) and HIV test (30,000 Iranian Rials equivalent to ~1 US dollar). The survey was approved by the Research Ethics Board at Kerman University of Medical Sciences (K/93/209).

Measures

Drug use measures

We measured the self-reported use and/or injection of the following illicit drugs: opium, heroin/crack, crystal methamphetamine (CM), hashish, marijuana, ecstasy, cocaine, norjizak/tamjizak, and non-prescription methadone. Participants who reported lifetime drug use were also asked about the drugs they had used in the last month with the following response options: i) never, ii) no use in the past six months, iii) almost once per month, iv) several times per month, v) 2–3 times per week, and vi) 4 or more times per week. We then dichotomized each drug as: non-users or no use in the last month users (i.e., options i or ii) vs. last-month drug users (i.e., any option from iii to vi) (Shokoohi, et al., 2018). The following drug-specific dependent variables were considered for the current study: a) last-month *any drug use*, defined as reporting last-month use of any of the above-mentioned drugs (Yes vs. No); b) last-month use of *opium* (Yes vs. No); c) last-month use of *CM* (Yes vs. No); d) last-month use of heroin-crack (Yes vs. No); and e) *poly-drug use*, defined as reporting last-month use of two or more of the above-listed drugs (Yes vs. No).

Measure of socio-structural determinants

In the current study, we examined five social-structural determinants: education, occupation, housing status, incarceration, and sexual violence. These determinants were chosen based on the following criteria: i) have the potential to be modifiable (e.g., education), ii) were measured in the survey, and iii) were reported as current/recent experiences. Selection of these five indicators was limited to current/recent statuses to avoid the potential for collider stratification bias (VanderWeele & Robinson, 2014). Therefore, we included and defined the following five SDH indicators: a) *currenteducation*: FSWs were asked, "What is you're the highest level of education?" with the following response options: illiterate, only able to read and write, primary school, middle or high school, diploma, university degree. We dichotomized this variable as: diploma or more (code 0) vs. high school or less (code 1: adversity indicator); b) *currentoccupation*: FSWs were asked, "Do you have any other source of income other than sex work?" with the following binary response options: Yes, I have another occupation other than sex (code 0) vs. No, sex work in my sole source of income (code 1: adversity indicator). We did not consider the last-month total income of participants

due to the sensitivity surrounding the question and the potential to be underreported; c) *currenthousing* status: FSWs were asked, "In the current moment, whom are you living with?" with the following response options: living in a stable house, with responses such as living in their own house either alone or with a partner, living with their parents (code 0) vs. living in an unstable house, such as living in shelters or streets (code 1: adversity indicator); d) *recentincarceration*: FSWs who reported experiencing ever incarceration were asked, "Have you been incarcerated in the last 12 months?" with the following binary response options: No (code 0) vs. Yes (code 1: adversity indicator); and finally e) *recent sexual violence*: FSWs who reported lifetime sexual violence were asked, "Have you experienced any act of forced/threatened sexual contact against your will in the last 12 months?" with the following binary response options: No (code 0) vs. Yes (code 1: adversity indicator). To identify a clear and distinct group within the LCA model, these indicators were recoded to three-category indicators: code 2, reported experiencing of the specific SDH indicator vs. code 1, not experiencing that SDH indicator vs. code 0, not experiencing any of the SDH indicators. The code 0 had the same proportion in all the included SDH indicators, an approach that has been utilized in other studies (Carter, et al., 2018).

Covariates

The association between the SDH classes and illicit drug use was adjusted for the measured covariates that may have occurred before the exposures used to define SDH clusters to meet the temporality: age (treated as a continuous measure); marital status (a 4-category measure, categorized as being single, married, temporarily married [i.e., locally called *Sigheh*], widowed/divorced); and sex work duration defined as the duration between the date they started selling sex through the interview time (treated as a continuous measure).

