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Development of Causation Model between Automatic Negative Thoughts and Craving Mediating by Cognitive Emotional Regulation among Methadone Maintained Clients

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Abstract

Introduction: The purpose of this study was to investigate the causal effects of automatic negative thought on craving mediating by cognitive emotional regulation.
Method: This study had a descriptive and correlational design. The study population consisted of methadone maintained clients of the Iranian National Center for Addiction Studies, Tehran City (n=78) and Mehr-Aein clinic in Rey city (n=42) who referred to treatment centers during February to April 2019. Data were collected through convenient sampling using craving questionnaires including Francken's Obsessive-compulsive Drug Use Scale and Visual Analog Scale. Other study questionnaires were Cognitive Emotional Regulation Questionnaire and Automatic Negative Thought Scale. For data analysis, we used multivariate linear regression using the structural equation modeling and path analysis using STATA software.
Results: Findings revealed that there are significant correlations between automatic negative thoughts, cognitive emotional regulation and craving ($P<0.001$). Also, the results of hierarchical regression analysis indicate that cognitive emotional regulation can mediate the relationship between automatic negative thoughts and craving ($P< 0.001$).
Conclusion: According to the results of this study, it can be concluded that clients who have higher levels of automatic negative thoughts and higher negative strategies of cognitive emotional regulation, experience a higher level of craving. Thus, identifying the level of negative thoughts and cognitive emotion regulation strategies of methadone-treated clients can predict the severity of craving and their leave or retention of the treatment.

Keywords: Craving, Cognitive Emotional Regulation, Automatic Negative Thoughts

Introduction

Opioid use disorder is a major international public health issue with marked mortality, morbidity and high rates of relapse [1].

Currently, Methadone Maintenance Treatment (MMT) is an important method for the treatment of opiate dependence in many parts of the world [2]. Furthermore, MMT provides a stable background dosage of opioids that blocks craving, blocks the "high" of other opioids, provides physiologic homeostasis [3], and reduces side effects, such as deaths related to heroin use [4].

Previous studies have shown that treatment with methadone is safe and effective [5]. However, nearly half of people in ongoing MMT continue to use opioids during treatment or relapse within six months [6]. Opiate craving may play a role in the continued use of

opiates, despite being in MMT [7]. Craving is generally defined as a subjective experience of a desire or urge to use drugs, and is considered as the core feature of substance use disorders [8].

Craving is a major risk factor for relapse, often comprising physiological discomfort, intrusive substance-related cognitions, and affective distress [9, 10]. The complexity of the construct and the affective, cognitive, behavioral, and environmental features associated with it make the essential nature of what craving is and how it is measured particularly challenging. Thus, individual-level variables should be examined in studies, as there is the potential to identify important subgroups that might more clearly benefit from an intervention that reduces craving [11]. Several recent studies established that craving-related cognitions reported by tobacco users attempting to quit, such as "Having this unwanted thought means I will act on it," predict relapse after the start of a quit attempt [12, 13]. Identifying measurable cognitive factors that influence the development and effects of opiate related thoughts, images, impulses, and urges may support efforts to reduce the development of problematic use.

One of the cognitive processes affecting craving are automatic negative thoughts. Because confronting a stressful situation in life results in automatic thoughts and negative thoughts about craving, this plays a critical role in the generation and consequences of craving for individuals who struggle with substance use [10, 14]. On the basis of Back theory on emotional disorders, the first point in this kind of disorder is the presence of automatic negative thoughts. Automatic thoughts are thoughts or pictures that are reported as schemas or core beliefs by a person[15].

