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The pathways between abstinence self-efficacy, perceived social support and substance use craving

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Low abstinence self-efficacy, lack of social support, especially from family and friends, low self-esteem, feeling lonely, and lack of self-control have been considered as risk factors for substance use disorders, but the pathways of these risk factors on drug craving have not yet been determined. Therefore, the present study aimed to evaluate the association between abstinence self-efficacy and perceived social support on the one hand to drug craving in patients referred to substance use treatment centers on the other hand, with loneliness, self-control, and self-esteem as mediating variables. The present study is a descriptive-correlational modeling study. The statistical population of this study included all individuals with a history of substance use referring to substance use treatment centers in Mazandaran province. Of these, 249 individuals were selected using a random cluster sampling method. Data were collected using six validated questionnaires including a demographic part, and questions on substance abstinence self-efficacy e, perceived social support, substance craving, self-esteem, self-control, and loneliness. The data were analyzed using structural equation modeling (SEM) with a partial least squares (PLS) approach to evaluate the relationships between variables. Based on the findings of this study, self-efficacy for drug abstinence was significantly and negatively associated with loneliness ($p < 0.001$), significantly positively associated with self-esteem ($p < 0.001$), significantly negatively associated with drug craving ($p < 0.001$), but no significant association was found with self-control ($P = 0.377$). Loneliness also was significantly positively associated with drug craving ($p < 0.001$). On the other hand, perceived social perception was significantly positively associated with drug abstinence self-control ($p < 0.001$), significantly negatively correlated with loneliness ($p < 0.05$), and significantly positively correlated with self-control ($p < 0.001$). However, no significant associations were found between perceived social perception on the one hand and self-esteem ($P = 0.891$) and drug craving ($P = 0.144$) on the other one. Further, we found that self-control was not significantly associated with substance craving ($P = 0.121$). Self-esteem was significantly negatively associated with loneliness ($p < 0.001$). Finally, a significant and direct association was found with substance craving ($p < 0.001$), but not with self-control ($p = 0.458$). Our study revealed that abstinence self-efficacy, loneliness, and social perception play a key role in predicting drug craving and self-esteem. As such, interventions to reduce drug craving might focus on increasing abstinence self-efficacy and social support, reducing loneliness, improving self-esteem, and self-control.

Keywords Abstinence self-efficacy, Social support, Loneliness, Self-control, Craving, Self-esteem

One of the most obvious psychosocial harms that can destroy the foundation of personal, family, and social life is substance use[1]. Opioid Use Disorder (OUD) is a chronic condition in the DSM-5 in the form of frequent use of opioids and tolerance, causing symptoms of withdrawal after discontinuation. Unsuccessful attempts to quit or reduce it, failure to fulfill role commitments, and withdrawal of activity for substance use are defined[2]. The United Nations Office on Crime Prevention and Drug Control reported 5% of people who use substances among 15-64-year-olds worldwide[3]. In the United States, approximately 6.7 to 7.6 million adults live with OUD[2]. In

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Iran, the dominant type of opioid used is opium[4] and studies demonstrated that the prevalence of opium use in Iran is 11.9%[5].

OUD is a chronic and destabilizing condition that can lead to multiple complications and deaths[2]. These complications may include personal problems, such as lack of responsibilities at home or work, as well as legal problems. It can also cause health-related, social, economic, political and cultural harm to society. In addition, health risks like as hepatitis and AIDS resulting from needle use or high-risk sexual behavior, are more common in this population. Crimes related to addiction, such as theft, violence, unemployment, child abuse, and increased family separations, also rise due to this disease[6–13]. So, substance use addiction treatment is an important issue. However, one of the major challenges in treating substance use addiction—and the greatest threat to a patient's recovery—is relapse, with the primary cause being the desire to use substances[14,15]. The desire to return to substance use is defined as the subjective experience of motivation or craving to consume substances[16]. In fact, cravings have been reported as a significant predictor of substance use and relapse[17,18]. A single increase in cravings or related indicators is associated with more than double the substance use or relapse in the future[19]. Therefore, identifying risk factors that increase cravings and understanding their relationships is crucial.

No single factor can effectively predict substance use cravings, but certain factors -such as components of social capital (e.g., social support, communication, and personal trust), the frequency and duration of substance use, self-esteem, self-control, traumatic childhood experiences, and educational level- are associated with cravings[20–22]. Since higher levels of craving are consistently inked to relapse among individuals undergoing substance use disorder treatment, and because craving acts as a barrier to maintaining treatment and predict non-compliance[23], identifying the key variables to design appropriate interventions is essential for reducing drug cravings.

One of the important variables associated with drug use and desire to use substances is withdrawal self-efficacy[24]. Various studies have shown that self-efficacy predicts treatment outcomes and relapses[25–27]. Abstinence self-efficacy or coping self-efficacy refers to a person's confidence in their personal ability to avoid substance use in high-pressure and problematic situations[28]. Abdullahi and colleagues demonstrated a relationship between self-efficacy and relapse, as well as its association with age of first drug use, dose and treatment procrastination[29]. Similarly, Ibrahim and colleagues found a significant negative correlation between self-efficacy and relapse[30]. Torrecillas and colleagues also reported that self-efficacy is inversely associated with the number of drugs used and with chronic addiction[31]. Therefore, low self-efficacy can have a negative impact on substance use cravings and hinders recovery from addiction[30].

