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Cognitive Impairments and Its Related Factors in People Who Injects Drugs in Iran

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Abstract

Background: One of the most common psychological problems among people who use drugs (PWUD) is cognitive impairments (CIs). Several studies show that the prevalence of cognitive impairments in PWUD is higher than in the general population.

Objectives: The aim of the current study was to investigate the prevalence of CI and its related factors among people who inject drugs (PWID) in Iran.

Methods: A cross-sectional study was designed among PWID in 2023. About 410 PWID were recruited using snowball and convenience sampling in four provinces in Iran. Demographic and clinical data, as well as the status of cognitive impairments, were collected using bio-behavioral and Montreal Cognitive Assessment questionnaires, respectively. We examined the relationship between all independent variables and CIs status using bivariate logistic regression.

Results: The prevalence of CI among participants was 28% (95% confidence interval (CI): 22% - 32%). Behaviors associated with an increased risk of CIs included the length of injecting drug use [adjusted odds ratios (aOR) = 2.7, P = 0.01], methamphetamine use (aOR = 2.8, P < 0.05), and alcohol use (aOR = 2.8, P < 0.05).

Conclusions: Methamphetamine and alcohol use were identified as the main predictors of cognitive impairments among PWID. It also seems necessary to consider new interventions in harm reduction programs to address cognitive impairments.

Keywords: Cognitive Impairments, Drugs, Amphetamine, HIV, Substance Use Disorder

1. Background

Some evidence shows an increase in the number and proportion of injecting drug users. People who inject drugs (PWID) are estimated to be 14.8 million worldwide (1), and about 12% of them are living with HIV (2). Due to their risk behaviors, such as unprotected sex and using shared syringes, these individuals are more vulnerable to various physical and mental health problems (1, 3). Like other regions in the world, drug injection and its related harms are considered public health concerns in Iran (4, 5). The latest estimates in Iran show that 9.7% and 45% of PWID are infected with HIV (6) and HCV (7), respectively.

Substance use disorder (SUD) consists of cognitive, behavioral, and physiological symptoms manifested by an impaired ability to control use, increasing priority given to use over other activities, and persistence of use despite harm or negative consequences (8). It has been shown that SUD is associated with cognitive impairments (CIs), with prevalence ranging between 30% to 80% (9, 10). Cognitive impairments in people with SUDs are clinically relevant as they hinder readiness and commitment to substance use behavior change (10), and they are associated with unfavorable treatment

outcomes and higher dropout rates (11, 12). There are limited studies on the impact of substance types on CIs among people with SUDs. Furthermore, CIs negatively affect vocational functioning and quality of life, complicating the course of recovery for individuals with SUDs (13, 14). Previous studies have suggested that CIs are associated with high-risk sexual and injecting-related behaviors and poor risk reduction intervention and HIV treatment outcomes among high-risk people with SUDs (15, 16). Thus, unaddressed cognitive issues may contribute directly and indirectly to the public health burden of high-risk drug use.

There is a gap in knowledge regarding the prevalence of CIs and associated factors in PWID in Iran. Understanding this association can help policymakers and clinicians develop specific interventions to lower the odds of poor response to services.

2. Objectives

The primary aim of our study was to determine the prevalence of CIs and its related factors among PWID in Iran.

3. Methods

3.1. Study Design

A cross-sectional study was designed to determine the prevalence of CIs and their related factors among PWID in four provinces in Iran.

3.2. Study Settings and Population

About 410 PWID were recruited using snowball and convenience sampling from drop-in centers (DICs) between January 2022 and March 2023 in four provinces in Iran: Tehran, Fars, Kerman, and Kermanshah. These provinces were selected due to the high prevalence of injection drug use. We used the following formula to calculate the required sample size: $n' = z^2 * p (1 - p)/d^2$. Error type 1 and power were considered 0.05 and 80%, respectively. According to a previous study, the prevalence (p) of CIs was 25%.

Participants with the following characteristics were eligible for the study: PWID aged 18 years and over who reported injecting illicit drugs at least once within the last month. Additionally, they had to have the ability to provide informed consent and a good command of the Farsi language to respond to survey questions.

3.3. Study Instruments and Procedure

Data were collected by interviewers using standard questionnaires. The first questionnaire gathered socio-demographic factors (i.e., age, place of residence, job, and educational status) and history of drug use (i.e., type, frequency, and route of drug use, including opium, heroin, methamphetamine, and stimulants) during the last 6 months. The internal consistency of the questionnaire was assessed using Cronbach's alpha, which ranged between 0.81 and 0.90.

