



Original Article

Influence of psychological factors on the prognosis of temporomandibular disorders pain



Won Jung, Kyung-Eun Lee, Bong-Jik Suh*

Department of Oral Medicine, School of Dentistry, Institute of Oral Bioscience, Jeonbuk National University, Jeonju, South Korea

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Abstract *Background/purpose:* The leading symptom of temporomandibular disorders (TMD) is pain, and psychological factors are involved in the persistence of TMD-related pain. Therefore, this study was aimed to analyze the influence of psychological factors on the prognosis of TMD-related pain.

Materials and methods: The medical records of 486 patients with TMD-related pain were analyzed. Each patient's psychological profile was assessed using the Symptom Checklist-90-Revised (SCL-90-R). Patients were classified into two groups according to a post-treatment numeric rating scale (NRS). Patients with an NRS score of 0 or 1 at the last visit were classified into group G, and those with an NRS score of 2 or greater were classified into group P. Following this, all patients were re-classified into groups N and R according to pain recurrence. Statistical analysis was performed to evaluate differences in the SCL-90-R T scores between the groups. In addition, multiple logistic regression analysis was used to identify psychological factors that affected treatment outcome.

Results: The patients in groups P and R had higher scores in all subscales of the SCL-90-R than groups G and N, respectively. In particular, somatization (SOM) and psychoticism (PSY) scores showed significant differences between the groups in the treatment outcome.

Conclusion: A correlation is identified between psychological factors and treatment outcome in patients with TMD-related pain. In particular, patients with elevated SOM and PSY scores are more likely to develop refractory pain, and thus require additional interventions to control this risk.

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* Corresponding author. Department of Oral Medicine, School of Dentistry, Jeonbuk National University, 567 Baekje-daero, Deokjin-gu, Jeonju, 54896, South Korea. Fax: +82 63 250 2058.
E-mail address: yonam@jbnu.ac.kr (B.-J. Suh).

Introduction

Temporomandibular disorders (TMD) are a group of clinical problems related to the masticatory muscles, temporomandibular joint (TMJ), and related orofacial structures.^{1,2} The leading symptom of TMD is a pain, which often limits the movement of the TMJ.^{3,4} The etiology of TMD is multifactorial. Many contributing factors are involved in the induction and persistence of TMD-related pain, such as trauma, parafunctional habits, occlusal factors, and psychological distress.^{1–3}

Psychological factors are thought to influence TMD. Psychosocial disorders, including anxiety and depression, are known to be associated with TMD,^{5–7} and psychological distress is thought to be involved in the development of TMD.^{8,9} On the other hand, TMD-related pain can itself induce psychological distress. Persistent pain associated with TMD significantly limits the quality of life of patients, and can affect their psychological status.^{1,8,10} Moreover, psychological distress can negatively affect patient compliance; it can interrupt a patient's understanding of the disease, reducing their motivation for treatment.¹¹ Therefore, assessment of the psychological status of patients is important for successful treatment of TMD.

The Symptom Checklist-90-Revised (SCL-90-R), a self-reported multidimensional questionnaire, is widely used in the clinic because it is relatively simple and can be analyzed by non-specialists.^{12,13} Several previous studies have investigated the psychological status of TMD patients using the SCL-90-R.^{14–18} However, little is known about how psychological status (SCL-90-R scores) affects treatment outcome.

In this regard, this study aimed to investigate the relationship between SCL-90-R scores and treatment outcome by retrospectively evaluating the medical records of TMD patients experiencing pain. Also, this study aimed to identify objective psychological indicators for predicting treatment outcome in TMD patients.

Materials and methods

Subjects

TMD patients experiencing pain who had undergone an SCL-90-R examination at the Department of Oral Medicine, Jeonbuk National University Hospital from 2007 to 2016 were included in this retrospective study. The following exclusion criteria were applied: age less than 18 years, diagnosis of other orofacial pain disorders, and presence of polyarthritides, other rheumatoid disease, or psychiatric disease.

The study adhered to the Declaration of Helsinki II and was approved by the Institutional Review Board of Jeonbuk National University Hospital (IRB No: CUH 2018-06-011).

Data collection

The following data were extracted from each patient's first visit medical record: age, sex, medical history, pain history, SCL-90-R scores, and clinical examination results.