Social support is also an important component in preventing cravings and relapse. Surveys revealed that people using substances do not receive proper social support from their environment[32]. Some researchers have defined social support as the amount of love, companionship, care, respect, attention and help received by a person from other people or groups such as family members, friends and important people. Establishing early social support has been shown to be beneficial not only in reducing cravings and relapse behaviors, but also in improving the quality of life of people struggling with drug addiction[33]. Atadakht et al. (2015) and Nashee et al. (2014) demonstrated a relationship between perceived social support and decrease in substance use relapse[32,34]. Also, self-control have been found to be an important component to prevent substance use relapse[35]. Some studies have also shown that the use of self-control strategies by individuals with addiction helps reduce negative emotions and drug cravings[36,37].

Feelings of loneliness can also be identified as one of the factors influencing drug carving and relapse[38,39]. Addiction often leads to the rejection of drug users, causing them to distance themselves from their loved ones to prevent the harmful side effects of drug use from affecting others. In some cases, families may reject and withdraw support over time, leading to feelings of loneliness, which can drive individuals to return to drug use[40]. Another factor that influence the urge to use substances is self-esteem. Individuals struggling with addiction often experience unhappiness, dissatisfaction and discomfort with themselves or the environment or both. They frequently suffer from feelings of insecurity, inadequacy, loneliness, hatred, depression, severe anxiety, emotional sensitivity and especially internal conflicts. They struggle to solve problems and feel incapable of livingin relative peace and comfort[41]. In other words, self-esteem increases individual motivation and is one of the most influential factors in determining performance, particularly in controlling, monitoring and preventing relapse within treatment programs for individuals with substance use disorders[42].

Finally, since modeling plays an important role in determining the most accurate pathway of drug cravings in individuals prone to substance use disorder[43], and given the influence of key variables on relapse, these variables were included in the model as mediators in the current study. Considering both mediating and direct variables in research offers new insights and enables a deeper and broader analysis of substance use disorder.Therefore, recognizing the importance of identifying risk factors and mediating variables related to drug cravings for designing effective interventions, the present study aimed to investigated the associations between of self-efficacy abstinence and perceived social support on the one hand, and drug craving in patients referred to substance use treatment centers in Mazandaran province (the north of Iran) on the other one. Further, the mediating role of loneliness, self-control and self-esteem was assessed. The results of this study can inform experts in developing preventive and control policies by enhancing their understanding of the factors influencing drug cravings.

Methods

The present study is a descriptive-correlational study using a modeling approach to investigate the effects of abstinence self-efficacy and social support on drug cravings in patients referred to substance use treatment centers in Mazandaran Province. This investigation also examines the mediating roles of loneliness, self-control, and self-esteem among individuals with substance use disorders. The statistical population of this research includes all individuals with a history of drug use who attend addiction treatment centers in Mazandaran province. Considering the potential for participant attrition and the minimum required sample size for structural models

(200 participants), a total of, 250 were initially selected. Ultimately, 249 participants with substance use disorders were included in the study, consisting of 192 men (77.10%) and 57 women (22.90%), selected through random cluster sampling.

The inclusion criteria were basic reading and writing literacy,an age range of 20–60 years, a history diagnosis of physiological dependence on at least one psychoactive substance and substance use disorder based on the DSM-5 criteria, they have been dependent on substances in the past 3 months to one year, have been referred for treatment for the first time, and they do not receive any psychological and pharmacological treatment. The exclusion criteria included the presence of psychotic disorders such as schizophrenia, delusions, epilepsy, or bipolar disorder, as well as unwillingness to participate in the research, lack of cooperation in answering the questionnaires, and incomplete questionnaire responses.

Data collection tools

Data were collected using six standard questionnaires, each containing validated scales to measure the following variables: demographic information, substance abstinence self-efficacy, perceived social support, substance craving, self-esteem, self-control, and loneliness.

Demographic characteristics

This questionnaire includes questions on age, age at onset of substance use, marital status, level of education, employment status, place of residence, economic status, history of substance withdrawal, history of a person with a substance use disorder in the family, number of children, and history of relapse.

Drug abstinence self-efficacy scale (DASE)

