Original Article

Multiple Substance Use Patterns and Its Relationship with Imprisonment in a High-Risk Group of Iranian Adults

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Abstract

Background: Substance use is recognized as an important factor associated with many diseases and premature deaths and the main risk factor for disability worldwide. This study aims to identify subgroups of substance use in adults and detect the effect of imprisonment on the membership of participants in latent classes of substance use.

Study Design: A cross-sectional study.

Methods: This study was performed on 930 adult people who were referred to behavioral health counseling centers in Tehran province. All participants completed some checklists and questionnaires. Data analysis was performed using chi-square, Fisher's exact test, and latent class analysis (LCA).

Results: Four latent classes were identified, including non-users (58%), cigarette smokers (11.6%), users of low stigma substances (27.4%), and drug users (3.1%). After adjusting for other studied variables, having a history of imprisonment increased the odds of membership in the cigarette smoker class (Odds ratio [OR]=5.82, 95%, confidence interval [CI]: 3.19-10.63) and drug user class (OR=53.59, 95% CI: 18.00-159.52) compared to non-user class. Among all participants, 84 (9.0%) had a history of imprisonment.

Conclusion: Results from the present study indicate that 30.5% of the participants fell under the user of the low-stigma substance or drug user group. Focusing on increasing prisoner's knowledge of the dangers of using different substances and considering various programs for prisoners' leisure time may help reduce substance use prevalence.

Background

Substance use refers to the illicit use of psychoactive substances or narcoticdrugs and is recognized as an important factor associated with many diseases and premature deaths and is the main risk factor for disability worldwide.[1,2]

Substance use can affect a large number of organs and systems in the human body, leading to numerous medical problems and an increased risk of multiple diseases. For example, alcohol or drug use can impair a person's self-care abilities, which may subsequently increase the risk of cardiovascular disease, cancers, road traffic accidents, liver disease, and disease complications.[3,4] Decreased social welfare, health problems, mental disorders, and

premature mortality are also some of the most important consequences of substance misuse.[3,5]

It is estimated that the prevalence of substance use among adults shows an increasing trend. As such, the results of the Monitoring the Future study have indicated that the prevalence of substance use in this age group increased from 38.2% in 1999 to 49% in 2017.[6]

The death epidemic from opioid use in the United States has turned into a serious health concern as the use of illicit drugs, psychoactive substances, and cocaine is particularly increasing in this country.[7] In Europe, 11% of disability-adjusted life years are due to alcohol and illicit drugs.[8] Moreover, the misuse of substances such as cannabis, amphetamines, opioids, and tobacco is increasing and is a major threat to public health in Asian countries.[9,10] Opium has also been widely used for a long time in Iran, so opium use in this country is three times higher than the global average.[11,12] It should be noted that the use of heroin and stimulants has also shown an increasing trend in Iran.[13] Furthermore, the substance abuse mortality rate in Iran increased between 2014 and 2018.[2]

Voluntary Counseling and Testing (VCT) was first developed in 1995 as a major tool for HIV/AIDS control and a viable means of preventing the disease spread.[13] In Iran, behavioral health counseling centers provide services for patients with AIDS and other diseases, HIV counseling, diagnostic tests, and services aimed at harm reduction in substance use (e.g., syringe and needle exchange) and a condom to ensure protected intercourse.[14]

The latent class analysis (LCA) provides a framework to identify heterogeneity within the population by analyzing the behavioral patterns of individuals so that the latent groups with similar patterns are identified in a set of observations.[15]

This study aimed to identify subgroups of substance use in adults and detect the effect of imprisonment on the membership of participants in latent classes of substance use in people who were referred to behavioral health counseling centers using LCA.

Methods

This cross-sectional study was conducted on 930 adult people who were referred to behavioral health counseling centers in Tehran province from March 2018 to March 2020. Participants were selected by convenience sampling from three behavioral health counseling centers, including Bouali Counseling Center in Eastern Tehran, Darband Counseling Center in Northern Tehran, and Imam Khomeini hospital Counseling Center in the center of Tehran. All clients of these three counseling centers who were detected as having high-risk behaviors for HIV/AIDS were recruited into this study after being counseled by counselors and being referred to a laboratory for HIV testing. The interview was conducted after the test and before the announcement of the test results. First, the trained interviewers explained the purpose of the study to the participants, and if they were willing to participate in the study, they would start to be interviewed, after obtaining the informed consent. The format of the checklist used in this study was similar to the individual HIV test form. If the person had an acceptable literacy the checklist was given to the participant to answer the questions himself. Finally, the answers were checked by the interviewer, and unanswered questions were asked by the interviewer.

