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Prediction of Substance Use Relapse Based on Early Maladaptive Schemas and Loneliness in Individuals Undergoing Methadone Maintenance Treatment

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ABSTRACT

The present study aimed to predict substance use relapse based on early maladaptive schemas and loneliness in individuals undergoing methadone maintenance treatment (MMT). To achieve the research objectives, out of 10,500 patients receiving MMT in District 7 of Tehran during the spring and summer of 2023, a total of 374 individuals were randomly selected using Cochran's formula, of whom 343 participants were ultimately included as the final sample. Data were collected using the Substance Abuse Relapse Risk Questionnaire (Aghaie et al., 2007), the Young Schema Questionnaire–Short Form (Young, 2005), and the UCLA Loneliness Scale (Russell, 1980). Data were analyzed using multiple regression analysis and Pearson's correlation coefficient. The results showed that early maladaptive schemas and loneliness were significant predictors of substance use relapse ($p < .001$), with the highest contribution belonging to the disconnection and rejection schema domains as well as loneliness. Furthermore, there were significant positive relationships between the schema domains of disconnection and rejection, impaired autonomy, impaired limits, and substance use relapse ($p \leq .001$), while no significant relationships were observed between the schema domains of other-directedness and hypervigilance with substance use ($p \geq .001$). Finally, a significant positive relationship was found between loneliness and substance use relapse ($p \leq .001$). These findings may help clinicians place greater emphasis on these psychological factors in treatment to reduce the likelihood of substance use relapse.

Keywords: substance use relapse, early maladaptive schemas, loneliness, methadone maintenance treatment

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Introduction

Substance use disorders remain one of the most persistent global health challenges, with opioid dependence standing out for its high rates of relapse and the profound personal, social, and economic consequences it generates (1). Despite significant advances in pharmacological and psychosocial interventions, relapse after treatment is still common and is considered a defining feature of the chronic, relapsing nature of addiction (2, 3). Methadone maintenance treatment (MMT) has long been recognized as one of the most effective evidence-based therapies for opioid dependence (4, 5). By stabilizing

neurobiological functioning and reducing cravings, MMT can substantially improve retention in treatment and decrease illicit opioid use. However, a considerable proportion of patients still return to substance use during or after MMT, which underscores the need to investigate psychological mechanisms that predispose individuals to relapse (6, 7).

Recent conceptualizations of addiction increasingly emphasize its multifactorial psychological underpinnings beyond the biomedical model (1). Among these, cognitive-behavioral frameworks highlight the role of early maladaptive schemas (EMS) — pervasive, dysfunctional cognitive-emotional patterns developed in childhood and adolescence that influence how individuals interpret experiences (8). These schemas, formed when core emotional needs are unmet, often persist into adulthood and drive maladaptive coping strategies such as substance use (9, 10). Patients with substance use disorders frequently present with pronounced EMS, particularly in domains like disconnection and rejection, impaired autonomy, and impaired limits, which predispose them to feelings of defectiveness, isolation, and vulnerability (11, 12). These schemas can serve as enduring risk factors for relapse, as they amplify negative emotions and limit adaptive coping when stressors occur (13, 14).

A growing body of empirical research confirms the association between EMS and addictive behaviors. For instance, Brotchie and colleagues demonstrated that core negative beliefs about the self are strongly related to alcohol and opiate misuse (15). Shorey and colleagues found that patients entering residential treatment often report elevated schema scores that correlate with depression and anxiety, which in turn predict substance use severity (16). More recent reviews and meta-analyses also support these findings, showing consistent links between maladaptive schemas and a variety of addictive behaviors (10, 17). Understanding the specific schemas involved can guide personalized therapeutic strategies aimed at cognitive restructuring and relapse prevention (9, 14).