The Drug Abstinence Self-Efficacy Scale is a modified version of the Alcohol Abstinence Self-Efficacy Scale (AASE), originally developed by DiClemente et al. in 1994 whose psychometric properties were subsequently examined. In 2000, Hiller et al., addressing the relative lack of instruments for assessing drug abstinence self-efficacy, evaluated this questionnaire in a drug-using population and estimated its psychometric pproperties. DASE consists of 20 items and 4 constructs including negative effects (items 18, 16, 14, 6, 3), social/positive effects (items 20, 17, 15, 8, 4), physical and other problems (items 13, 12, 9, 5, 2), and withdrawal/craving (items 19, 11, 10, 7, 1) that are able to identify the role of self-efficacy in abstaining from drug use in users in situations where there is a possibility of drug relapse. All items are given on a 5-point Likert scale from not at all sure[1] to very sure[5]. The Cronbach's alpha coefficient for the original version of the questionnaire was between 0.92 and 0.87, and for the dimensions of the negative effects dimension (0.88), the social/positive effects dimension (0.82), the physical and other problems dimension (0.83), and the deprivation/craving dimension (0.81), and for the entire questionnaire it varied between 0.81 and 0.88, which was cited for various studies[13]. In the study by Hiller et al.[14], 4 factors were confirmed. The Cronbach's alpha coefficient for the negative effects dimension (0.92), the social/positive effects dimension (0.92), the physical and other problems dimension (0.87), and the deprivation/craving dimension (0.89) varied between 0.92 and 0.87 for the entire questionnaire. The minimum score for each subscale of the questionnaire s 5, and the maximum score for each dimension is 25, considering the number of 5 items in each dimension. The minimum score for the entire questionnaire is 20 and the maximum score is 100. Higher scores indicate greater self-efficacy for abstaining from drug use, and lower scores indicate lower self-efficacy for abstaining from drug use in situations where relapse is likely. This questionnaire has been translated, psychometrically validated, and validated by Khazaee-Pool et al. (2021). Cronbach's alpha coefficient for the Persian version of the questionnaire was between 0.90 and 0.93[44].

Perceived social support questionnaire

This questionnaire was designed by Zimet, Dahlem, Zimet & Farley in 1988. The Multidimensional Scale of Perceived Social Support (MSPSS) is a 12-item instrument developed to assess perceived social support from three subscales: Friends, Family and Significant Other. The purpose of designing the Multidimensional Scale of Perceived Social Support (MSPSS) is to measure the level of perceived social support received from three subscales of Friends, Family and Significant Other in participants, because low levels of perceived social support are associated with high levels of anxiety and depression in individuals. The scoring of the Multidimensional Scale of Perceived Social Support Questionnaire (Zimet et al., 1988) is based on a 5-point Likert scale ranging from strongly disagree (score 1) to strongly agree (score 5). Strongly disagree (1 point), disagree (2 points), no opinion (3 points), agree (4 points), strongly agree (5 points). Therefore, the subject receives a score from 1 to 5 for each question in this questionnaire[45]. Questions 3, 4, 8, and 11 of the questionnaire measure social support from family; questions 6, 7, 9, and 12 measure social support from friends; and questions 1, 2, 5, and 10 measure social support from significant others. The total score of the scale is obtained from the sum of the scores of individuals in the 12 questions of the questionnaire. The minimum possible score is 12 and the maximum is 60. In this questionnaire, the higher the score an individual receives, the greater the perceived social support. In Besharat's (2019) study, the reliability of this scale was reported as 0.91 for the entire scale and 0.89, 0.81, and 0.83 for the subscales of friends, family, and others around them, respectively, using Cronbach's alpha, and the internal consistency coefficients were confirmed[46].

Short-form substance use disorder scale

This test is an 8-item self-report instrument designed by Somoza et al. in 1995 and measures the duration, frequency, and intensity of substance use disorder on a 5-point Likert scale (very much = 4, somewhat much = 3, little = 2, very little = 1, none = 0). Questions 1 and 5 indicate the type of primary and secondary dependence of individuals on substances. Questions 2 to 4 and 6 to 8 are added together to obtain the total score of the substance use disorder scale. The range of scores on the substance use disorder scale is between 0 and 32, with

higher scores indicating greater substance use disorder and vice versa. This scale has shown high correlation with other addiction severity scales, and its Cronbach's alpha coefficient has been reported to be 0.88[47]. In addition, Cronbach's alpha coefficient of 0.78 was reported in the study conducted by Basharpour et al.[48]. The correlation of this questionnaire with the addiction severity scale in the present study was 0.75, which was significant and indicates convergent validity. The reliability coefficient of this scale in the present study was 0.83.

Loneliness questionnaire (UCLA)

This questionnaire was developed by Russell, Pilva, and Cortona in 1980. The purpose of this questionnaire was to investigate ways to solve adolescent problems. It has 20 questions, and these twenty questions include 10 negative questions and 10 positive questions. This questionnaire is based on a Likert scale and its Likert is 4-point. The scoring method of the questionnaire is as follows: never has a score of (1), rarely has a score of (2), sometimes has a score of (3), and always has a score of (4). However, the scores of questions 1, 5, 6, 9, 10, 15, 16, 19, and 20 are reversed. That is, never has a score of (4), rarely has a score of (3), sometimes has a score of (2), and always has a score of (1). The range of scores is between 20 (minimum) and 80 (maximum). Therefore, the average score is 50. A score higher than the average indicates greater severity of loneliness. The test-retest reliability of the scale was reported by Russell, Pilva, and Ferguson (1980) to be 89%[49]. This scale was translated by Shekharkan and Mirdrikund and used after preliminary implementation and modifications[50].