The study was conducted using a checklist designed based on a form commonly used in VCT centers in Iran. The necessary data were collected by a questionnaire containing information on high-risk behaviors, including heterosexual and homosexual intercourse and the history of injecting drug users.

To report some characteristics of participants and levels of engagement in each substance, we used descriptive statistics. In the next step, we performed LCA seven times using one to seven classes to find the best model. For model identification, each model has been fitted 20 times with different starting values. For the selection of the best model, some statistics were calculated and then compared across all models (seven models). These indices were likelihood-ratio statistic G2, the Akaike information criterion (AIC), the Bayesian information criterion (BIC), entropy, and the log-likelihood value. The lower value of G2, AIC, BIC, and the log-likelihood show a more optimal model fit; however, the higher value of entropy indicates more fitness of a model. For better identification, the interpretability of the results and parsimony of a model should be considered.

Eight dichotomous observable variables (i.e., indicators) were used to detect latent subgroups of participants based on substance use. These variables were cigarette smoking, hookah smoking, alcohol, cannabis, ecstasy, amphetamine-type stimulants (ATS), opium, and heroin use. After identifying the optimal model, we conducted an LCA by considering covariates to detect the effect predictors of latent class membership. These covariates were age, gender, education, job, and imprisonment history. To investigate the effect of predictors, the non-user class was considered the reference class.

To perform a simple statistical analysis, the chi-square and Fisher's exact test were used by SPSS 16, and LCA was performed by using PROC LCA in SAS 9.2 software. In all analyses, P value < 0.05 was considered statistically significant.

Results

From 1090 distributed questionnaires, a total of 930 (85.3% response rate) were completed by the participants. In this study, the mean age of the participants was 32.09 ± 9.17 (range: 17-66) years old. Most of the participants were male (73.2%), and 9.0% of them had a history of imprisonment. Furthermore, 0.9% of the sample was illiterate, and only 9.8% were unemployed.

Table 1 presents the prevalence of different substance use based on the history of imprisonment. This table shows

Table 1. Substance use by imprisonment in a sample of high-risk group of Iranian adults

Variables	Total		Not imprisonment		Imprisonment		P value
	Number	Percent	Number	Percent	Number	Percent	
Cigarette smoking (last month)							
No	535	57.5	519	61.3	16	19.0	0.001
Yes	395	42.5	327	38.7	68	81.0	
Hookah smoking (last month)							
No	643	69.1	584	69.0	59	70.2	0.819
Yes	287	30.9	262	31.0	25	29.8	
Alcohol use (last year)							
No	566	60.9	510	60.3	56	66.7	0.253
Yes	364	39.1	336	39.7	28	33.3	
Cannabis use (last year)							
No	856	92.0	786	92.9	70	83.3	0.002
Yes	74	8.0	60	7.1	14	16.7	
Ecstasy use (last year)							
No	923	99.2	840	99.3	83	98.8	0.486
Yes	7	0.8	6	0.7	1	1.2	
Amphetamine-type stimulants (last year)							
No	899	96.7	831	98.2	68	81.0	0.001
Yes	31	3.3	15	1.8	16	19.0	
Opium (last year)							
No	873	93.9	811	95.9	62	73.8	0.001
Yes	57	6.1	35	4.1	22	26.2	
Heroin (last year)							
No	896	96.3	838	99.1	58	69.0	0.001
Yes	34	3.7	8	0.9	26	31.0	

that some substances are more common than others. For example, the prevalence of cigarette smoking, hookah smoking, and alcohol use was obtained to be 42.5%, 30.9%, and 39.1%, respectively. On the other hand, ecstasy use was an uncommon substance among participants with a prevalence of 0.8%. Table 1 indicates a significant relationship between cigarette smoking, cannabis, ATS, opium, and heroin use with a history of imprisonment.