Parallel to the cognitive vulnerabilities captured by EMS, loneliness has emerged as a powerful psychosocial risk factor for addiction and relapse (18, 19). Loneliness represents a distressing discrepancy between desired and actual social relationships and is associated with a wide range of adverse health outcomes, including depression, anxiety, and substance misuse (20). For individuals in recovery, loneliness can be particularly dangerous because it often triggers craving, negative affect, and maladaptive coping mechanisms (21, 22). Evidence suggests that socially isolated individuals may use substances to regulate emotions, cope with rejection, or fill interpersonal voids (22, 23). In MMT populations, loneliness has been associated with treatment dropout and poor psychological well-being, which are both predictors of relapse (6, 24). Moreover, relapse itself can exacerbate social alienation, creating a vicious cycle that undermines recovery efforts.

The interplay between EMS and loneliness may be particularly critical. Maladaptive schemas such as abandonment, mistrust, and emotional deprivation directly contribute to chronic feelings of social disconnection and difficulty forming secure, supportive relationships (8, 13). Individuals entrenched in these schemas often experience heightened loneliness, which in turn activates substance use as an avoidant coping strategy (3, 20). Studies also show that loneliness intensifies self-critical and rejection-based schemas, creating a feedback loop that increases emotional pain and relapse vulnerability (18, 23). From a clinical standpoint, this suggests that relapse risk is not solely a function of external triggers or pharmacological factors but is also shaped by deeply ingrained interpersonal and cognitive vulnerabilities (9, 14).

Methadone maintenance programs typically focus on medication adherence and harm reduction but may insufficiently address these complex psychological dimensions (4, 5). Research indicates that incorporating schema-focused interventions alongside standard treatment can improve emotional regulation and reduce relapse risk (12, 13). Likewise, enhancing social connectedness through mutual aid, peer support, and community-based networks has been shown to promote sustained recovery (24, 25). Individuals who receive targeted support to reduce loneliness and challenge maladaptive beliefs about themselves and others may be better equipped to maintain abstinence (26). In particular, addressing shame, mistrust, and feelings of defectiveness — key elements of EMS — alongside interventions to rebuild meaningful social bonds could be transformative in relapse prevention (15, 20).

Additionally, the persistence of addiction as a chronic illness calls for integrative frameworks that unite biological, psychological, and social determinants of relapse (1, 2). Models like Marlatt's relapse prevention approach emphasize coping with high-risk situations and restructuring cognitive processes underlying substance use (3). Emerging findings suggest that combining such approaches with schema therapy and social connection interventions may offer a more comprehensive path to sustained recovery (7, 14). Moreover, global public health trends indicate that loneliness is increasing across many populations (18), suggesting that attention to this factor is timely and critical in addiction research and practice.

In the context of Iran and other regions where methadone programs have expanded significantly, relapse remains a pressing clinical concern despite wide availability of maintenance therapy (5, 6). Sociocultural dynamics, stigma, and limited psychosocial resources may further compound the effects of loneliness and maladaptive schemas, making locally grounded research essential (25). By exploring how these psychological vulnerabilities operate within patients on MMT, clinicians and policymakers can design more holistic treatment models that extend beyond pharmacological stabilization and address the relational and cognitive roots of addiction (23, 24).

Against this background, the present study was designed to examine whether early maladaptive schemas and loneliness can predict substance use relapse in individuals undergoing methadone maintenance treatment.

Methods and Materials

Study Design and Participants

The present study employed a descriptive–correlational research design. The statistical population consisted of patients undergoing methadone maintenance treatment (MMT) in District 7 of Tehran. The sample size was determined using Cochran's formula, one of the most widely applied methods for calculating sample size in statistical research. Out of 10,500 patients receiving MMT in District 7 of Tehran—distributed across 28 double-shift clinics and 49 single-shift clinics—374 individuals were randomly selected. The collected dataset included 343 participants who were ultimately analyzed across 11 different clinics. During this process, 30 individuals were excluded due to incomplete data or other issues. Data collection was carried out during the spring and summer of 2023.

The inclusion and exclusion criteria for this study were carefully defined to ensure the accuracy and validity of the collected data. Only individuals who were undergoing MMT, had been in treatment for at least two months, and were in a normal and stable psychological state—capable of completing the questionnaires

and participating in the study—were included. Conversely, individuals undergoing treatment with medications other than methadone, those who had been in maintenance treatment for less than two months, those without stable psychological conditions, or those unable to fully complete the questionnaires were excluded. These criteria ensured that the findings would be based on reliable and valid data.