Craving is also related to affect and emotions. Negative affective states trigger craving across drug types. Specifically, acute induction of negative affect has been shown to increase craving for cigarettes [16], cocaine [17], opiates [18], and alcohol [19-21]. Given the relationship between negative affect and drug use, regulation of negative affect has important implications for substance use disorder treatment. Difficulty in emotion regulation is one of the reliable predictors for danger of tendency to use drugs [21, 22]. Evidence indicates that mutual relation between emotion regulation deficits and the use of drug leads to intensifying each other [22]. People who suffer from drug abuse disorders have problems in paying attention to emotional information; correctly comprehending them, and correct processing and desirable managing of excitements and emotions in communicating with people. These difficulties result in a person being confronted with stressful situations losing their ability to analyse, make decisions, choose appropriate behaviour, and exhibit uncompromising behaviour [23]. Garland [24] indicates a cognitive appraisal deficit contributing to increased craving and emotional pressure and ultimately to opioid abuse. Therefore, it can be said that disability in managing the excitements and the use of maladaptive cognitive emotion regulation strategies can play a role in people's tendency to the use of drugs [25]. Emotional regulation is using behavioural and cognitive strategies for making change in a period of time or intensity of experiencing an excitement [26]. It was determined that when confronting stressful situations, people use different emotional regulation strategies to adjust or improve their excitement experiences [27, 28]. Cognitive strategies are one of the most frequently used strategies for emotion regulation. Cognition or cognitive processes assist individuals in regulating their excitement and emotions and avoiding being overcome by the excitement intensity [29]. Numerous studies on cognitive beliefs about craving and relapse have been conducted [30]. However, research on cognitive beliefs, particularly negative thoughts about opioid temptation, is insufficient, and additional studies are needed to examine the relationship between cognitive factors and opioid craving in a sample of methadone-treated individuals using a model that may play a role in the development of this phenomenon.

Various studies have examined the role of many variables in substance abuse, including cognitive beliefs and negative emotions. The direct and indirect relationship between these factors and substance craving, on the other hand, has received less attention. Additionally, while multiple studies have been conducted on the cognitive factors influencing cravings for alcohol and other substances [31-34], few have examined the cognitive processes influencing craving for methadone-containing opioids. Given the importance of negative spontaneous thoughts as a self-regulatory cognitive factor in increasing the temptation to use drugs, this study aimed to determine whether negative spontaneous thoughts increase the perception of temptation via difficulty with emotion regulation. Moreover, is the proposed model of drug use temptation in recovering addicts sufficiently accurate? How do the model's variables affect the temptation to use drugs, both directly and indirectly?

Method

The current study is a correlated and modeling one conducted on a collection of variables with direct and indirect relationships. The statistical population in this study was afflicted with opioid abuse and receiving MMT treatment at the national center for addiction studies and the Mehr-Aein clinic in Tehran. The convenience sampling technique was used to select the sample, including 120 volunteered individuals, 78 from the Iranian National Centre for Addiction and 42 from the Mehr-Aein clinic. They were selected for the study based on available sampling between January 2018 and March 2019. After conducting a preliminary study and preparing and validating investigation tools, including the negative automatic thoughts scale developed by Holon and Kendall, the cognitive-emotional regulation scale developed by Granfesky and Keraij, and the obsessive-compulsive drug use questionnaire, these questionnaires were distributed to 78 addicts in treatment at the Iranian National Center for Addiction Studies and 42 people at the Mehr-Aein clinic located in Rey city, Tehran, under ethical considerations and a consent was obtained from them in order to participate. Participants were interviewed

prior to the distribution of the questionnaire through a demographic questionnaire and were asked about their history of drug use. The inclusion criteria of all subjects in the present study were dependence on opioids and receiving maintenance treatment. Also, they were excluded if they had psychotic, bipolar, or dissociative disorders or a severe physical illness that precluded them from participating in the study.