Eight dichotomous variables were used to conduct LCA. The different measures of model selection are shown in Table 2. For the selection of the final model, we compared the values of G^2, AIC, BIC, entropy, and the log-likelihood across seven models. According to model selection criteria and interpretability of the results, the four-class model was identified as the best model. Table 3 present the result of the LCA model for substance use pattern. This table includes the latent class prevalence and item response probabilities. The participants of this study were grouped into the non-user class (58%), cigarette smokers (11.6%), users of low-stigma substances (27.4%), and drug users (3.1%). Specifically, people in the non-user class had low probabilities of using all substances. Participants in the cigarette smoker class had a high probability of cigarette smoking (98.8%). It should be noted that the probability of hookah smoking was 34.8% among participants of

this class. Moreover, individuals in the group of low-stigma substance users had a high probability of cigarette smoking (77.3%), hookah smoking (59.6%), and alcohol use (98.3%). Finally, among individuals in the drug user class, cigarette smoking (89.3%), alcohol (87.5%), cannabis (74.9%), ATS (64.8%), opium (70.5%), and heroin use (64.7%) had high probabilities. Table 3 indicates that among all substances, only ecstasy use had no important role in classifying the participants. In other words, the probability of using ecstasy was obtained to be under 50% in all latent classes.

We found four significant predictors of latent class membership (Table 4), implying different distributions of latent class membership across these variables. With increasing age, the odds of being a user of low-stigma substance class decreased to 0.96. Being male increased the odds of membership in the cigarette smoker (OR = 4.24) and user of low-stigma substance (OR = 2.10) classes compared to the non-user class. Furthermore, being unemployed increased the odds of being in cigarette smoker (OR = 2.80), user of low-stigma substances (OR = 2.33), and drug use classes (OR = 9.39) relative to the "non-user" class. Moreover, having a history of imprisonment had the strongest effect on the membership of participants in different latent classes in this study and

Table 2. Comparison of LCA models with different latent classes based on model selection statistics

Number of Latent Class	No. of estimated parameters	G²	df	AIC	BIC	Maximum log-likelihood
1	8	257.34	247	773.34	812.02	-2626.91
2	17	294.46	238	328.46	410.66	-2395.47
3	26	175.10	229	227.10	352.82	-2335.79
4	35	129.64	220	199.64	368.88	-2313.06
5	44	92.75	211	180.75	393.50	-2294.62
6	53	77.25	202	183.25	439.51	-2286.87
7	62	69.18	193	193.18	492.97	-2282.84

Note. LCA: Latent class analysis; df: Degrees of freedom; AIC: Akaike information criterion; BIC: Bayesian information criterion.

Table 3. The four latent classes' model of pattern of substance use among a sample of high-risk groups of Iranian adults

	Non User	Cigarette smoker	User of low stigma substances	Drug user
Latent class prevalence	0.580	0.116	0.274	0.031
Item-response probabilities				
Cigarette smoking (last month)	0.122	0.988	0.773	0.893
Hookah smoking (last month)	0.157	0.348	0.596	0.455
Alcohol use (last year)	0.159	0.028	0.983	0.875
Cannabis use (last year)	0.004	0.008	0.193	0.749
Ecstasy use (last year)	0.000	0.009	0.010	0.115
Amphetamine-type stimulants (last year)	0.002	0.082	0.010	0.648
Opium (last year)	0.010	0.137	0.064	0.705
Heroin (last year)	0.000	0.118	0.010	0.647

Note. The probability of a "No" response can be calculated by subtracting the item-response probabilities shown above from 1. Item-response probabilities > 0.5 in bold to facilitate interpretation.

increased the odds of membership in the cigarette smoker (OR = 5.82) and drug use (OR = 53.59) classes compared to the non-user class.

Discussion

The results of the present study showed four latent classes for patterns of substance use among Iranian adults who were referred to health counseling centers. The prevalence of non-users, cigarette smokers, users of low-stigma substances, and drug user classes were 58%, 11.6%, 27.4%, and 3.1%, respectively. Members of a non-user class displayed a lower probability of using all types of substances. The results of the present study suggest a significant co-occurrence of substance use among Iranian adults. As such, a high probability of using cigarettes, alcohol, cannabis, ATS, opium, and heroin was observed in the drug user class. Tzilos et al showed that daily marijuana use is associated with a significantly increased likelihood of opiate, cocaine, hallucinogen, inhalant, and tobacco use in the United States.[16] The results of a review study also showed that more than 90% of cocaine and methamphetamine users report smoking.[17] These findings demonstrated the considerable importance of noticing the co-occurrence nature of substance use in developing preventive interventions. Therefore, focusing on the co-incidence and co-using of different substances may effectively contribute to the reduction of substance use.