Evaluation of psychological factors

The SCL-90-R consists of 90 items, each of which is scored on a five-point Likert scale (0–4). The instrument is divided into nine symptom subscales and three global indices. The symptom subscales are somatization (SOM), obsessive-compulsive (O-C), interpersonal sensitivity (I-S), anxiety (ANX), depression (DEP), hostility (HOS), phobic anxiety (PHOB), paranoid ideation (PAR), and psychoticism (PSY). The global indices are the global severity index (GSI), the positive symptom total (PST), and the positive symptom distress index (PSDI).^{12,13} Using the SCL-90-R analysis software based on a standard normal table, T scores for the nine symptom subscales and three global indices were calculated.

Evaluation of treatment outcome

Treatment outcome was assessed by the presence of pain and pain recurrence after treatment at the last visit. First, patients were classified into two groups based on pain, which was rated on a numeric rating scale (NRS). Patients with an NRS score of 0 or 1 at the last visit were classified into group G (remission/good prognosis), and those with an NRS score of 2 or greater were classified into group P (pain).^{17,19–21} Therefore, in this study, group P included patients who discontinued to visit the hospital (on their own) before the cessation of pain.

Following this, all patients were re-classified into groups N (non-relapse) and R (relapse) according to pain recurrence. We defined relapse as a case in which patients revisited the clinic for TMD-pain in medical records. However, patients who visited the hospital with the continuing pain after stopping their visit were excluded from this study.

Statistical analysis

All statistical analyses were performed using SPSS Statistics 25 software for Windows (SPSS Inc. Chicago, IL, USA). The independent t-test was used to analyze the differences in SCL-90-R T scores between groups G and P and between the groups N and R. One-way ANOVA was used to analyze differences in SCL-90-R T scores between the four groups (group G/N, group G/R, group P/R, and group P/N).

Multiple logistic regression analysis was used to identify psychological factors affecting treatment outcome. SCL-90-R scores and clinical factors were used as independent variables, and the presence of post-treatment pain and recurrence as dependent variables. The dependent variables were as follows:

- 1) No pain = 0; pain = 1
- 2) Non-relapse = 0; relapse = 1

A forward stepwise selection model was used to identify variables affecting treatment outcome. Variables were entered based on the significance calculated from the likelihood ratio test. Pearson's correlation analysis was performed to investigate the relationship between

psychological factors and treatment duration in group G. *P*-values <0.05 were considered statistically significant.

Results

A total of 486 patients were included in this study. The age and sex distribution of the patients according to group are shown in Table 1. There were no significant differences between the groups with respect to age or gender.

Comparison of SCL-90-R scores between groups

Patients in group P had higher SCL-90-R T scores in all subscales than those in group G. There were significant differences in the scores of all SCL-90-R subscales between groups G and P, except PHOB (Fig. 1).

Patients in group R had higher scores in all SCL-90-R subscales, and there were significant differences in SOM, PHOB, PSY, and PSDI scores between groups N and R (Fig. 2).

Comparison of SCL-90-R scores according to prognosis and recurrence

Patients were reclassified according to prognosis and recurrence into good prognosis and non-relapse (group G/N), good prognosis and relapse (group G/R), pain and non-relapse (group P/N), and pain and relapse groups (group P/R).

The T scores of all SCL-90-R subscales were significantly different between the groups, and post-hoc analysis showed that group P/R showed higher T scores in all SCL-90-R subscales than group G/N. In particular, there were significant differences in SOM and PSY scores between group P/R and the other three groups (Table 2).

Factors affecting treatment outcome

The results of multiple logistic regression analysis of factors affecting the prognosis of TMD-related pain are summarized in Table 3. Chronic pain, pain during muscular palpation, SOM score, and PSY score were significantly associated with prognosis. Chronic pain and muscular pain were associated

with a higher risk of persistent pain (1.70 and 1.80 times, respectively). In addition, elevated SOM and PSY scores were associated with a higher risk of persistent pain (1.05 and 1.04 times, respectively).

The results of the analysis of the risk factors for recurrence are shown in Table 4. SOM score was significantly associated with recurrence. An elevated SOM score was associated with a higher risk of pain recurrence (1.03 times). Meanwhile, in group G, treatment duration was significantly correlated with SOM, O-C, I-S, DEP, ANX, HOS, PAR, GSI, PST, and PSDI scores (Table 5).