Automatic Thoughts Questionnaire (ATQ): Hollon and Kendall [35] developed this scale in 1980, which consists of 30 questions and is graded using the Likert range. Thus, for the alternatives never, sometimes, usually, often, and always, grades ranging from 1 to 5 were assigned. The ATQ measures the frequency of automatic negative statements about the self. Such statements are critical in developing, maintaining, and treating a variety of psychopathologies, including depression. ATQ addresses four dimensions of these automatic thoughts: Personal Maladjustment and Desire for Change (PMDC), Negative Self-concepts and Negative Expectations (NSNE), Low Self-Esteem (LSE), and helplessness. Items are classified according to their frequency of occurrence, ranging from "never" to "always." The total score is the sum of all 30 items. The items for each factor are: PMDC; 7, 10, 14, 20, 26; NSNE: 2, 3, 9, 21, 23, 24, 28; LSE: 17, 18; and Helplessness: 29, 30. A high total score indicates a high level of automatic negative self-statements. Golparvar translated and validated this questionnaire for the first time in Iran [36]. Hollon and Kendall [35] reported that this questionnaire had a Cronbach's alpha of 0.89. Cronbach's alpha was used in Iran to determine reliability, and factor analysis was used to determine validity. For this scale, Golparvar [36] obtained a Cronbach's alpha of 0.95 and a reliability of 0.93 [37]. The internal consistency of this scale was 0.96 in the current study using Cronbach's alpha method.

Cognitive Emotion Regulation Questionnaire (CERQ): Garnefski and Kraaij developed this questionnaire in 2001. It is a 36-dimensional tool that assesses cognitive excitement adjustment approaches in response to threatening and stressful life events on a five-point scale ranging from 1 (never) to 5 (always) based on nine scales: self-blame, blaming others, focusing on thoughts/ruminant, catastrophizing, positive refocusing, positive reappraisal, and refocusing on planning. Minor scale grades range from 40 to 20. High scores indicate greater use of people from a cognitive standpoint. The questionnaire categorizes cognitive emotion regulation strategies into two broad categories: adaptive and maladaptive strategies. Cronbach's alpha values ranged from 0.62 to 0.80 for nine minor scales in the study of Garnefski and Kraaij. The questionnaire's psychological measurement characteristics were evaluated by Hassani in Iran, and its reliability (Cronbach's Alpha 0.68 to 0.82) and validity were found to be acceptable [38, 39]. The internal consistency of this scale was 0.86 in the current study using Cronbach's alpha method.

Obsessive-Compulsive Drug Use Scale (OCDUS): This questionnaire is based on craving and was developed as a motivational status measure by Franken et al. in 2002 [40]. It considers the craving for a period of time, typically one week. The main questionnaire consists of 12 questions. Three factors are evaluated: "thoughts and interference," which includes questions 2, 3, 4, 6, 8, and 9, "tendency to use heroin and usage control," which includes questions 1, 7, 12, and 13, and "resistance to thoughts and decisions to use heroin," which includes questions 5 and 11. Internal consistency of the components of this questionnaire in the study conducted by Hassani-Abharian et al. [41] was meaningful for abusers of various opioids, including heroin. This questionnaire in Persian includes four factors: "desire for usage and mental obsession with drugs," which includes four questions 1, 2, 7, and 8; the second factor is the effect of desire and thoughts about drugs on the work and life of users, which includes two questions 3 and 9; the third factor is "motivation, emotion, and lack of control," which includes four questions 4, 6, 11, and 12; and the fourth factor is "resistance to drug use," which includes two questions 5 and 10. Each question was assigned a grade between 1 and 5, and the grade attributed to each subset is equal to the average grade corresponding to all of its questions [40, 41]. The internal consistency of this scale was 0.97 in the current study using Cronbach's alpha method.

Visual Analog Scale (VAS): The justified study scale by Sinha et al. [17] was used to assess heroin craving levels. The VAS scale includes questions on the most intense temptation experienced in the last week, the last two days, the last 24 hours, and the current moment. Conscious craving levels range from zero (not at all) to 100 (very high). The examiner should demonstrate a ruler to the examinee to ascertain the extent to which his craving ranged from none to extremely strong. The back of the ruler is then graded from zero to 100. The examiner notes the number between zero and 100 on the back of the ruler by considering the point to which the person referred on the ruler. This number represents the intensity of the craving. The VAS was developed in response to previous research on a visual test for craving measurement. Ekhtiari et al. reported a high degree of reliability and validity for craving measurement [42]. The internal consistency of this scale was 0.95 in the current study using Cronbach's alpha method.