Following approval from the Vice-Chancellery of Treatment and Medical Education at Shahid Beheshti University of Medical Sciences and the Food and Drug Administration of Tehran Province, the researchers visited 11 MMT clinics in District 7 of Tehran. With the collaboration of clinical directors at addiction treatment centers, the study questionnaires were administered. The research objectives were explained to both the clinical directors and the patients, and adherence to ethical considerations was emphasized. Preliminary interviews were conducted with all participants to ensure they met the inclusion criteria. All questionnaires were administered by the researcher and an assistant, providing guidance and clarification when needed. Data collection took place during the spring and summer of 2023. Notably, the sequence of questionnaire administration was consistent for all participants.

Data Collection

The Substance Abuse Relapse Risk Questionnaire was developed by Aghaie et al. (2007) and was recently validated by Amirpour and Sharifi (2023). This instrument consists of 35 closed-ended items rated on a five-point Likert scale (from “strongly agree” to “strongly disagree”) and evaluates five main domains: anxiety and urge to use (8 items), emotional problems (8 items), compulsion to use (4 items), positive expectations and lack of control over use (6 items), and lack of negative expectancy from the substance (4 items). It also includes a lie detection scale (5 items) to assess the individual’s level of insight regarding their problem. Responses are scored from 1 to 5, and the total score is calculated by summing all items. Scores ranging from 35 to 70 indicate low risk, 71 to 140 moderate risk, and above 140 high risk of relapse. The questionnaire’s validity was confirmed by expert judgment, and its reliability in the study by Shaker (2018) with a sample of 30 participants yielded a Cronbach’s alpha of .84.

The Young Schema Questionnaire—Short Form (YSQ-SF, 2005) is designed to assess early maladaptive schemas and consists of 75 self-report items scored on a six-point Likert scale (1 = completely untrue to 6 = completely true). The questionnaire measures 15 schemas across five domains: disconnection and rejection, impaired autonomy and performance, impaired limits, other-directedness, and hypervigilance and inhibition. Each schema comprises five items, and scores for each item range from 1 to 6, making the total possible score between 75 and 450. The minimum and maximum scores vary by domain; for example, the disconnection and rejection domain (items 1–25) ranges from 25 to 150, and the impaired autonomy and performance domain (items 26–45) ranges from 20 to 120. Clinically, the presence of three or four high scores (5 or 6) within a schema indicates its significance. The YSQ-SF has demonstrated strong psychometric properties. Smith et al. (1995) reported Cronbach’s alpha coefficients for the subscales ranging from .50 to .82 and found strong correlations with measures of psychological distress and personality disorders. In Iran, Ahi (2005) standardized the questionnaire on 387 university students, reporting internal consistency with Cronbach’s alpha of .97 for females and .98 for males, with schema reliabilities ranging from .72 to .90. In another study, Zolfaghari et al. (2008) reported an overall Cronbach’s alpha of .94 for the short form among 70 couples, with domain-specific reliabilities of .91 for disconnection and rejection, .90 for impaired

autonomy and performance, .73 for impaired limits, .67 for other-directedness, and .78 for hypervigilance and inhibition.

The UCLA Loneliness Scale was developed by Russell, Peplau, and Cutrona (1980) and includes 20 four-choice items, with 10 positively worded and 10 negatively worded statements. Response options include never (1), rarely (2), sometimes (3), and always (4); however, items 1, 5, 6, 9, 10, 15, 16, 19, and 20 are reverse-scored (never = 4, rarely = 3, sometimes = 2, always = 1). The total score ranges from 20 to 80, with an average of 50 considered normative; higher scores indicate greater loneliness. The reliability of the revised version of this scale has been reported as .78, and its test–retest reliability by Russell, Peplau, and Ferguson (1978) was .89. The Persian translation by Shekarkan and Mirdrikvand, adapted after pilot testing and revisions, has also shown satisfactory validity (Naderi & Haqshenas, 2009).