Statistical analysis

Latent class analysis (LCA)

In estimating the latent classes, LCA assumes that any covariation among observed indicators is accounted for by the identified latent/unobserved class variable – known as the assumption of *local/conditional independence* (Collins & Lanza, 2010; Lanza, 2003). In the current study, we assumed that the associations between SDH indicators owe to their association with underlying SDH classes/clusters. We used the multi-step approach maximum likelihood method (Vermunt, 2010) to examine the associations of interest. We first explored the appropriate number of classes and their interpretabilities, and then identified and labelled the best LCA model on this basis. We assigned participants to LCAs based on their posterior class membership probabilities and used identified latent classes as an independent variable in the regression model to examine its association with illicit drug use adjusted for covariates. To identify the best number of SDH latent classes, we assessed models with 2 classes and then progressively increased them to eight classes (Table 2). To assess the model fitting, expectation–maximization algorithm with 5,000 iterations was employed, and the log-likelihood (LL) was replicated with 1,000 random starting values. We considered both the interpretability and the following goodness-of-fit measures in selecting the best LCA model: loglikelihood, Akaike's information criteria (AIC), Bayesian information criteria (BIC), sample-size-adjusted BIC (aBIC), and consistent AIC (CAIC)

(Lanza, Dziak, Huang, Xu, & Collins, 2015). For each criterion, the lower values suggested better model fit. Entropy was reported as a measure of classification accuracy (ranged 0 to 1), with higher estimates reflecting better class distinction. LCA provides the estimate of two parameters: a) class membership probabilities, which are the percentage of the study population *assigned* to each identified class (i.e., prevalence/percentage of each class), and b) item-response probabilities, which are the conditional probability of each observed indicator given the identified classes (Table 3).We used a threshold of 0.40 to set class memberships (Collins & Lanza, 2010), with cut-offs less than 0.3 usually considered as low conditional probabilities representing the relationship between an individual indicator and a latent class. LCA was performed in SAS using PROC LCA, an add-on procedure, developed by the Methodology Centre at the Pennsylvania State University (Lanza, et al., 2015).

Regression analysis

To explore the association between the SDH clustering and illicit drug use, we used logistic regression with log link and Poisson distribution (Zou, 2004). This modified Poisson approach estimates the risk ratio (or prevalence ratio in cross-sectional studies) and their 95% confidence intervals (CIs) for binary outcomes using a robust error variance procedure (Royall, 1986), without which variances result in wide CIs. Crude prevalence ratios (PR) along with 95% CIs were reported. Associations were adjusted for age, marital status, and sex work duration, and then adjusted PRs were reported. Survey analysis was conducted to adjust for the clustering effect of the study cities (i.e., individuals nested within studies sites within the cities) (Ferguson & Corey, 1990). These analyses were done in Stata v.15 (StataCorp, College Station, Texas, USA).

Results

Sample characteristics

The mean age was 35.3 [standard deviation (SD) = 8.8] years, with 10.3% being younger than 25 years of age. The mean duration of sex work was 8.8 [SD = 7.1] years, with 32.8% reporting being involved in sex work for more than 10 years. FSWs mostly commonly reported being divorced/widowed (44.2%), 33% reported being currently married, 16.5% temporarily married and 6.3% single (Table 1).

Individual and clustered SDH

Approximately three-quarter of the sample reported having a high school level of education (73.1%) and 59.2% of FSWs reported that sex work was their only source of income. Appoximately one in ten respondents reported they were currently in unstable housing (10.2%). Recent experiences of sexual violence and incarceration was reported by 16.9% and 6.8% of FSW, respectively (Table 1).

The goodness-of-fit estimates from eight examined LCA models for these five SDH indicators suggested the 5-class model was the best fitting model (log-likelihood −3011.4 with 188 degrees of freedom, AIC = 136.0, BIC = 416.7, and CAIC = 470.7) and yielded a more parsimonious model, with optimal entropy estimates (0.806) indicating greater

confidence in class distinction. Additionally, the 5-class model was more interpretable than other models (Table 2).