The data were analyzed using descriptive and inferential statistics. Descriptive statistics were used to examine the sample's demographic information in terms of frequency and percentage and some descriptive indicators of research variables (mean, standard deviation, skew, and elongation). The Pearson correlation coefficient and the fit-test were used as inferential statistics. Then, through SPSS 21 and STATA 14 software, the structural equation analysis method was employed to evaluate the hypothetical model. Cronbach's alpha was also used to determine the tools' reliability.

Results

The findings of this study are presented in two distinct descriptive and inferential sections. The study enrolled 120 participants, most of whom

were men (98%). The age range of the participants was from 27 to 76 years. Table 1 contains the entire sample's descriptive indices (mean, median, and standard deviation). The calculated mean and standard deviation indicate that the scores have a wide range of variability.

Table 2 contains descriptive statistics pertaining to drugs. By counting the number of participants who used each substance, the most frequently used drugs were cigarettes, opium, alcohol, illegal methadone, heroin, marijuana, methamphetamine, and tramadol, and the most frequently used method of use was smoking.

Table 1. Demographic and Clinical Characteristics of Sample (N _ 120)

Demographics	N (%)	Craving		Automatic negative thoughts		Cognitive emotional regulation	
		Mean (±SD)	P	Mean (±SD)	P	Mean (±SD)	P
Sex							
Male	(98.3) 118	6.28±3.93	0.74	64.73±29.4	*0.015	119.39±18.20	0.68
Female	2(1.7)	5.37±1.94		116.5±2.12		108±29.69	
Marital status							
Single	41(34.2)	6.29±4.5	0.84	72.41±27.66	0.32	119.24±17.92	0.92
Married	69(57.5)	5.96±3.72		61.13±29.75		118.66±18.7	
Widow	2(1.7)	5.37±1.94		82.5±45.96		122±9.89	
Quarrel	4(3.3)	6±2.31		58.5±21.39		119±12.72	
Divorced	3(2.5)	6±2.13		80.66±59		131±33.18	
Work status							
Full-time	34(28.3)	5.51±3.11	0.28	58.52±21.26	*0.02	117.17±14.34	0.83
Regular part time	13(10.8)	6.05±3.48		59.53±20.8		122.15±18.66	
Irregular part time	19(15.8)	7.11±3.82		65.63±26.11		121.42±16.64	
Unemployed	35(29.2)	6.87±4.76		78.60±32.84		119.31±18.15	
Retired	18(15)	5.44±3.59		55.66±38.88		119.44±26.60	
Location							
Home	116(96.7)	6.17±3.87	0.36	65.35±30.01	0.88	119.38±18.48	0.74
Workplace	3(2.5)	9.08±5.39		74±36.34		111.33±14.36	
Ownership of the house							
My own or my wife	43(35.8)	5.41±3.25	*0.01	51.46±25.52	*0.001	115.76±18.78	0.48
Family	36(30)	7.49±4.73		74.44±27.08		120.47±17.83	
Rent	29(32.5)	5.8±3.31		71.69±31.70		121.82±18.57	
partner							
Parents	36(30)	7.22±4.53	*0.014	72.16±29.02	0.018	121.16±16.74	0.82
Spouse and/or baby	67(55.8)	5.52±3.30		58.35±28.43		118.31±19.01	
Alone	12(10)	6.52±3.8		84.25±32.8		121.33±21.38	
education							
illiterate	6(5)	4.70±1.73	0.45	78.83±46.1	0.43	119.16±27.24	0.78
Under the diploma	51(42.5)	6.79±4.33		69.41±29.56		117.58±18.34	
diploma	52(43.3)	6.26±3.92		69.44±30.20		120.34±18.55	
Associate Degree until the Bachelor	10(8.3)	4.77±1.51		56.2±15.46		123.10±11.66	
military service status							
Completion of military service	90(75.5)	6.65±4.12	0.18	66.42±30.18	0.23	119.32±19.68	0.28
Escape	1(0.8)	4±0		80±0		97±0	
Absenteeism	3(2.5)	8.5±4.27		71.33±13.05		127±8.54	
Exemption	24(20)	4.71±2.68		56.95±27.73		119.66±12.29	