Data analysis

Descriptive statistics were used to identify the demographic characteristics of the participants and describe the study variables. To examine relationships between variables and meet parametric test assumptions, inferential statistics, including multiple regression analysis and Pearson's correlation coefficient, were employed. All analyses were conducted using SPSS software, and the results were utilized to evaluate the interrelationships and predictive effects of the studied variables.

Findings and Results

Analysis of the data obtained from the questionnaires shows the percentage and frequency distribution of participants based on their age, as presented in the following table and chart:

Table 1. Percentage and Frequency Distribution of Respondents' Age

Age Variable	Frequency	Percentage
20–30 years	157	45.8
30–40 years	141	41.1
40–50 years	35	10.2
No response	10	2.9
Total	343	100

The results of Table 1 show that the majority of participants were between 20 and 30 years old (45.8%). Participants aged 40 to 50 years had the lowest frequency and percentage, accounting for 10.2% of the sample.

Table 2. Results of the Kolmogorov–Smirnov Test for Normality of the Study Variables

Research Variables	Kolmogorov–Smirnov	Significance (p)
Disconnection and Rejection	0.875	0.429
Impaired Autonomy and Performance	1.23	0.08
Impaired Limits	1.31	0.07
Other-Directedness	1.30	0.06
Hypervigilance and Inhibition	1.05	0.22
Loneliness	0.82	0.50
Substance Use Relapse	0.81	0.52

As shown in Table 2, the non-significant F values and significance levels greater than .05 ($p > .05$) indicate that the data for the study variables are normally distributed. Therefore, it is appropriate to use parametric tests for data analysis.

To address the first hypothesis of the study and determine the contribution of each early maladaptive schema and loneliness in predicting substance use relapse among individuals undergoing methadone maintenance treatment, multiple regression analysis was performed. Prior to conducting the regression, its assumptions were examined.

To assess the assumption of univariate normality, skewness and kurtosis values were calculated. To test multicollinearity, the Variance Inflation Factor (VIF) and tolerance indices were examined. To evaluate the independence of errors among predictor variables, the Durbin–Watson statistic was used. Table 3 presents the skewness, kurtosis, tolerance, VIF, and Durbin–Watson values for the study variables.

Table 3. Skewness, Kurtosis, Tolerance, VIF, and Durbin–Watson Index for Study Variables

Research Variables	Skewness	Kurtosis	Tolerance	VIF	Durbin–Watson
Substance Use Relapse	-0.33	0.263	Criterion	Criterion	Criterion
Disconnection and Rejection	1.83	0.263	0.89	1.12	1.99
Impaired Autonomy	0.50	0.269	0.89	1.12	
Impaired Limits	0.70	0.265	0.89	1.12	
Other-Directedness	1.21	0.268	0.89	1.12	
Hypervigilance and Inhibition	0.20	0.267	0.89	1.12	
Loneliness	1.50	0.265	0.89	1.12	

The above table shows that none of the skewness and kurtosis values for the study variables exceed ±2. Therefore, the univariate distributions can be considered normal. Klein (2016) notes that skewness and kurtosis values between -2 and +2 indicate normal distribution. The tolerance and VIF values also show that all predictors have tolerance values greater than .10 and VIF values less than 10, suggesting no multicollinearity. According to Meyers, Gamst, and Guarino (2006), VIF values above 10 and tolerance values below .10 indicate multicollinearity. Additionally, the Durbin–Watson statistic was 1.99. Field (2006) suggests that values above 2 may indicate non-independence of errors; therefore, the calculated value supports the independence of errors. The results of the multiple regression analysis using the enter method are shown in Tables 4–7.

Table 4. Results of Multiple Regression Analysis (Enter Method) for Predicting Substance Use Relapse Based on Early Maladaptive Schemas and Loneliness

Statistical Index	Sum of Squares	df	Mean Square	F	p	R	R^2
Regression	6082.678	4	1520.670	8.455	0.001	0.097	0.312
Residual	56471.685	314	179.846				
Total	62554.46	318					

Since the significance level for the predictor variables (early maladaptive schemas and loneliness) is less than .01 ($p < .01$), the predictors have a statistically significant effect on the criterion variable (substance use relapse). The coefficient of determination (R^2) is .31, indicating that 31% of the variance in substance use relapse in the sample is explained by early maladaptive schemas and loneliness. The remaining variance is related to other variables not examined in this study or unknown factors.