Discussion

This study was performed to investigate the relationship between psychological factors and treatment outcome in TMD patients experiencing pain. The SCL-90-R is a useful assessment tool that can be easily used in an outpatient setting to screen psychiatric symptoms.^{12,13,22} However, since the SCL-90-R is a self-reported examination, it is less reliable in patients with signs of mental disorders.^{23,24} Therefore, patients who had received treatment from a psychiatrist were excluded from this study.

We found that patients in groups P and R had higher scores in all SCL-90-R subscales than patients in groups G and N, respectively. In particular, SOM and PSY scores showed significant differences in all statistical analyses. Patients in group P/R who exhibited post-treatment pain and relapse had significantly higher SOM and PSY scores than patients in the other three groups. Moreover, all SCL-90-R subscales showed a significant positive correlation with duration of treatment in group G. This indicates that with higher scores on SCL-90-R subscales, the treatment period can be longer. In addition, high SOM and PSY scores were associated with a higher risk of unsuccessful treatment. These findings suggest that patients suffering from psychological distress may not respond to conventional treatment and may have a long duration of treatment. Indeed, Rugh et al.⁹ reported that TMD patients who do not respond to treatment may be suffering from psychological distress.

Several previous studies have reported a correlation between SOM score and TMD-related pain.^{25–27} The SOM subscale reflects distress from perceived physical dysfunction such as headache and complaints of various organ systems.^{12,28} Regression analysis showed that with each one-point increase in SOM score, the probability of pain persisting increased by 1.05 times. Furthermore, with a one-point increase in the SOM score, the probability of recurrence increased by 1.03 times. Results of these magnitudes may not be considered large, but these represent the change according to a one-point increase in SOM score. Clinically, SCL-90-R scores show significant variation between patients. For example, in this study, the mean SOM score for group G was 47.9, and the mean score for group P was 52.4. Therefore, clinically the score difference in SCL-90-R between patients with psychological concerns and those without psychological concerns is comparatively large, indicating the significance of the results. Rammelsberg et al.²⁵ demonstrated that SOM score is associated with the prognosis and recurrence of

Table 1 The distribution of patients.

	Group G (n = 313)	Group P (n = 173)	<i>p</i> -value
Age (years) ^a	34.9 (13.6)	35.0 (13.4)	.760
Gender (n, %)			
Male	69 (22.0)	37 (21.4)	.867
Female	244 (78.0)	136 (78.6)	
	Group R (n = 110)	Group N (n = 376)	<i>p</i> -value
Age (years) ^a	34.2 (12.0)	35.1 (14.0)	.737
Gender (n, %)			
Male	26 (23.6)	80 (21.3)	.598
Female	84 (76.4)	296 (78.7)	

^a Values are presented as mean and standard deviation (in parentheses).