Table 2. Descriptive Statistics of Drug

Types of Drugs	N (%)	First time use		Years of consumption		Days of consumption in last month		Days of consumption in Last week		Frequency of consumption ways
		Mean	Standard deviation (SD)	Mean	Standard deviation (SD)	Mean	Standard deviation (SD)	Mean	Standard deviation (SD)	
Cigarette	155 (95%)	18.65	8.27	24.73	13.31	28.03	7.42	6.53	1.75	-
Alcohol	75 (62%)	12.08	13.75	2.88	6.66	2.25	7.53	0.16	0.95	-
Opium	115 (95%)	21.84	8.39	14.08	11.74	20.48	13.80	0.01	0.09	Intravenous injection=4 Eating=25 Intravenous injection=4 Non-venous injection=1
Heroin	56 (46%)	12.88	15.08	4.00	7.54	8.78	13.86	0.07	0.64	Sweetheart=35 Intravenous injection=17 Inhalation=3 Eating=1
Illicit Methadone	63 (52%)	19.10	19.50	0.78	2.80	4.98	10.94	0.001	0.001	Eating=62 Intravenous injection=1
Tramadol	29 (24%)	6.13	11.66	0.23	0.86	1.09	5.43	0.001	0.001	-
Cannabis	55 (45%)	8.95	10.54	2.00	5.42	2.28	7.69	0.001	0.001	Intravenous injection=54 Eating=1
Methamphetamine	48 (40%)	12.06	15.84	1.21	2.64	4.66	0.97	0.01	0.091	Sweetheart=45 Intravenous injection=4

Table 3 summarizes the participants' descriptive indices for subscales of the cognitive emotion regulation, negative thoughts, and craving variables. This table shows that the OCDUS index's minor scale of the effect of desire on work and life has the highest average. Additionally, the average grades of sick people on questions about the intensity of temptation on a Visual Analog Scale (VAS) are comparable and close to one another. This demonstrated that patients almost always responded similarly to questions about the intensity of temptation at different times. Finally, the question about current temptation intensity received the highest average grade.

Furthermore, the participants' highest grade on the negative thoughts index is associated with a negative self-concept and expectations, with an average of 15.58. The study sample received the highest grade on the ruminant subscales of the negative cognitive emotion regulation index, with an average of 13.91. In the positive excitement, the focus on planning received the highest grade for the cognitive adjustment approach, with an average of 14.55. The treatment duration was 75 months based on the results obtained with an average dose of 20 ccs of methadone. Moreover, no significant relationship was observed between these two indicators and psychological variables.

Before doing the path analysis, the essential hypotheses of this approach were investigated including the normality of a single variable, the normality of a multivariable, the lack of multicollinearity and discarded data. All hypotheses were correct except the normality of data distribution. To eliminate the abnormalities of the distributions, Sattora-Bentler normal correction method in the STATA software was used. By considering the basis of the approach analysis, the latent and observed variables were the basis of correlation. Table 4 shows the correlation coefficient of endogenous and exogenous research variables. According to the presented results in Table 4, negative thoughts have a positive meaningful relationship with the components of negative strategy ($P<0.05$, $r=0.53$), craving ($P<0.05$, $r=0.57$) and has a negative and meaningful relationship with the component of positive cognitive emotion regulation strategies ($P<0.05$, $r=-0.24$). Negative cognitive emotion regulation strategies have meaningful relationships with components of craving ($r=0.49$) and negative thoughts ($r= 0.53$). Positive strategy has only a meaningful relationship with negative thoughts ($r=-0.24$). In addition to these two variables, the duration of treatment and the amount of dose of methadone has no meaningful relationship with variables of negative thoughts, emotion regulation strategies, and craving. Only the duration of treatment and the amount of dose of methadone have a low correlation with the coefficient ($r=0.25$) at the level $P<0.05$. There is only a correlation between the age index and the duration of treatment with a coefficient of ($r= 0.18$). Notably, in the visual analog and obsessive-compulsive drug scales for measuring craving, the Spearman correlation coefficient shows a relatively high correlation (0.7) of participants' scores for both scales.