Table 5. Summary of Regression Coefficients for Predicting Substance Use Relapse Based on Early Maladaptive Schemas and Loneliness

Variable	B	Beta (β)	t	p
Constant	64.414	—	17.159	0.0001
Disconnection and Rejection	0.172	0.227	2.51	0.013**
Impaired Autonomy	0.075	0.097	0.879	0.38
Impaired Limits	-0.104	-0.071	0.824	0.41
Loneliness	0.154	0.132	2.404	0.017**

*p < 0.05; **p < 0.01

The results in Table 5 show that the disconnection and rejection domain (β = .22) and loneliness (β = .13) significantly contributed to predicting substance use relapse in the sample. The greatest contribution belonged to the disconnection and rejection domain (β = .22). Given the positive regression coefficients for these predictors, it can be concluded that both early maladaptive schemas (specifically disconnection and rejection) and loneliness have a direct positive effect on predicting substance use relapse among individuals undergoing methadone maintenance treatment. In other words, the greater the levels of disconnection and rejection schemas and loneliness, the higher the likelihood of relapse. Therefore, sufficient evidence existed to support the first hypothesis of the study at the 99% confidence level.

Table 6. Summary of the Correlation Matrix Results Between Early Maladaptive Schemas and Substance Use Relapse

Variables	1	2	3	4	5	6
1. Disconnection and Rejection	—					
2. Impaired Autonomy and Performance	0.796**	—				
3. Impaired Limits	0.618*	0.779*	—			
4. Other-Directedness	0.681**	0.595*	0.642**	—		
5. Hypervigilance and Inhibition	0.517*	0.512*	0.575*	0.631**	—	
6. Substance Use Relapse	0.272**	0.194**	0.151**	0.098	0.10	—

n = 343; **p < 0.01; *p < 0.05

According to Table 6, the calculated correlation coefficients indicate that there are significant positive relationships between the disconnection and rejection domain and substance use relapse (r = 0.272, p < .01, n = 343), between the impaired autonomy and performance domain and substance use relapse (r = 0.194, p < .01, n = 343), and between the impaired limits domain and substance use relapse (r = 0.151, p < .01, n = 343) among individuals undergoing methadone maintenance treatment. However, there were no significant relationships between other-directedness and substance use relapse (r = 0.098, p > .05, n = 343), or between hypervigilance and inhibition and substance use relapse (r = 0.10, p > .05, n = 343). In other words, the more individuals undergoing methadone maintenance treatment exhibit maladaptive schemas in the domains of disconnection and rejection, impaired autonomy and performance, and impaired limits, the greater the likelihood of substance use relapse, and vice versa. No relationships were observed for other-directedness and hypervigilance and inhibition with relapse. Therefore, there was sufficient evidence to support the second hypothesis of the study at the 0.01 significance level.

Table 7. Summary of the Correlation Matrix Results Between Loneliness and Substance Use Relapse

Variables	Loneliness	Substance Use Relapse	Significance (p)
1. Loneliness	—		
2. Substance Use Relapse	0.164**	—	0.003

n = 343; **p < 0.01; *p < 0.05

According to Table 7, the calculated correlation coefficients indicate a significant positive relationship between loneliness and substance use relapse ($r = 0.164$, $p < .01$, $n = 343$) among individuals undergoing methadone maintenance treatment. In other words, the higher the level of loneliness among individuals in MMT, the greater the likelihood of substance use relapse, and vice versa. Therefore, there was sufficient evidence to support the third hypothesis of the study at the 0.01 significance level.

In this study, Cronbach's alpha was used to ensure the reliability of the measurement instruments. This method assesses the internal consistency of the measurement tools, and reliability is considered acceptable when Cronbach's alpha is higher than .70.