Table 3 shows the class membership probabilities and item response probabilities for the 5-class model. Identified classes were: Class 1) *No SDH adversities* (10.6%): defined as no adversities with regard to the five individual SDH; Class 2) *Unemployment* (13.3%): characterized mainly by FSWs reporting no other sources of income other than sex work [Yes probability = 0.999]; Class 3) *Low education and unemployment* (69.8%): the largest SDH class, characterized by those who reported adversities with regard to both low education [0.999] and having no other sources of income [0.577]; Class 4) *Sexual violence experience and unemployment* (2.9%): the smallest class, characterized by recent sexual violence [0.738] and partially no other income sources [0.410]; and Class 5) *Multiple SDH adversities* (3.4%): characterized by those who experienced almost all of these five adversities, with low education [0.995], no other sources of income [0.886], unstable housing [0.689], recent incarceration [0.430], and recent sexual violence experience [0.685].

Illicit drug use prevalence by clustered SDH

Table 4 shows the high prevalence of any illicit drug use, specific-drug use, and poly-drug use among those FSWs who experienced SDH adversities, either in single adversities or in combinations, versus those who experienced no SDH adversities. Any drug use among those who experienced multiple SDH adversities (class 5) was 53.3% vs. 7.0% among those with no SDH adversities (class 1), with 16.9%, 27.2%, 35.9% among those in class 2, 3, and 4, respectively. Opium use was reported by 19.0% of FSWs who reported multiple SDH adversities (class 5) vs. 1.4% among those with none (class 1), with 2.9%, 7.2%, and 10.8% among FSWs in classes 2, 3, and 4, respectively. CM use was also higher among participants with multiple SDH adversities (class 5) than those in class 1 (41.9% vs. 3.6%), with 7.0%, 17.5%, and 25.6% among those in classes 2, 3 and 4, respectively. A higher prevalence of heroin-crack use was also observed among FSWs who reported experiencing multiple SDH adversities (class 5) than those in class 1 with least adversities (24.4% vs. 2.2%). Lastly, poly-drug use was reported among 28.9% of FSWs with multiple SDH adversities (class 5) vs. 2.1% in those in class 1.

Association of clustered SDH with illicit drug use

Both crude and adjusted prevalence ratios (PRs) of any illicit drug use and specific-drug use across the SDH classes are presented in Table 4. Adjusted models showed that FSWs in class 2, 3, 4 and 5 were respectively aPR = 2.47, 3.69, 4.49 and 6.35 times more likely to report any drug use than those in class 1. The same cumulative increasing pattern of higher likelihood of drug use for opium use, CM use, heroincrack, and ploy-drug use was observed. For example, the likelihood of poly-drug use among FSWs in class 2 (aPR 3.49), 3 (aPR 6.52), 4 (aPR 10.28) and 5 (aPR 10.91) was significantly higher than those in class 1.

Discussion

Drawing on a large sample of FSWs from the most recent nationwide surveillance survey, our findings showed that a substantial proportion of women experience SDH adversities, and

that membership in either individual (e.g., unemployment) or combination (e.g., sexual violence and unemployment) of SDH latent classes, versus no SDH adversity class, increased their likelihood of recent illicit drug use. Experiencing multiple SDH adversities (class 5) was substantially associated with an increased likelihood of drug use among FSW.

Consistent with the existing literature (Argento, et al., 2015; Shannon, et al., 2011; Shokoohi, Bauer, et al., 2019; Shokoohi, Karamouzian, et al., 2019; Strathdee, et al., 2008), these findings suggest that social and structural stressors have the potential to elevate the risk of illicit drug use, particularly among vulnerable populations such as FSWs who are typically exposed to a wide range of everyday life stresses. However, unlike prior research which often treats indicators of social and structural determinants as independent factors associated with illicit drug use, our findings showed that these indicators have the potential to cluster together. This may suggest that adversities with regard to the social and structural determinants have the potential to synergistically elevate the likelihood of drug use risks among vulnerable and underserved populations. While our findings for the SDH latent classes relied on cross-sectional data, research in future may benefit from examining longitudinal changes in latent classes, applying latent transition approaches (Collins & Lanza, 2010) to explore changes in the patterns of SDH classes in association with drug use practices over time. Future research could also examine the clustering of social determinants using more indicators to obtain a better picture of the distinct and unique latent profiles associated with drug use among FSW.