Table 3. Descriptive Statistics of Variables

Variables	Mean	SE	SD	Min	Max
Craving					
Desire and mental preoccupation with drugs	1.60	0.09	1.06	1	5
The effect of desire for drugs	1.65	0.11	1.21	1	5
Motivation, emotion and lack of control	1.56	0.08	0.98	0.75	4.50
Resistance to drug use	1.44	0.07	0.82	1	5
Automatic negative thoughts					
Desire for Change	13.13	0.51	5.59	5	25
Negative Self-Concepts	15.58	0.69	7.61	7	35
Low Self-Esteem	3.84	0.21	2.31	2	10
Helplessness	3.85	0.22	2.45	2	10
Negative strategy cognitive emotional regulation					
Self-blame	13.86	0.29	3.21	4	20
Rumination	13.91	0.26	2.93	4	20
Catastrophizing	13.30	0.31	3.47	4	20
Other blame	13.90	0.30	3.32	4	20
Positive Strategy Cognitive emotional regulation					
Acceptance	14.36	0.31	3.46	4	20
Positive refocusing	13.60	0.33	3.68	4	20
Refocus on planning	14.55	0.28	3.10	4	20
Positive reappraisal	12.07	0.35	3.92	4	20
Putting into perspective	9.60	0.42	4.69	4	20
VAS(Severity of craving)					
In Present	12.70	2.23	24.50	0	100
Last 24 hours	10.90	2.24	24.53	0	95
2,3 days past	10.70	2.24	24.59	0	100
Last week	11.58	2.27	24.92	0	100
Dose of Methadone(cc)	20.30	1.03	11.37	2	42
Duration of treatment(month)	70.10	4.83	52.93	1	192

Table 4. Zero-Order Correlations between Study Variables (N _ 120)

Variables	Negative Strategy of CERQ	Positive Strategy of CERQ	ATC	OCDUS	Dose of Methadone	Duration of treatment	Age
Negative Strategy of CERQ	1						
Positive Strategy of CERQ	0.16	1					
ATC	0.53**	-0.24**	1				
OCDUS	0.40**	-0.16	0.57**	1			
Dose of Methadone(cc)	0.08	-0.07	0.04	-0.01	1		
Duration of treatment(month)	-0.05	-0.01	-0.09	-0.1	0.33**	1	
Age	0.02	-0.28	-0.14	-0.02	-0.06	0.20*	1

Note. CERQ _ Cognitive emotional regulation Questionnaire; ATC _ Automatic negative thoughts; OCDUS _ Obsessive Compulsive Drug Use Scale.–Depression subscale.
* P<0.05. **P<0.01

For determining the role of negative thoughts in predicting the components of excitement cognitive adjustment and cravings, a model was designed based on theoretical foundations and research background. Negative thoughts as endogenous variables and cognitive emotion regulation strategy and craving were as exogenous structures of the suggested model for the study. Negative thoughts included four indicators (maladjustment, negative self-concept, low self-esteem and helpless) and cognitive emotional regulation included negative and positive strategies. The suggested model was analyzed by the use of path analysis approach in STATA. The final research model has been presented in Figure 1.