Table 8. Cronbach's Alpha for the Study Variables

Variable	Cronbach's Alpha	Status
Early Maladaptive Schemas	0.921	Acceptable
Loneliness	0.888	Acceptable
Substance Use Relapse	0.774	Acceptable

Given that most values are higher than .70, the Cronbach's alpha coefficients for the study variables are confirmed, indicating that the instruments used in this research have acceptable internal consistency and reliability.

Discussion and Conclusion

The present study examined the predictive role of early maladaptive schemas (EMS) and loneliness in substance use relapse among individuals receiving methadone maintenance treatment (MMT). The results demonstrated that specific EMS domains—particularly disconnection and rejection, impaired autonomy and performance, and impaired limits—were significantly associated with relapse risk. Additionally, loneliness emerged as an independent predictor of relapse. These findings provide compelling evidence that beyond the pharmacological benefits of MMT, enduring cognitive-emotional vulnerabilities and social isolation remain key determinants of sustained recovery outcomes (1, 8).

One of the most salient findings was the significant role of the disconnection and rejection schema domain in predicting relapse. Patients who scored higher in this domain, characterized by core beliefs of abandonment, mistrust, emotional deprivation, and social isolation, were more likely to return to substance use. This is consistent with a robust body of research showing that individuals with entrenched schemas of rejection and isolation tend to struggle with interpersonal trust and intimacy, leading them to rely on substances as a maladaptive coping strategy (11, 12). Brotchie and colleagues reported that negative self-representations and beliefs of defectiveness among individuals with alcohol and opiate misuse perpetuate emotional dysregulation and reinforce relapse cycles (15). Likewise, Shorey and collaborators identified that schema domains associated with disconnection are highly prevalent in clinical substance-using populations and contribute to chronic negative affect, which heightens relapse vulnerability (9, 16). These findings align with schema theory's proposition that unmet childhood needs for security and acceptance can manifest as deep-seated vulnerability to interpersonal pain, prompting substance use as emotional self-medication (8, 10).

The second major result revealed that loneliness significantly predicts relapse among MMT patients. This reinforces decades of research linking social isolation and substance use disorders (18, 21). Loneliness has been conceptualized as a critical psychosocial risk factor because it intensifies craving, hopelessness, and the desire to escape aversive affective states (20). DeWall and Pond argued that when individuals feel socially excluded or disconnected, they may turn to addictive substances to fill the emotional void or to cope with perceived rejection (22). In line with our results, Nguyen and Dinh's multicenter study on MMT patients in Vietnam found that social disconnection and limited supportive relationships were strong predictors of relapse (6). Similarly, Christie demonstrated that social isolation is a major driver in the progression of opioid misuse and compromises recovery outcomes (23). Together, these findings underscore that loneliness is not merely a co-occurring symptom but an active contributor to relapse pathways.

The interplay between EMS and loneliness observed in this study deserves special attention. Theoretically, EMS—particularly those in the disconnection domain—predispose individuals to chronic feelings of isolation and difficulty forming safe attachments (8, 14). These cognitive-emotional vulnerabilities increase sensitivity to rejection and undermine the ability to build or maintain supportive social networks, thereby intensifying loneliness (18, 20). Our results suggest that loneliness may partially mediate the effect of maladaptive schemas on relapse risk: individuals with high levels of abandonment and mistrust are more likely to feel socially disconnected, which in turn increases the likelihood of returning to substance use. This conceptual integration is consistent with the findings of Bakhshipour Roudsari and Karimpour, who noted that emotion dysregulation and interpersonal pain linked to EMS heighten relapse vulnerability (13). Likewise, del Palacio-Gonzalez and colleagues highlighted the predictive value of psychological distress—including social isolation—for post-treatment relapse risk (7).