The dependent variable was cognitive impairments. The Montreal cognitive assessment (MoCA) was used to assess the cognitive status in PWID (17). The MoCA includes 13 items and can be administered in approximately 10 minutes. It assesses seven cognitive domains: Executive functioning, visuospatial abilities, attention, concentration, and working memory (referred to as 'attention'), language, abstract reasoning, memory, and orientation. The total score is a maximum of 30 points, calculated by summing the scores on all items. A score of 26 or higher is considered normal (18). The psychometric properties of the Persian version of the MoCA have been evaluated in previous studies, with an optimal screening cutoff of 24 for mild cognitive impairment (19, 20).

3.4. Statistical Analysis

Data analysis was conducted in two steps. In the first step, descriptive statistics were used to characterize the prevalence of CIs by demographics, socio-economic status, drug use history, and history of high-risk behaviors in the study population. To adjust for confounding variables, a multiple regression model was implemented in two steps.

First, the relationship between all independent variables and CI status was examined using bivariate logistic regression. In the next step, variables with a P-value < 0.2 were entered into the multiple logistic regression model. Finally, adjusted odds ratios (aOR) and 95% confidence interval (CI) 95% were reported in the final model. We used STATA v. 14 for this analysis. In all analyses, $P < 0.05$ was considered statistically significant.

4. Results

A total of 410 participants were included in the study, of which 350 (85%) were male, and 193 (47%) had less than a high school diploma. The majority were unemployed and not married. The mean ± standard deviation age of illicit drug use initiation was 23.5 ± 5.2 years. Opioids were the most common drug used among participants (72%). About 50% of participants reported

Table 1. Characteristics of Participants with and Without Cognitive Impairments by Demographic Characteristics, Socio-Economic Status, and Drug use History

Characteristics	Cognitive Impairment [a]		P-Value
	Yes (n = 110)	No (n = 300)	
Age (y)			
< 35	64 (57)	180 (60)	
35 - 40	32 (30)	80 (27)	
40+	14 (13)	40 (13)	
Age	26.4 ± 2.8	33.2 ± 4.2	0.04
Gender			0.2
Male	105 (90)	245 (81)	
Female	5 (10)	55 (19)	
Education			0. 11
High school and less	66 (60)	152 (51)	
Upper high school	45 (40)	148 (49)	
Marital status			0.4
Single or ex-married	57 (52)	141 (47)	
Married	53(48)	159 (53)	
Employment status			0.07
Unemployed or not in the workforce	80 (72)	190 (63)	
Employed	30 (28)	110 (37)	
Methamphetamine use (L6M)			
Yes	90 (82)	120 (40)	0.003
No	20 (18)	180 (60)	
Cannabis use			0. 2
Yes	9 (8)	15 (5)	
No	101(92)	285 (95)	
Age of illicit drug use initiation (y)			
< 22	80 (72)	180 (40)	0.02
≥ 22	30 (28)	120 (60)	
Duration of inject drug			
≤ 2	40 (36)	151 (52)	0.01
≥ 2	70 (74)	149 (48)	
History of overdose			0.002
Yes	25(22)	33 (11)	
No	85(78)	267(89)	
Poly drug use (L6M)			0.01
Yes	72 (65)	157 (52)	
No	38 (35)	143 (48)	
Alcohol use (L6M)			0.04
Yes	75 (67)	172 (57)	
No	35 (33)	128 (43)	

[a] Values are expressed as No. (%) or mean ± SD.

using methamphetamine, and 60% had consumed alcohol within the last 6 months (L6M). The prevalence of CIs in participants was 28% (95% CI: 22% - 32%). The CI status among different subgroups is presented in Table 1.

Compared to participants without CIs, those with CIs were more likely to be unemployed or out of the workforce (72% vs. 63%, P = 0.03), have started illicit drug use at age 22 or younger (72% vs. 40%, P = 0.03), be single (52% vs. 47%, P = 0.4), use methamphetamine in L6M (82% vs. 40%, P = 0.04), drink alcohol in L6M (67% vs. 57%, P = 0.03), and use multiple drugs simultaneously (65% vs. 52%, P = 0.02).