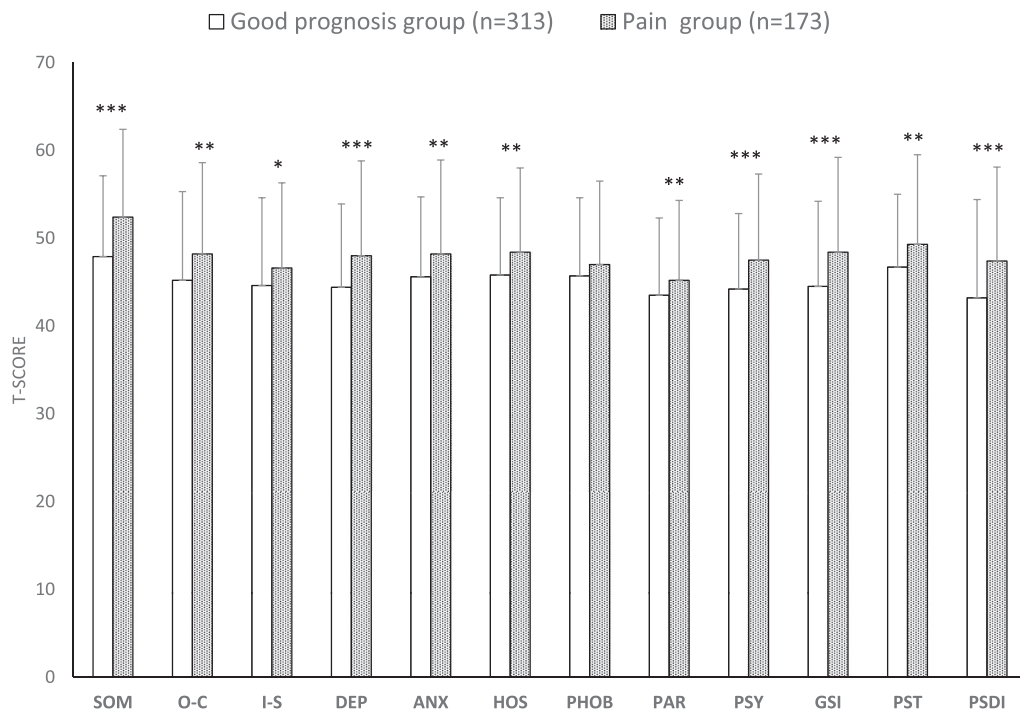


Figure 1 Comparison of SCL-90-R scores between Group G and Group P. Vertical bars represent means and whiskers indicate standard deviation. *p*-value by Independent *t*-test. **p* < 0.05, ***p* < 0.01, ****p* < 0.001. ANX, anxiety; DEP, depression; GSI, global severity index; HOS, hostility; I-S, interpersonal sensitivity; O-C, obsessive-compulsive; PAR, paranoid ideation; PHOB, phobic anxiety; PSDI, positive symptom distress index; PST, positive symptom total; PSY, psychoticism; SCL-90-R, symptom checklist-90-revised; SOM, somatization.

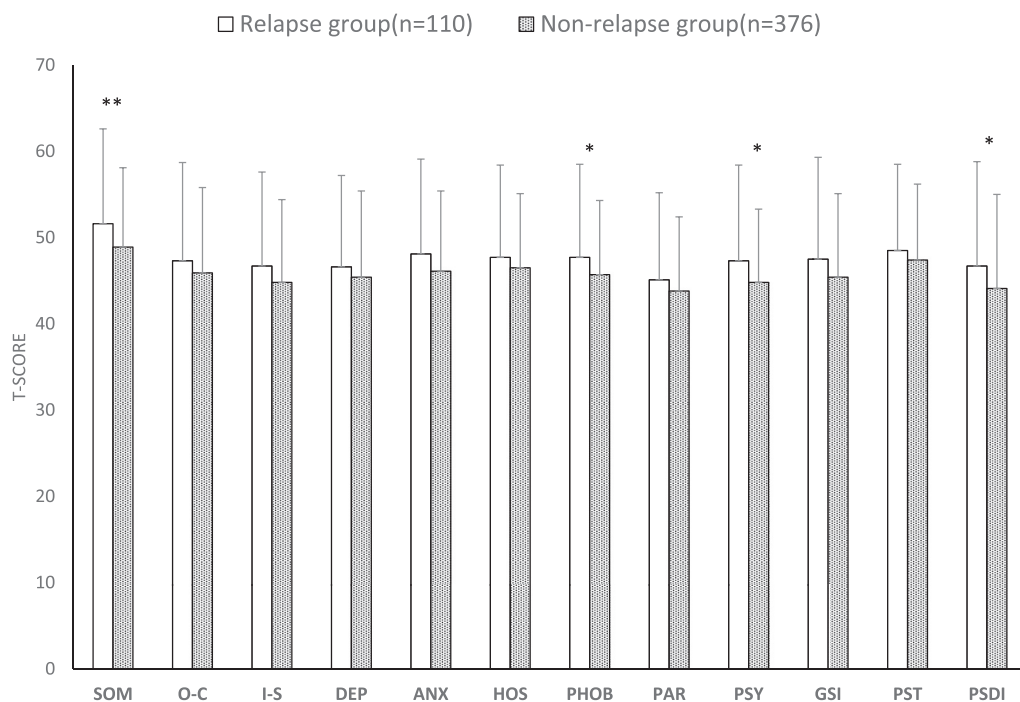


Figure 2 Comparison of SCL-90-R scores between Group R and Group N. Vertical bars represent means and whiskers indicate standard deviation. *p*-value by Independent *t*-test. **p* < 0.05, ***p* < 0.01. ANX, anxiety; DEP, depression; GSI, global severity index; HOS, hostility; I-S, interpersonal sensitivity; O-C, obsessive-compulsive; PAR, paranoid ideation; PHOB, phobic anxiety; PSDI, positive symptom distress index; PST, positive symptom total; PSY, psychoticism; SCL-90-R, symptom checklist-90-revised; SOM, somatization.