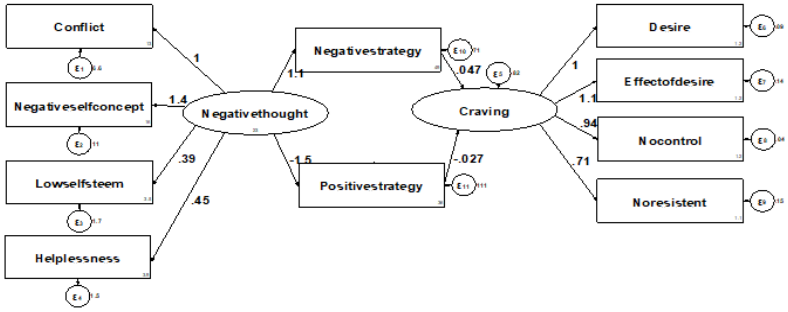

Figure 1. Final Model of the Research Variables

In the present study, to assess the fitting of the model for approach analysis, a set of indicators such as RMSEA, TLI, CFI and SRMR have been used. Table 5 shows the related statistics about the fitting of the used model. According to the mentioned indexes, especially indexes of (RMSEA =0.06), (CFI = 0.096), (TLI =0.97), and (SRMR =0.094), the investigated hypothetical model (Figure 1) in this study is compatible with the data, so it can significantly predict the craving of drug usage. The final structural model of the research along with the standardized coefficients is presented in Figure 1. As it can be seen, all direct path of cognitive emotion regulation strategies and indirect path of negative thoughts on craving at the level of (P <0.05) are meaningful.

After determining the total fitting of the model, the direct and indirect paths among the study variables were investigated (Table 6). Based on the final structural model as given in Table 6, the observed variables for latent structures of negative thoughts and craving were defined very well based on the factor loads among latent structures and indicator variables (more than 0.30).

Table 7 indicates the direct and indirect effects of endogenous variables on exogenous variables. According to Figure 17, the direct and indirect effects of all independent variables on dependent variables were meaningful and in compatible with the hypothetical model of the study. According to the results of Table 7, automatic negative thoughts with 1.14 have a direct effect on negative strategies. Moreover, with a value of -1.46, it has a negative effect on positive cognitive emotion regulation strategies. This means that by increasing the use of negative strategies of cognitive emotion regulation (self-blame, blaming of others, ruminant and catastrophizing) and also by decreasing positive emotional regulation strategies, it leads to increased craving in individuals. Also, negative strategies with a rate of 0.47 have a direct effect on craving. Cognitive emotional regulation positive strategies with a coefficient of 0.026 have an opposite effect on craving.

Table 5. Goodness-of-Fit Indexes

Fitting indexes	X^2	df	p	RMSEA	TLI	CFI	SRMR
Value	45.714	32	0.055	0.06	0.97	0.09	0.09

Table 6. Relations between Latent Variables with Obvious Variables

Latent Variables	Obvious Variables	Beta
Automatic negative thoughts	Desire for Change	1
	Negative Self-Concepts	1.4
	Low Self-Esteem	0.39
	Helplessness	0.45
Craving	Desire and mental preoccupation with drugs	1
	The effect of desire for drugs	1.1
	Motivation, emotion and lack of control	0.94
	Resistance to drug use	0.71

Table 7. Direct and Indirect Effects of Endogenous and Exogenous Variables

Direction path	Types of effect			
	Direct effect	P	Indirect effect	P
Automatic negative thoughts on Positive Strategy	-1.46	0.001		
Automatic negative thoughts on Negative Strategy	1.14	0.001		
Automatic negative thoughts on Craving			0.07	0.001
Negative Strategy on Craving	0.47	0.001		
Positive Strategy on Craving	-0.02	0.001		

Discussion

The results of the present study showed that cognitive self-regulatory strategies have a significant direct effect on craving and mediate the relationship between negative automatic thoughts and cravings. This means, automatic negative thoughts include components of maladjustment,

negative self-concept and expectations, low self-esteem, and helplessness. Among these, the components of negative self-concept and expectations of oneself and maladjustment indicate most of the negative thoughts. According to this model, automatic negative thoughts (negative thoughts about oneself, others, and the future that are automatically activated in the mind and the person is unable to prevent them) results in more use of negative strategies of cognitive emotion regulation such as rumination of thoughts, blaming himself , blaming others , and catastrophizing. By reducing the person's ability to use positive strategies of cognitive emotion regulation, including acceptance, positive reappraisal, planning, positive refocus leads to more perception of craving, and instrumental approach to decrease excitement and negative thoughts.