Table 2. Identified Factors with Cognitive Impairments Among People Who Inject Drugs Using Multipale Regression Model

Characteristics	Cognitive Impairment		P-Value
	aOR	(%95 CI)	
Age (y)			0.3
< 30	1	-	
30 - 39	1.3	0.1 - 5.3	
≥ 40	1.4	0.2 - 4.8	
Education			0.4
≥ High school	1		
< High school	1.3	0.8 - 2.31	
Monthly income (USD)			0.3
≥ 150	1		
< 150	1.65	0.93 - 2.99	
Age of illicit drug use initiation (y)			0.01
< 22	2.2	1.8 - 5.7	
≥ 22	1	-	
Duration of injecting drug use (y)			0.02
< 2	2.7	1.6 - 4.61	
≥ 2	1		
Methamphetamine use (L6M)			0.02
Yes	2.8	1.8 - 7.4	
No	1		
Polydrug use (L6M)			0.01
Yes	3.1	1.4 - 5.3	
No	1		
Alcohol use (L6M)			0.01
Yes	2.8	1.2 - 4.3	
No	1		

In Table 2, after adjusting for confounding variables, the factors associated with an increased risk of CI were: Initiation of illicit drug use at age 22 or younger (aOR = 2.2, P < 0.01), having a history of injecting drug use for two years or more (aOR = 2.7, P = 0.01), methamphetamine use in L6M (aOR = 2.8, P < 0.05), using multiple drugs simultaneously in L6M (aOR = 3.1, P < 0.05), and drinking alcohol in L6M (aOR = 2.8, P < 0.05).

5. Discussion

The present study aimed to assess the prevalence of CIs and contributing factors in PWID in Iran. Although some studies have investigated the prevalence of CIs among people with SUDs, to the best of our knowledge, this is the only study conducted among PWID recruited from DICs in Iran. The findings of our study showed that the prevalence of CIs was 28%. This prevalence is close to the 31% prevalence of CIs measured by MoCA (cut-off score 24) in another study among people with SUDs seeking outpatient treatment in the Netherlands (21) and the 35% prevalence of CIs measured by MoCA (cut-off score 26) among young adults with polysubstance use disorders in outpatient and residential settings in Norway (22).

Our findings indicated that PWID who started drug use at an early age (< 22 years) and those with a longer injecting drug-use career (≥ 2 years) were more likely to experience CIs. This finding was consistent with the results of the study from the Netherlands (21). Previous research revealed that drug use at an early age can be a significant predictor of CIs (9). The mechanism behind this may be that early age is a critical stage of vulnerability to drug use because the part of the brain responsible for processing feelings of reward and pain, crucial drivers of drug use, is still developing, and some brain areas are less mature than others (9).

In our study, polydrug use was determined to be significant for CIs. Cognitive impairments among people with polysubstance use were more common than those who use a single substance, consistent with research from Gustavson et al. (23) and Schmidt et al. (24). While this could be explained biologically and

socially, it can be challenging to compare substance use patterns across people with various backgrounds.

Consistent with other studies, our results revealed that methamphetamine use can increase the risk of cognitive impairments among study participants. Previous studies have suggested that people who use methamphetamine score lower than healthy individuals on various cognitive functions (25). For example, studies by Zhong et al. (26) and Iudicello et al. (27) show a positive association between amphetamine use and CIs (27, 28). There appears to be an association between the activation of glutamatergic neurons and dysfunction of GABAergic neurons in the frontal cortex, which can lead to cognitive deficits and altered decision-making in methamphetamine users.

Some studies have demonstrated that cognitive impairment in people who use methamphetamine is associated with factors such as the length of usage, education, gender, and impulsivity (26).

5.1. Limitation of Study

We acknowledge the limitations of our study. As the current study is a cross-sectional study, we can only calculate the association between exposure and the main outcome. Furthermore, our data were collected using participants' self-reports, which may be prone to social desirability bias. Misclassification errors can also occur due to self-reporting, potentially diminishing the true effect of associated factors. Caution is needed in interpreting the results of this study since other factors might be related to CIs, including pre-morbid CIs, comorbid psychiatric disorders, HIV infection, previous history of non-fatal overdoses, and head trauma, which were not measured in this study (29, 30). Further studies to include all potential factors contributing to CIs are warranted.

5.2. Conclusions

Methamphetamine and alcohol use were identified as the most significant predictors of cognitive impairments among PWID. Given the high prevalence of CIs in PWID, the chances of favorable outcomes of treatment and harm reduction interventions could be improved by detecting cognitive impairments at an early stage.

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Footnotes

Authors' Contribution: Study conceptualization and design were performed by M.N., A.N., and M.S.N. Data gathering and data analysis were performed by M.H.F., drafting and writing by M.N., J.B., A.N.A., and N.D., and all authors contributed to the drafting, writing, and editing of the article. All authors have read and agreed to the published version of the manuscript.

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Data Availability: The raw data supporting the conclusions of this article will be made available by the authors without undue reservation.

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Informed Consent: We obtained informed consent from all participants.

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