These findings also have implications for understanding why pharmacological treatments alone may be insufficient to achieve long-term recovery. While MMT is highly effective in reducing withdrawal and illicit opioid use (4, 5), patients who maintain deeply entrenched maladaptive schemas and unresolved loneliness remain psychologically vulnerable. Marlatt's relapse prevention model emphasizes the importance of addressing cognitive and affective triggers in addition to environmental risk (3). Our results expand this perspective by highlighting the foundational role of EMS and social disconnection in shaping these triggers. Without targeted psychosocial interventions, patients may continue to interpret stressors through a lens of rejection or defectiveness and return to substances when interpersonal pain resurfaces (9, 15). Similarly, persistent loneliness may erode motivation to remain abstinent and contribute to disengagement from recovery networks (24).

From a broader public health perspective, the findings resonate with concerns about rising loneliness across societies and its intersection with addiction vulnerability (18). Social isolation has been identified not only as a driver of substance misuse but also as a barrier to seeking and sustaining treatment (19, 23). Addressing loneliness as a core therapeutic target could improve retention and outcomes in MMT programs. Likewise, schema-informed approaches have demonstrated promise in reducing relapse among addicted populations (14, 17). Integrating these two psychological dimensions may offer a more comprehensive framework for relapse prevention, aligning with emerging integrative treatment paradigms that consider biological, psychological, and social determinants of addiction (1, 2).

Finally, our results also connect with emerging qualitative evidence about the lived experiences of individuals overcoming addiction. Studies have described how shame, abandonment, and chronic interpersonal pain fuel both self-harming and addictive behaviors (25, 26). These narratives highlight that healing from addiction often requires addressing deep-seated relational wounds and rebuilding meaningful social connections. Our findings lend quantitative support to these insights and reinforce the value of integrating trauma-informed and relational approaches into MMT settings.

This study has several limitations that should be considered when interpreting the results. First, the cross-sectional design prevents any firm conclusions about causality. Although EMS and loneliness were found to predict relapse risk, the directionality of these relationships cannot be fully established; it is possible that relapse itself exacerbates maladaptive schemas and social disconnection. Second, data were collected through self-report questionnaires, which may be influenced by social desirability bias, underreporting, or inaccurate self-perception, especially in populations with high stigma surrounding addiction. Third, the study sample was limited to individuals undergoing MMT in District 7 of Tehran, which may reduce the generalizability of the findings to other geographic regions or treatment settings with different cultural, social, or health system dynamics. Fourth, other potentially important psychological and social predictors of relapse, such as trauma history, peer substance use, and family support, were not included in the analysis and may account for additional variance in relapse outcomes. Lastly, while the psychometric properties of the instruments were robust, cultural adaptation nuances might have affected the measurement of constructs like loneliness and maladaptive schemas.

Future research should employ longitudinal and prospective designs to track the dynamic interplay between EMS, loneliness, and relapse over time. Such approaches could clarify causal pathways and identify critical windows for intervention. Expanding samples to include diverse cultural contexts, treatment modalities, and patient populations would also enhance the external validity of findings. Further, future studies could integrate qualitative methods to deepen the understanding of how patients experience loneliness and maladaptive schemas during recovery and relapse episodes. Mixed-methods research could provide a richer, patient-centered view of these vulnerabilities and inform culturally tailored interventions. Additionally, examining potential mediators and moderators—such as social support networks, resilience, and emotion regulation skills—could help refine theoretical models and guide targeted treatment strategies. Finally, future work should explore how combining MMT with schema therapy, group-based social connection interventions, and digital health tools for loneliness reduction can synergistically reduce relapse risk.

For clinical practice, these findings highlight the necessity of integrating psychological assessment and intervention into MMT programs. Clinicians should routinely screen for early maladaptive schemas and loneliness among patients receiving maintenance therapy to identify those at higher risk for relapse. Incorporating schema-focused cognitive-behavioral therapy, interpersonal skills training, and support groups can help patients reframe maladaptive beliefs and foster healthier relationships. Developing structured peer support and community-based recovery networks may reduce social isolation and enhance treatment retention. Tailoring relapse prevention plans to address both cognitive vulnerabilities and loneliness could empower patients with sustainable coping strategies. Interdisciplinary collaboration between addiction specialists, psychologists, and social workers is recommended to create comprehensive,

person-centered treatment approaches that move beyond symptom management to address the deeper cognitive and relational dimensions of addiction recovery.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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