Our findings have implications for the prevention and treatment programs for drug use among FSW. While available research recommends behavioural and opioid substitution therapeutic strategies for responding to drug use among such vulnerable populations, these findings reflect recommendations (Shokoohi, Bauer, et al., 2019; Spooner & Hetherington, 2005) that optimal benefits in reduction and prevention of drug use are accrued by also mitigating everyday stressors resulting from social and structural determinants. The most common strategy for dealing with drug use among drug users in Iran is methadone maintenance therapy (Dolan et al., 2011; Farnia, Ebrahimi, Shams, & Zamani, 2010; Dolan et al., 2011), and studies of drug using women reported multiple improvements such as reduction in illicit drug use, levels of dependence, social functioning, and HIV risk behaviour as a result of methadone maintenance therapy harm reduction programs (Dolan, et al., 2012). Our findings suggest that to achieve improved outcomes from opioid replacement therapies, strategies to reduce the burden of social and structural adversities need to be into account. Future research in Iran should pay greater attention to such structural interventions in addition to targeted drug-related harm reduction programs. For example, programs should focus on identifying and addressing the main barriers for FSWs' education and employment. Consistent with the literature on the potential significance of women's economic empowerment programs for HIV prevention responses (Kim, Pronyk, Barnett, & Watts, 2008), targeting FSWs with effective evidence-based interventions to better address their economic vulnerabilities and improve their skills needed for employment are required. Previous research has shown the significant contribution of interventions addressing women's economic and social vulnerability to the reductions of HIV risk behaviours (including drug use patterns) and intimate partner violence (Pronyk, et al., 2008; Sherman, German, Cheng, Marks, & Bailey-Kloche, 2006). Approaches addressing housing issues

have also shown improvements in housing stability and other aspects of health and well-being among vulnerable individuals with substance use disorders (Baxter, Tweed, Katikireddi, & Thomson, 2019). In the context of HIV prevention, interventions addressing violence and trauma have also shown to be feasible and acceptable among FSWs, and have the potential to reduce risk behaviours (Decker, et al., 2017).

Limitations

This research has five main limitations. First, the study design was cross-sectional and like other cross-sectional studies we were able to only measure the associations, as opposed to causality, between SDH classes and drug use. Second, participants were recruited through convenience sampling making the generalizability of these findings unclear/uncertain. Third, drug use was measured by self-report which may have resulted in under-reporting due mainly to the criminalization of drug use practices and the marginalization of the study population. Fourth, we relied on the clustering of SDH using only five potentially modifiable indicators. Key and relevant social determinants, such as social support and stigma were not asked about in the survey and have been infrequently measured among Iranian vulnerable populations, particularly women involved in drug use who have poor social functioning (Dolan et al., 2011). Collecting a wider range of SDH-related information and examining their role in illicit drug use and other health outcomes would improve our understanding of the moderating role of SDH in drug use among FSWs. Fifth, we used the data from 2015 (the last national survey of FSW in Iran) and our results may not reflect current associations between SDH and drug use in this population.

Conclusion

Our findings suggest that, in addition to the promotion of harm reduction programs, a multidisciplinary service delivery program is needed to comprehensively address the needs of FSW. These programs would be potentially more effective than those targeting only drug dependence in improving the overall health and promoting the human rights of this under-served and socioeconomically vulnerable population.

Acknowledgements

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Table 1

Descriptive statistics of sociodemographic and individual factors of female sex workers, Iran (Study N = 1347).