Different person-centered studies have used different variables to identify subgroups of substance use among adults, and the results of some relatively similar studies can be discussed here. Liu et al identified five latent classes of substance use among lifetime cocaine users: Past 30-day tobacco use only (45%), past 30-day alcohol, marijuana, and tobacco use (31%), past 30-day tobacco, prescription of opioid and sedative use (13%), past 30-day cocaine, alcohol, marijuana, and tobacco use (9%), and past 30-day cocaine and multiple polysubstance use (2%).[18] Another study in Australia revealed five latent classes for the pattern of polysubstance use: Alcohol only, alcohol and tobacco, cannabis, ecstasy, and licit drug use, cannabis, amphetamine derivatives, and illicit drug use, and sedative and alcohol use.[19] Due to demographic

differences and variations in substance use patterns, the results of substance use classification can be different in various countries. However, there are some levels of co-occurrence in substance use patterns in person-centered studies.

The findings of the present study showed that the male gender significantly increased the odds of membership in cigarette smokers and users of low-stigma substances classes compared to non-user classes. Merlin et al. found that the female gender was associated with lower substance use.[20] In another study, men were at higher risk of polysubstance use.[19] Compared to men, Iranian women have less tendency toward substance use due to their socio-cultural background.[21] In addition, men are more likely to use substances due to social norms and gender roles.[22]

We found that unemployment increased the odds of a cigarette smoker, a user of low-stigma substances, and drug user membership compared to the non-user class. Generally, unemployment is associated with substance abuse in both men and women.[23] Studies also have shown that recession and unemployment increase psychological stress, which can lead to illicit drug use.[24,25] Melchior et al also indicated that an increased unemployment rate is associated with an increased rate of illicit drug use.[26] Therefore, basic long-term control measures aiming at reducing unemployment should be established to subsequently reduce the prevalence of substance use.

The present study showed that a history of imprisonment significantly increases the odds of being in the cigarette smoker and drug user classes compared to the non-user class. Studies in different countries showed that substance use is higher among prisoners than in the general population.[27,28] The results of a study conducted in Iran showed that the prevalence of substance use in Iran's prisons is magnificently high, and the history of imprisonment is an important risk factor for substance

Table 4. Predictors of membership in latent classes of substance use among Iranian adults

Predictors	Cigarette smoker	User of low stigma substances	Drug user	P value
	OR (95% CI)	OR (95% CI)	OR (95% CI)	
Age	1.02 (1.00, 1.04)	0.96 (0.94, 0.98)	0.99 (0.95, 1.04)	0.001
Gender (being male)	4.24 (2.13, 8.41)	2.10 (1.50, 2.96)	7.37 (0.77, 70.69)	0.001
Education (illiterate)	0.32 (0.06, 1.57)	0.84 (0.23, 3.01)	0.01 (0.00, 7.97)	0.272
Job (unemployment)	2.80 (1.56, 5.00)	2.33 (1.46, 3.73)	9.39 (4.02, 21.90)	0.001
Imprisonment history	5.82 (3.19, 10.63)	1.64 (0.84, 3.20)	53.59 (18.00, 159.52)	0.001

Note. Odds ratio; CI: Confidence interval; The reference group: Non user.

use.[29] Yitayih et al also reported that incarcerated people have poor social support, making them more exposed to illicit drugs.[30] Being in a weak social context with insufficient economic resources, being exposed to drugs in their place of residence, and stressful situations are important factors associated with substance use in people with a history of imprisonment.[31] Therefore, harm reduction programs and interventions aimed at reducing the prevalence and complications of drug use in prisoners are of great importance.

One of the study limitations was using a self-administered questionnaire, which could lead to the underestimation of the results. Additionally, this cross-sectional study was unable to explain the causal relationship between independent variables and substance use.

Conclusion
In the present study, we evaluated the prevalence and pattern of substance use among a sample of Iranian adults who were referred to behavioral health counseling centers. We also evaluated the impact of imprisonment as well as age, gender, education, and job status on membership in different latent classes identified by the LCA. It was found that although a small number of participants are in the drug user class, the probability of using most substances is quite high in this class. We found that a history of imprisonment increases the odds of being in cigarette smoker and drug user classes compared to non-user classes. Consequently, focusing on educational interventions in prisons could help prisoners to increase their knowledge of the dangers of using different substances. In addition, considering various programs for prisoners' leisure time may help reduce substance use among these adults.

Highlights

- Four latent classes were identified, including non-users (58%), cigarette smoker (11.6%), users of low-stigma substances (27.4%), and drug user (3.1%).
- Alcohol use was more common among participants.
- Having a history of imprisonment increased the odds of membership in the cigarette smoker and drug user classes.
- Among all participants, 84 (9.0%) had a history of imprisonment.

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