Rosenberg self-esteem questionnaire

The Rosenberg Self-Esteem Questionnaire (1965) measures general self-esteem and personal worth. This scale consists of 10 general statements that measure the degree of satisfaction with life and feeling good about oneself[51]. According to Burnett and Wright (2002), the Rosenberg Self-Esteem Questionnaire (SES) is one of the most commonly used scales to measure self-esteem and is considered a valid scale because it uses a concept for self-esteem similar to the conceptpresented in psychological theories of the "self". The SES was created to provide an overall picture of positive and negative attitudes about oneself[52]. This scale has a higher correlation coefficient than the Coopersmith Self-Esteem Questionnaire (SEI) and is more valid in measuring levels of self-esteem. The Rosenberg Self-Esteem Questionnaire consists of 10 items in which the subject is asked to answer them accurately on a four-point Likert scale from strongly agree to strongly disagree. The range of scores for this scale is from 10 to 40, with higher scores indicating higher self-esteem. Five of its statements are presented in a positive manner (items 1 to 5) and five are presented in a negative manner (items 6 to 10). The scoring method for this scale is as follows: Questions 1 to 5, I strongly disagree = 0, I disagree = 1, I agree = 2, and I strongly agree have a score of 3. Also, in questions 6 to 10, I strongly agree = 0, I agree = 1, I disagree = 2, and I strongly disagree have a score of 3. Rosenberg reported the scale's reliability as 0.9 and its scalability as 0.7. Cronbach's alpha coefficients for this scale were calculated as 0.87 for men and 0.86 for women in the first round, and 0.88 for men and 0.87 for women in the second round[53]. The test-retest correlation is in the range of 0.88 – 0.82 and the internal consistency coefficient or Cronbach's alpha is in the range of 0.88 – 0.77. This scale has satisfactory validity (0.77). It also has a high correlation with the New York National Questionnaire and Gottman in measuring self-esteem, so its content validity is also confirmed.

Self-control questionnaire

This scale was designed by Tangeni et al. (2004). This scale has 36 items that measure positive and negative values of self-control. 15 items are considered for negative values and 21 items are considered for negative values. Items 2-3-4-6-8-9-10-11-12-14-16-17-19-20-21-23-25-28-29-31-32-33-34-35 are reverse scored and items 1-5-7-13-15-18-22-24-27-30-36 are direct scored. The interpretation of the scores is evaluated at four levels from very good to poor. It follows the five-point Likert scale as follows: always (5), most of the time (4), sometimes (3), somewhat (2), and not at all (1). The maximum score for this scale is 180 and the minimum is 36. Higher scores indicate higher self-control of the individual and vice versa. Tangeni et al. (2004) obtained the reliability of this scale using Cronbach's alpha test of 0.83 and 0.85[54]. In Iran, this scale was validated by Mousavi et al. (2015). The reliability coefficient of the instrument in Iran was reported to be 0.7. The Cronbach's alpha coefficient was obtained as 0.81[55].

Ethics

The study procedure was approved by the Medical Ethics Committee of Mazandaran University of Medical Sciences [Ethical code number: IR.MAZUMS.REC.1402.526].

Statistical analysis

In the initial part, demographic variables and main research variables were examined using descriptive statistics. Inferential analyses were conducted using structural equation modeling (SEM) with partial least squares (PLS) approach to evaluate the relationships between variables. The mediation and moderating effects of variables were tested using bootstrap methods. The results were reported with appropriate statistical measures, including path coefficients, t-statistics, and p-values, to provide a comprehensive understanding of the findings. The software used in this study is SPSS and Smart PLS.

Results

The average age of the respondents is 40.73 ± 10.08. Most of the participants are married49.4%), have a middle school degree (37.3%), live with their spouse (84.3%). have a part-time job (36.1%), and have their own home (35.7%). Further, 20.1% of patients reported to live with an addicted person, regarding drug use, 31.3% of patients use methamphetamine, 28.9% heroin, and 24.9% opium. 53.8% of patients reported a history of overdose once and 41% had two or more overdoses. Other socio-demographic characteristics are presented in Table 1.

Var.	Category	Number	Percent	Var.	Category	Number	Percent (%)
Marital status	Permanent marriage	123	49.4%	Living with individuals who use substances	Yes	50	20.1
	Temporary marriage	3	1.2%		No	197	79.1
	Single	73	29.3%		I don't want answer	2	0.8
	Divorced	45	18.1%	Family support	Ever	47	18.9
	Widowed	5	2.0%		Some	48	19.3
Education status	Illiterate	15	6.0%		Average	84	33.7
	Primary education	41	16.5%		High	70	28.1
	Middle school diploma	93	37.3%	Person who uses substances in thefamily	Brother	15	6.0
	High school diploma	63	25.3%		Father	1	0.4
	Above high school diploma	37	14.9%		Friend	220	88.4
Live with Who	Spouse	210	84.3%		Alone	13	5.2
	Friend	1	0.4%	Drug Name	Heroine	72	28.9
	Alone	23	9.2%		Crack	19	7.6
	Without a guardian	15	6.0%		Methamphetamine	78	31.3
Job	Full-time	67	26.9%		Hashish	18	7.2
	Workless	83	33.3%		Opium	62	24.9
	Retired	9	3.6%	Over dose	Once	134	53.8
	Part-time	90	36.1%		Twice or more	102	41.0
Housing status	Owned home	89	35.7%		I don't want answer	13	5.2
	Rented home	59	23.7%	Hospitalization	Once	141	56.6
	Parent's home	77	30.9%		Twice or more	80	32.1
	Homeless	24	9.6%		I don't want answer	28	11.2

	N	Mean	Median	Mode	Std. deviation	Minimum
Age	249	38.00	35	10.082	24	74

Table 1. Demographic characteristics of research participants.