Variables	N (%) or Mean [SD][a]
Mean [SD] age, year	35.3 [8.8]
Age categories (N=1335)	
< 25 years	137 (10.3)
25–34 years	526 (39.4)
35+	672 (50.3)
Mean [SD] sex work duration, year	8.8 [7.1]
Sex duration categories	
2 years	233 (18.0)
2–5 years	303 (23.4)
5–10 years	334 (25.8)
> 10 years	424 (32.8)
Current marital status	
Single	84 (6.3)
Currently married	440 (33.0)
Temporary marriage[b]	220 (16.5)
Divorced/widowed	590 (44.2)
Binary SDH measures under the study	
Low education[c]	978 (73.1)
Unemployment[d]	788 (59.2)
Unstable housing (Yes)	136 (10.2)
Last-year experience of sexual violence (Yes)	225 (16.9)
Last-year experience of incarceration (Yes)	90 (6.8)

[a]Categorical variables reported as N (%) and continuous variables reported as mean [standard deviation];

[b]Locally called Sigheh;

[c]Low education was defined as having high school or less;

[d]Unemployment was defined as having no income source other than sex work.

Table 2

LCA classes and goodness of fit measures for eight latent class models (LCA) for female sex workers in Iran.

Number of latent classes	LL[a]	DF[b]	AIC[c]	BIC[d]	CAIC[e]	Entropy[f]
1 class	−4905.7	232	3836.5	3888.5	3898.5	1
2 classes	−3100.3	221	247.7	356.9	377.9	1
3 classes	−3061.0	210	191.1	357.4	389.4	0.72
4 classes	−3019.6	199	130.5	354.0	397.0	0.746
5 classes[g]	*−3011.4*	*188*	*136.0*	*416.7*	*470.7*	*0.806*
6 classes	−3006.7	177	148.6	486.5	551.5	0.859
7 classes	−3002.1	166	161.5	556.5	632.5	0.878
8 classes	−3001.1	155	181.4	633.6	720.6	0.861

[a]LL: log likelihood;

[b]DF: degree of freedom;

[c]AIC: Akaike information criterion;

[d]BIC: Bayesian information criterion;

[e]CAIC: Corrected Akaike information criterion;

[f]Entropy is a measure of classification accuracy, with values close to 1 indicate better class distinction.

[g]The best identified LCA model (italicized row)

Table 3

Class probabilities and item-response probabilities of the 5-class model, as the best identified LCA model.

SDH measures	Class 1[a] (N=142)	Class 2[b] (N=178)	Class 3[c] (N = 933)	Class 4[d] (N = 39)	Class 5[e] (N = 45)
Class probabilities[g]	10.6%	13.3%	69.8%	2.9%	3.4%
Item-response probabilities					
Low education	0.000	0.290	0.999[f]	0.297	**0.995**
Unemployment	0.000	0.999	**0.577**	**0.410**	**0.886**
Under-housing	0.000	0.049	0.088	0.225	**0.689**
Last-year incarceration	0.000	0.000	0.063	0.232	**0.430**
Last-year sexual violence	0.000	0.085	0.141	**0.738**	**0.685**

[a]Class 1: no SDH adversities experienced;

[b]Class 2: unemployment (i.e., lack of other income sources than sex work);

[c]Class 3: low education and unemployment;

[d]Class 4: Sexual violence experience and unemployment;

[e]Class 5: experiencing multiple SDH adversities;

[f]Cut-off for being assigned to each class was set to be 0.40, bold probabilities (all ≥ 0.40)

[g]Indicates the proportion of the total sample assigned to each class.

Table 4

The association between the SDH clusters and the patterns of drug use among female sex workers, Iran.