Table 2 Comparison of SCL-90-R scores by groups.

Variable	Group G/N (a) n = 246		Group G/R (b) n = 67		Group P/N (c) n = 130		Group P/R (d) n = 43		F	Scheffé post-hoc tests
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
SOM	47.6	9.1	48.9	9.5	51.2	9.1	56.0	11.8	11.7**	d>a,b,c c>a
O-C	45.0	9.9	45.7	10.7	47.7	9.7	49.8	12.1	3.9*	d>a
I-S	44.5	9.9	44.9	10.5	45.6	9.1	59.6	11.0	3.3*	d>a
DEP	44.5	9.6	44.4	9.1	47.3	10.4	50.1	11.8	5.5**	d>a,b
ANX	45.6	9.0	45.8	9.3	47.1	9.9	51.8	12.4	5.3**	d>a,b
HOS	45.6	8.3	46.7	10.3	48.1	9.0	49.3	11.1	3.4*	
PHOB	45.6	9.1	46.1	8.3	45.9	7.6	50.1	13.4	3.0*	d>a
PAR	43.5	8.9	43.6	8.5	44.4	8.0	47.6	11.7	2.7*	
PSY	43.9	8.3	45.0	9.7	46.5	8.7	50.9	12.1	8.2**	d>a,b,c
GSI	44.4	9.5	45.2	10.2	47.4	9.8	51.3	13.2	7.0**	d>a,b
PST	46.6	8.2	46.9	8.6	48.7	9.7	50.9	11.6	3.7*	d>a
PSDI	43.0	11.0	44.0	11.9	46.4	10.2	50.7	11.5	7.4**	d>a,b c>a

p-value by one-way ANOVA.

*p < 0.05, **p < 0.01.

ANX, anxiety; DEP, depression; Group G/N, good prognosis and non-relapse group; Group G/R, good prognosis and relapse group; Group P/N, pain and non-relapse group; Group P/R, pain and relapse group; GSI, global severity index; HOS, hostility; I-S, interpersonal sensitivity; O-C, obsessive-compulsive; PAR, paranoid ideation; PHOB, phobic anxiety; PSDI, positive symptom distress index; PST, positive symptom total; PSY, psychoticism; SCL-90-R, symptom checklist-90-revised; SOM, somatization.

TMD. They reported that patients who complain of continuous muscle pain over 5 years exhibit the highest SOM scores at the first visit. Furthermore, patients whose pain improves then shows a steady decrease in SOM score, though patients with pain recurrence do not. Canales

et al.²⁶ suggested that pain intensity is associated with SOM score in TMD patients. Moreover, Fillingim et al.⁷ analyzed the psychological characteristics of the patients who developed TMD, and showed using multivariate analysis that SOM score was a risk factor for TMD development. Similarly, in this study, an elevated SOM score increased the risk of pain recurrence by 1.03 times. These results suggest that SOM score is associated with the development of pain in TMD patients. Therefore, accurate evaluation of SOM score is thought to be important for predicting and evaluating treatment outcome in TMD patients experiencing pain.

Meanwhile, the present study also demonstrated that PSY score was associated with treatment outcome, and an elevated PSY score increased the risk of persistent pain by 1.04 times. The PSY subscale reflects a continuous dimension ranging from mild personal characteristics such as interpersonal avoidance and isolation to extreme symptoms of schizophrenia.^{22,28} A high PSY score does not mean that patients experience hallucinations or delusions, but rather that they possess personality traits such as impulsiveness, low persistence, lack of cooperation, and low social sensitivity.^{29,30} Therefore, the relationship between PSY score and patient compliance should be considered. Patient compliance refers to the extent to which a patient's behavior, such as taking medication, executing lifestyle changes, and attending hospital appointments, follows medical advice.³¹ Patients with a high PSY score have been shown to be uncooperative and require encouragement to increase their motivation.^{32,33} In order for treatment to be successful, it is important that patients are encouraged to adhere to treatment.³⁴ Therefore, future studies should be conducted to confirm the association between PSY score and patient compliance in patients with TMD, which would allow patients requiring additional encouragement to be identified.