	Mean	Median	Mode	Std. Deviation	Minimum	Maximum
Abstinence self-efficacy	47.68	49.00	39.00	9.44	25.00	66.00
Perceived social support	26.59	26.00	27.00	5.57	13.00	40.00
Loneliness	37.82	38.00	37.00	8.95	20.00	55.00
Self-control	73.75	75.00	62.00	15.65	37.00	107.00
Self-esteem	16.46	15.00	15.00	4.11	9.00	26.00
Substance use craving	5.59	4.00	1.00	4.49	0.00	18.00

Table 2. Descriptive indices of the main research variables.

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Drug abstinence	0.858	0.863	0.883	0.339
Loneliness	0.852	0.859	0.878	0.314
Perceived social cognition	0.81	0.814	0.854	0.396
Self-control	0.936	0.937	0.942	0.386
Self-esteem	0.731	0.748	0.808	0.349
Substance craving	0.778	0.784	0.85	0.533

Table 3. Convergent validity and composite reliability in the fit of measurement models.

Descriptive of self-efficacy to avoid drugs, feelings of loneliness, self-control, self-esteem, social perception and carving to use drugs are presented in Table 2.

In this study, 249 addict patients were included. After collecting the data and entering the variables into the model, some items were found to have low factor loadings (less than 0.4) or even negative factor loadings in some cases. In order to improve the quality of the model and achieve a structure with acceptable validity and reliability, these questions were removed step by step. The fit of the final model was good (see. table * in supplementary file). Table 3 presents the values of Cronbach's alpha, composite reliability and average variance extracted (AVE) for

	Drug abstinence	Loneliness	Perceived social cognition	Self-control	Self-esteem	Substance craving
Drug abstinence	0.582					
Loneliness	− 0.939	0.561				
Perceived social cognition	0.315	− 0.331	0.629			
Self-control	0.228	− 0.216	0.636	0.621		
Self-esteem	0.874	− 0.874	0.271	0.18	0.591	
Substance craving	− 0.749	0.762	− 0.367	− 0.293	− 0.559	0.73

Table 4. Correlation matrix and divergent validity check by Fornell and Larker method.

	Original sample (O)	T statistics (|O/STDEV|)	*P* values
Drug abstinence → loneliness	− 0.727	18.345	0.000
Drug abstinence → self-control	0.092	0.883	0.377
Drug abstinence → self-esteem	0.875	48.227	0.000
Drug abstinence → substance craving	− 0.51	5.034	0.000
Loneliness → substance craving	0.736	7.213	0.000
Perceived social cognition → drug abstinence	0.315	5.488	0.000
Perceived social cognition → loneliness	− 0.041	1.997	0.046
Perceived social cognition → self-control	0.626	14.269	0.000
Perceived social cognition → self-esteem	− 0.005	0.137	0.891
Perceived social cognition → substance craving	− 0.067	1.463	0.144
Self-control → substance craving	− 0.076	1.549	0.121
Self-esteem → loneliness	− 0.227	5.412	0.000
Self-esteem → self-control	− 0.07	0.743	0.458
Self-esteem → substance craving	0.561	7.632	0.000

Table 5. Direct path coefficients and significant coefficients.

the items. The values of Cronbach's alpha and composite reliability of most of the variables are acceptable and desirable, although some of the AVE values are less than 0.5, In addition, the measured constructs have been able to distinguish their unique concepts from other constructs and have a meaningful relationship with their indicators. The value of the standardized root means square residual (SRMR) index is 0.089, which indicates the appropriateness of the model (Table 4).

Based on the findings of this study, abstaining fromdrugs has a significant and inverse effect on loneliness ($t = 18.345$, $p < 0.001$), a significant and positive effect on self-esteem ($t = 48.227$, $p < 0.001$), and a significant and inverse effect on substance cravings ($t = 5.034$, $p < 0.001$), but it does not have a significant effect on self-control ($p = 0.377$). Loneliness has a significant and positive effect on drugs craving ($t = 7.213$, $p < 0.001$). Perceived social perception has a significant and positive effect on abstinence from drugs ($t = 5.488$, $p < 0.001$), a significant and inverse effect on loneliness ($t = 1.997$, $p < 0.05$), and a significant positive effect on self-control ($t = 14.269$, $p < 0.001$). However, perceived social support does not have a significant effect on self-esteem ($P = 0.891$) or drug cravings ($P = 0.144$). Self-control has no significant effect on drug cravings ($P = 0.121$). Self-esteem has a significant and inverse effect on loneliness ($t = 5.412$, $p < 0.001$), a significant and direct effect on drug addiction ($t = 7.632$, $p < 0.001$), but it does not have a significant effect on self-control (0.458 = P) (Table 5). Figure 1 shows the structural model of the research, and Fig. 2 shows the main model number with standard coefficients and significant coefficients.