SDH classes	Prevalence (95% CIs)	Crude PR [a] (95% CIs)	Adjusted [b] PR(95% CIs)
Outcome 1: Any drug use			
Class 1: No SDH adversities	7.0 (2.8, 16.8)	Ref.	Ref.
Class 2: Mainly unemployment	16.9 (10.2, 26.6)	2.39 (1.13, 5.06)	2.47 (1.15, 5.27)
Class 3: Low education and unemployment	27.5 (17.3, 40.8)	3.91 (1.73, 8.85)	3.69 (1.62, 8.36)
Class 4: Sexual violence and unemployment	35.9 (18.5, 58.0)	5.10 (1.95, 13.35)	4.49 (1.71, 11.78)
Class 5: Multiple SDH adversities	53.3 (27.8, 77.3)	7.57 (2.74, 20.91)	6.35 (2.42, 16.69)
Outcome 2: Opium use			
Class 1: No SDH adversities	1.4 (0.3, 6.9)	Ref.	Ref.
Class 2: Mainly unemployment	2.9 (1.2, 7.0)	2.02 (0.32, 12.88)	2.11 (0.33, 13.58)
Class 3: Low education and unemployment	7.2 (3.8, 13.2)	4.98 (1.27, 19.6)	4.84 (1.18, 19.95)
Class 4: Sexual violence and unemployment	10.8 (3.7, 27.9)	7.46 (1.53, 36.32)	6.49 (1.27, 33.19)
Class 5: Multiple SDH adversities	19.0 (8.3, 38.0)	13.14 (2.06, 83.96)	11.65 (1.91, 71.03)
Outcome 3: Crystal Methamphetamine use			
Class 1: No SDH adversities	3.6 (1.3, 9.2)	Ref.	Ref.
Class 2: Mainly unemployment	7.0 (2.6, 17.4)	1.95 (0.54, 7.04)	2.03 (0.56, 7.40)
Class 3: Low education and unemployment	17.5 (10.2, 28.5)	4.91 (1.84, 13.11)	4.94 (1.85, 13.20)
Class 4: Sexual violence and unemployment	25.6 (11.8, 47.0)	7.18 (2.26, 22.84)	6.60 (2.00, 21.70)
Class 5: Multiple SDH adversities	41.9 (19.8, 67.7)	11.72 (3.67, 37.46)	9.98 (3.31, 30.14)
Outcome 4: Heroin-crack use			
Class 1: No SDH adversities	2.2 (0.6, 6.9)	Ref.	Ref.
Class 2: Mainly unemployment	7.0 (3.2, 14.4)	3.23 (0.95, 11.02)	3.30 (0.97, 11.29)
Class 3: Low education and unemployment	13.1 (8.2, 20.2)	6.06 (1.77, 20.80)	5.24 (1.48, 18.53)
Class 4: Sexual violence and unemployment	20.5 (9.8, 38.1)	9.50 (2.34, 38.65)	7.87 (1.91, 32.34)
Class 5: Multiple SDH adversities	24.4 (13.5, 40.2)	11.33 (3.27, 39.26)	8.78 (2.63, 29.29)
Outcome 5: Poly-drug use			
Class 1: No SDH adversities	2.1 (0.6, 7.8)	Ref.	Ref.
Class 2: Mainly unemployment	7.3 (3.8, 13.7)	3.46 (0.89, 13.36)	3.49 (0.89, 13.72)
Class 3: Low education and unemployment	15.2 (9.0, 24.6)	7.20 (2.42, 21.44)	6.52 (2.26, 18.82)

SDH classes	Prevalence (95% CIs)	Crude PR [a] (95% CIs)	Adjusted [b] PR(95% CIs)
Class 4: Sexual violence and unemployment	25.6 (11.8, 47.0)	12.14 (2.87, 51.35)	10.28 (2.55, 41.42)
Class 5: Multiple SDH adversities	28.9 (18.1, 42.8)	13.67 (3.56, 52.53)	10.91 (3.10, 38.39)

[a]PR: Prevalence ratio (95% confidence intervals (CIs));

[b]The following covariates were adjusted for the association between SDH clusters and illicit drug use: age (continuous), sex work duration (continuous), and marital status (categorical).