Table 3 Logistic regression analysis of factors related to persistent pain.

Factors	B	S.E.	Wald	Sig.	Exp(B)
Chronic pain ^a	0.531	0.214	6.165	.013	1.701
PM ^b	0.585	0.219	7.138	.008	1.796
SOM	0.049	0.015	10.622	.001	1.050
PSY	0.035	0.016	4.485	.034	1.035
Constant	-2.895	0.594	23.786	.000	0.055

B, B coefficients; Exp(B), the exponentiation of the B coefficient; PSY, psychoticism; S.E., standard errors; Sig., significance; SOM, somatization.

^a Chronic pain; pain that lasted for longer than 6 months before treatment.

^b PM; tenderness (pain) to muscle palpation in clinical examination at their first visit.

Table 4 Multiple logistic regression analysis of factors related to pain recurrence.

Factors	B	S.E.	Wald	Sig.	Exp(B)
SOM	0.028	0.011	6.818	.009	1.028
Constant	-2.618	0.550	22.687	.000	0.073

B, B coefficients; Exp(B), the exponentiation of the B coefficient; S.E., standard errors; Sig., significance; SOM, somatization.

Table 5 Matrix table of correlation between treatment duration and SCL-90-R scores in Group G.

	Tx' duration	SOM	O-C	I-S	DEP	ANX	HOS	PHOB	PAR	PSY	GSI	PST	PSDI
Tx' duration	1												
SOM	0.11*	1											
O-C	0.17**	0.69**	1										
I-S	0.15**	0.59**	0.79**	1									
DEP	0.17**	0.67**	0.87**	0.82**	1								
ANX	0.13*	0.75**	0.79**	0.76**	0.82**	1							
HOS	0.13*	0.59**	0.70**	0.71**	0.76**	0.71**	1						
PHOB	0.06	0.58**	0.57**	0.60**	0.61**	0.71**	0.56**	1					
PAR	0.15**	0.50**	0.67**	0.75**	0.74**	0.68**	0.63**	0.55**	1				
PSY	0.05	0.63**	0.74**	0.79**	0.80**	0.78**	0.67**	0.66**	0.76**	1			
GSI	0.15**	0.81**	0.91**	0.87**	0.94**	0.91**	0.79**	0.71**	0.77**	0.84**	1		
PST	0.14*	0.63**	0.70**	0.56**	0.64**	0.59**	0.51**	0.46**	0.46**	0.49**	0.69**	1	
PSDI	0.14*	0.77**	0.86**	0.86**	0.91**	0.90**	0.79**	0.71**	0.79**	0.85**	0.97**	0.54**	1

Pearson's Correlation test.

* $p < 0.05$, ** $p < 0.01$.

ANX, anxiety; DEP, depression; Group G, good prognosis group; GSI, global severity index; HOS, hostility; I-S, interpersonal sensitivity; O-C, obsessive-compulsive; PAR, paranoid ideation; PHOB, phobic anxiety; PSDI, positive symptom distress index; PST, positive symptom total; PSY, psychoticism; SCL-90-R, symptom checklist-90-revised; SOM, somatization; Tx' duration, treatment duration.

This study has a limitation in that it was performed based on the patients' medical records. To resolve this, future studies involving TMD patients experiencing pain should be conducted prospectively. Specifically, a longitudinal study in which the Diagnostic Criteria for TMD is used and SOM and PSY scores are evaluated should be conducted. In addition, further research should be performed to investigate the efficacy of different interventions selected based on SOM and PSY scores.

In conclusion, the significant differences were identified in SCL-90-R scores between groups, suggesting that psychological factors should be considered when treating patients with TMD-related pain. SOM and PSY scores are associated with pain occurrence and TMD prognosis, and these may be used to assess and predict the pain status of TMD patients. Patients with high SOM and PSY scores may be at a higher risk of refractory pain. Therefore, the evaluation of SOM and PSY scores should be included in the diagnosis of TMD patients with pain, and patients with elevated SOM and PSY scores should receive additional psychological interventions relating to this increased risk.

Declaration of Competing Interest

No potential conflict of interest relevant to this article was reported.

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