The results of Table 6 show the indirect effects of the research variables on drug craving through different mediating pathways. Perceived social perception indirectly (via abstaining from drugs) has a negative and significant effect on drug craving. Also, social perception has a positive effect on drug craving through substance abstinence and self-esteem, which points to the role of self-esteem as a key variable in this relationship. On the other hand, abstaining from drugs has an indirect negative and significant effect on drug craving through self-esteem and loneliness. In addition, self-esteem as a mediating variable plays an important role in influencing other variables. Self-esteem significantly reduces drug cravings by reducing feelings of loneliness. Paths related to the effect of self-control as a mediator between self-esteem and drug craving, or between social perception and drug craving, were not significant. This indicates that self-control does not play a role a key mediator of drug craving.

Since the feeling of loneliness played a fundamental role in the study of the main model, acting as a mediating variable in most indirect relationships, it also appears to be a moderating variable for the relationships between the model's variables. Therefore, we considered another model in which loneliness is treated as a moderating variable. Figures 3 and 4 are related to model 2.

Based on the results of Table 7, the moderating coefficient of the loneliness variable is significant in in the effect of drug abstinence on drug craving ($p < 0.001$), in the effect of self-esteem on drug craving ($p = 0.033$)

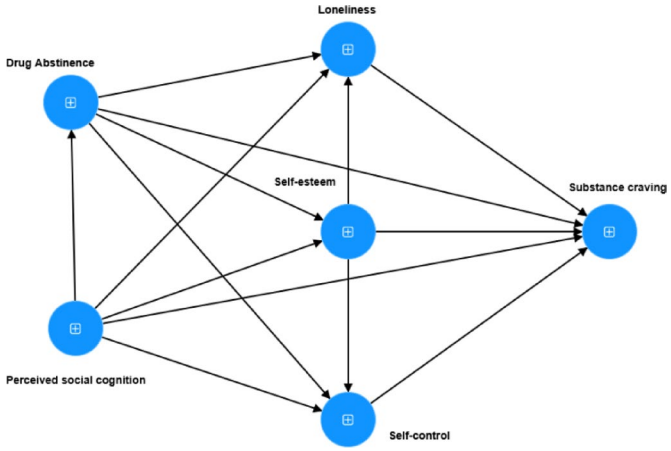

Fig. 1. The main model of research number 1.

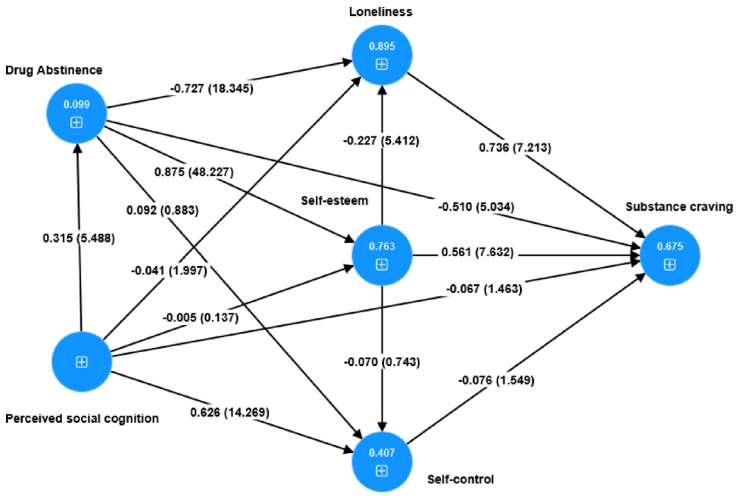

Fig. 2. The main model number 1 in the case of standard coefficients and significant coefficients.

	Original sample (O)	T statistics (|O/STDEV|)	*P* values
Drug abstinence → self-esteem → loneliness	− 0.199	5.367	0.000
Drug abstinence → loneliness → substance craving	− 0.535	6.562	0.000
Perceived social cognition → drug abstinence → loneliness	− 0.229	5.245	0.000
Perceived social cognition → drug abstinence → self-esteem → Loneliness	− 0.063	3.797	0.000
Drug Abstinence → self-esteem → substance craving	0.491	7.379	0.000
Perceived social cognition → drug abstinence → substance craving	− 0.161	3.515	0.000
Perceived social cognition → drug abstinence → self-esteem → loneliness → substance craving	− 0.046	3.441	0.001
Perceived social cognition → drug abstinence → self-esteem	0.276	5.428	0.000
Self-esteem → Loneliness → substance craving	− 0.167	4.374	0.000
Perceived social cognition → drug abstinence → self-esteem → substance craving	0.155	4.379	0.000
Perceived social cognition → drug abstinence → loneliness → substance craving	− 0.168	4.292	0.000
Drug abstinence → self-esteem → loneliness → substance craving	− 0.146	4.351	0.000

Table 6. Table of non-path coefficients and significant coefficients.