These findings are consistent with previous studies [16, 19] According to the research findings of Kober [43], negative affective states trigger craving across drug types. Given the relationship between negative affect and drug use, emotion regulation is one of the effective factors on reducing craving. Based on Beck's cognitive model, when a person is in high-risk situations (extrusive or intrusive, such as fatigue), basic beliefs related to drugs are activated in him and this matter leads to an increase in negative automatic thoughts and thus an increase in the temptation and desire to use drugs for decreasing the negative excitements and thoughts. The results of the present study, in compatible with the findings of these studies, show that negative thoughts with more use of negative cognitive emotion regulation strategies lead to more temptation and craving and finally drug use for decreasing excitement and negative thoughts [44, 45].

The second meaningful approach in this analysis is the effect of negative cognitive emotion regulation strategies, especially ruminating of thoughts and catastrophizing on more perception of craving. The more one uses negative strategies of cognitive emotion regulation, such as ruminating of negative thoughts and catastrophizing, the more tempted a person becomes. Craving is a core of relapse that can have a direct effect on drug use and indirect effects on other variables. In the studies related to therapeutic results, the reduction of craving is considered as a criterion for the success of treatment [45]. According to Marlatt and Gordon's prevention of relapse model, extrusive and intrusive motivations (such as negative excitement) by activating the automatic thoughts lead to the craving of drugs usage. Finally, the person perceives more craving by ruminating the negative thoughts and negative approaches, which leads one to drug usage (instrumental approach) in order to decrease negative thoughts and excitement. On the other hand, positive cognitive emotion regulation strategies such as acceptance, planning focus, positive reappraisal, and positive refocusing decrease drug craving [46].

Conclusion

To summarize, the results of the present study show that craving is a phenomenon that is influenced by many processes and cognitive factors. The negative automatic thoughts of an addict, which are often activated in high-risk situations (provoking negative emotion) in a person, play a significant role in increasing the perception of the craving. If a person is unable to use the positive strategies of cognitive emotion regulation and mostly uses the negative strategies of cognitive emotion regulation, it is more likely that he uses the instrumental drug usage approaches to decrease the excitement and suppress his negative thoughts. Thus, although methadone is one of the most common and effective approaches in the treatment of addicts who are opioid-dependent, it is not enough alone, and other therapeutic interventions focused on the psychological, social relationships, and environment of the sick peoples are essential. According to the findings of the present study, the negative thoughts and cognitive emotion regulation strategies have critical roles in predicting craving, which are the most significant factors in the relapse. By considering the frequent emotional reactions and maladjustment approaches of addicts such as ruminating of thoughts and catastrophizing in negative situations, it is suggested as a practical result that medical centers and addiction psychologists identify addicts who are prone to negative thoughts and depression and provide them a long-term training of cognitive emotion regulation strategies in a group or individually in clinical and general samples. One of the limitations of the present study was that the statistical sample of the study was limited to the Iranian National Center for Addiction Studies and the Mehr-Aein clinic in Rey city. Its application is just self-reporting tools, therefore overgeneralizing the results should be done on caution. Moreover, because of the low number of subjects of the study and the lack of control over other therapies (psychotherapy, abstinence therapy, etc.), it is suggested that for future studies bigger sample of study be chosen and the topic of this study to be applied in different treatment groups in order to be able to overgeneralize the results more carefully by increasing its validity.

Conflict of Interest

According to the authors of this article, there are no conflicts of interest.

Ethical Approval

Tehran University of Medical Sciences has confirmed this study with an ID (IR.TUMS.VCR.REC.1398.013). All ethical principles are observed in this article. Participants were allowed to leave the study at any time they desired. Also, all participants were aware of the study process and their information was kept confidential.

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