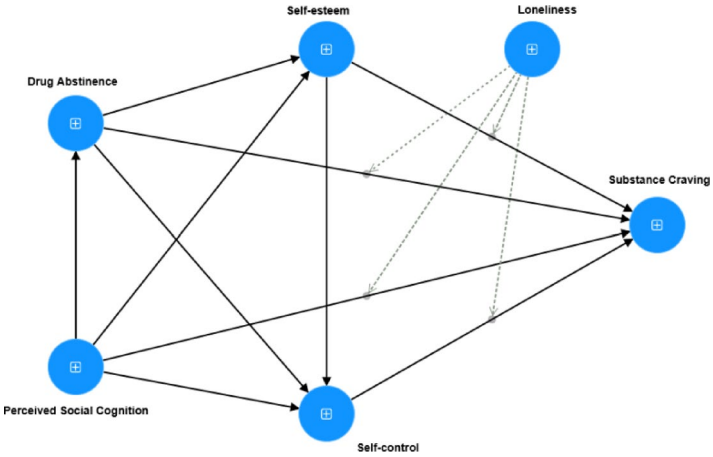

Fig. 3. The main model of research number 2.

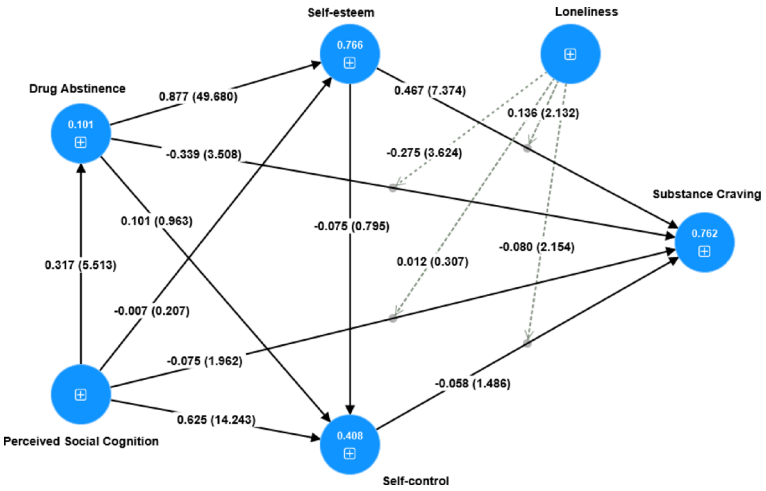

Fig. 4. The main model number 1 in the case of standard coefficients and significant coefficients.

	Original sample (O)	T statistics (|O/STDEV|)	*P* values
Loneliness × drug abstinence → substance craving	− 0.275	3.624	0.000
Loneliness × self-esteem → substance craving	0.136	2.132	0.033
Loneliness × perceived social cognition → substance craving	0.012	0.307	0.759
Loneliness × self-control → substance craving	− 0.08	2.154	0.031

Table 7. Moderating coefficients of loneliness variable.

and in the effect of self-control on drug craving ($p = 0.031$). Thus, loneliness plays a moderating role in these relationships.

Discussion

The aim of this study was to compile a self-efficacy model of abstinence and perceived social support on drug craving in patients referred to addiction treatment centers in Mazandaran province, with loneliness, self-control and self-esteem as mediating variables. The results showed that the initial hypothetical model had a good fit. We found that self-efficacy of avoiding drugs has a significant effect on loneliness, self-esteem and drug craving. Loneliness had a direct effect on drug craving for drugs, while self-esteem and perceived social support play a mediating role on drug craving. Self-efficacy was a protective factor against drug use[56], and an important predictor for the success of treatment in addicts[57].

Bader et al. (2005) showed that self-efficacy as a cognitive determinant should be considered to mediate the improvement of smoking cessation programs[58]. Naar-King et al. (2006) highlighted the potential of interventions

aimed at increasing self-efficacy to reduce substance use[59]. Other studies have shown that high self-efficacy reduces the desire to use substances and relapse[60–63]. Therefore, it seems that the designing and implementation interventions to improve self-efficacy can significantly impact reducing the urge to use drugs and its recurrence.

We further found that perceived social support has a significant effect on the self-efficacy of avoiding drugs, loneliness, and self-control. These mediating variables play a key role in predicting drug craving and self-esteem. These results emphasize the importance of social support and promoting self-esteem as vital factors in preventing substance abuse. Consistent with the present study, studies have shown that relapse in alcohol dependent individuals is associated with poor social support[64,65]. Rathinam et al. (2022) showed that perceived social support was higher among people who had abstained from drugs for three months or more[66], which is in line with the results of our study, as such, social support in rehabilitation programs is important to help prevent relapse after discharge from the rehabilitation center[67]. In addition, perceived social support has indirectly and through self-efficacy of drug abstinence a significant effect on drug craving. Stevens et al. (2015) found a positive and significant relationship between general social support and abstinence-specific self-efficacy[68]. As a result, social support, especially through the mediation of variables such as abstinence self-efficacy, loneliness, and self-control, can be used to reduce cravings.

Social support can also affect the mental health of substance-dependent individuals by reducing stigma and can increase self-esteem[69]. further, self-esteem which refers to the individual's sense of worth, approval, acceptance, and self-worth seems to affect the prevention of addiction and craving is, in a study by Akbari et al. (2018), self-esteem was examined as a mediating variable between personality traits and a tendency to substances. The study showed that personality traits and self-esteem have a significant effect on the tendency to abuse substances[70]. Nasiri et al. (2014) also found that a decrease in self-esteem, increases the tendency to addiction[71]. in line with the present study, several studies showed that self-esteem is an effective factor in the tendency to addiction and an important predictor in reducing craving and, as a result, treatment and relapse, is[72–74]. The findings of our study also showed that self-esteem, as a mediating variable, plays an important role in influencing other variables. More specifically, self-esteem significantly reduces drug cravings by reducing feelings of loneliness.

Another influential mediating variable in the present study is self-control. The core of addiction can be described as the loss of self-control, which is the ability to control one's behaviors, emotions, and instincts despite having the motivation to act[75]. Self-control is an important predictor in reducing substance use craving[76]. Bashirian et al. (2012), found that self-control was an important factor in adolescents' tendency to drug craving[77]. In a study of Ghadampour et al., the strongest predictor of substance craving was self-control[78]. Therefore, it is important to address the role of self-control and its improvement when designing appropriate interventions to prevent drug craving.

We further found that loneliness as a moderating variable plays a significant role in some of the relationships between independent variables and substance craving. More specifically, loneliness has a significant effect on the relationship between drug abstinence and drug craving, indicating that as loneliness decreases, craving increases. Also, loneliness significantly moderates the relationship between self-esteem and craving, such that in the presence of higher self-esteem, the role of loneliness decreases. Finally, loneliness has a significant effect on the relationship between self-control and craving, indicating a decrease in the effect of self-control on craving in situations where people feel lonelier. Consistent with this study, loneliness was shown to have an important predictive role in the tendency to use drugs[79]. Loneliness may lead to low self-esteem, anxiety, impaired social skills, aggression, suicidal thoughts, intense negative emotions, and mental disorders, all of which may predispose one to substance use[79]. In a study by Ghadampour et al., the relationship between loneliness and drug addiction was positive and significant[78]. Norouzi et al. showed a positive and significant relationship between loneliness and the prediction of addiction to social networks among middle school girls[80]. Hamed-Shammaie et al. showed a relationship between loneliness and the prediction of drug addiction in nurses[79]. Tavvafi et al. (2023) showed that self-control, loneliness, and self-harm together explained 50% of the variance in relapse to drug use[16]. These findings, in line with the present study, emphasize the importance of social and psychological interventions in reducing loneliness and strengthening self-control skills and self-esteem in order to reduce drug craving.

This study, like other studies, has a number of strengths as well as limitations. Some of the strengths of the study include the use of valid questionnaires, an appropriate sample size, a sample of women and men, and the presentation of two models, which increase the generalizability of its results. One of the limitations of the present study was that due to the limited access to individuals who only use one type of drug, this study included individuals who used various substances such as heroine, crack, methamphetamine, hashish, and opium, which could cause different cognitive functioning. On the other hands, a methamphetamine user in the early stages of treatment—who may still be experiencing withdrawal symptoms and possibly relapsing—will likely show different cognitive impairments compared to an opioid user who has been on long-term agonist maintenance therapy. To solve this limitation, we tried to select samples that had been used substances for a maximum of one year to reduce the different cognitive effects of stimulants use. In addition, people with a history of psychological disorders were excluded from this study, so this issue was prevented to some extent. There is considerable evidence that methamphetamine use disorder results in a diverse range of severe cognitive effects, including significant impairments in executive function, working memory, verbal fluency, attention, immediate and delayed memory, and decision-making[81–85]. Similarly, evidence reveal that opioid-dependent persons have major deficits in general cognitive functioning that remain even throughout withdrawal[86]. However, approximately half of the study participants used opioid derivatives and half used stimulant drugs. Thus, it is essential to explore the association between drug-related behaviors and cognition in opioid and stimulant-dependent patients. So, it is recommended that similarities and differences in cognitive impairment between opioid and stimulant dependent patients should be further substantiated in a larger sample.

Conclusion

Our study revealed that abstinence self-efficacy, loneliness, and social perception play a key role in predicting drug craving and self-esteem. According to the findings of this study, interventions to reduce drug craving should focus on increasing abstinence self-efficacy and social support, reducing loneliness, improving self-esteem, and self-control.

Data availability

All data generated or analyzed during this study are available upon request from the corresponding author.

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Author contributions
F.Y., and M.K., contributed to design and execution of the study. F.Y. fill the questionnaire. A.A.N.G. Did the statistical part. K.P. Edited the article. F.Y. wrote the first draft of the paper, which was revised by all authors. All the authors approved the final version of the paper for submission.

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Declarations

Competing interests
The authors declare no competing interests.

Ethical approval and consent to participate
The Ethics Committee of the Mazandaran University of Medical Sciences in Mazandaran, Sari, Iran, has approved the protocol for the current study [Ethical code number: IR.MAZUMS.REC.1402.526]. All the study procedures were carried out under the principles in the Declaration of Helsinki 1964 and its amendments later on. Written and oral informed consent were obtained from the participants prior to participate in the study. Furthermore, they were be informed that they had the right to withdraw from the study at any stage of the study, and that their decision to refuse contribution at any time was not influence or change the quality of services provided to them.

Additional information
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