General Psychiatry

Characteristics of implicit schemas in patients with major depressive disorder

Jiayu Yao ⬥ , Qingqing Lin, Ziwei Zheng, Shuangyi Chen, Yuan Wang, Wenhui Jiang, Jianyin Qiu

Department of Psychological Counseling & Psychotherapy, Shanghai Mental Health Center, Shanghai Jiao Tong University School of Medicine, Shanghai, China

Correspondence to
Dr Jianyin Qiu;
jianyin_qiu@163.com

ABSTRACT

Background Many psychotherapy theories emphasise the importance of self-schema and other-schema, but most previous studies focused on the explicit self-schema in major depressive disorder (MDD). However, the limited studies of implicit self-schema in MDD have shown inconsistencies in their findings. Furthermore, only a few studies have investigated the implicit other-schema, and the pathway illustrating how implicit schemas influence depression remains unclear.

Aims The primary aim of our study was to explore the characteristics of implicit self-schema and other-schema in patients with MDD. We also examine the chain-mediating effect of attachment relationships and interpersonal trust.

Methods The present study included 88 patients with MDD and 88 healthy controls (HCs). The Hamilton Depression Rating Scale-17, Experiences in Close Relationships Inventory—Revised Questionnaire, Trust Scale and the Extrinsic Affective Simon Task (EAST) were used to assess depressive symptoms, attachment relationships, interpersonal trust and implicit schemas, respectively. Paired sample t-test was used to compare the reaction time (RT) for positive and negative words within the two groups. Analysis of covariance was used to explore the difference between two groups from the perspective of implicit schemas and interpersonal patterns. The chain mediation model was verified by bootstrap.

Results (1) For interpersonal patterns, patients with MDD scored significantly higher on attachment anxiety (F=82.150, p<0.001) and attachment avoidance (F=23.192, p<0.001) and scored significantly lower on the predictability (F=30.297, p<0.001), dependence (F=39.728, p<0.001) and faith (F=60.997, p<0.001) dimensions of interpersonal trust. (2) As for implicit schemas, no significant difference was found between the RT for positive self-words and negative self-words in patients with MDD (t=−1.056, p=0.294). However, the HC responded faster to positive self-words than negative self-words (t=−3.286, p=0.001). The RT for positive other-words and negative other-words were significantly different in both patients with MDD (t=2.943, p=0.004) and HCs (t=−2.482, p=0.015), with opposite directions. The EAST effect of other-schema in patients with MDD was significantly different from that in HCs (F=13.051, p<0.001). (3) For the total sample, the EAST effect of other-schema significantly correlated with attachment avoidance, interpersonal trust and depressive symptoms. Attachment avoidance and interpersonal trust were the chain mediators between the EAST effect of other-schema and depressive symptoms (95% CI: −0.090 to −0.008).

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Many psychotherapy theories emphasise the importance of implicit schemas in major depressive disorder (MDD). However, the previous studies of implicit self-schema in MDD have shown inconsistencies in their findings, and few studies have focused on implicit other-schema in MDD.

WHAT THIS STUDY ADDS

⇒ Unlike healthy controls, patients with MDD lacked a positive implicit self-schema and had a negative implicit other-schema.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our results provide evidence for psychotherapeutic techniques that focus on self-schema and other-schema and suggest it is vital to recognise and intervene in the implicit schemas during clinical treatment.

However, no significant results were found for the EAST effect of other-schema when correlation and mediation analyses were performed for HCs and patients with MDD separately.

Conclusions This study verified that patients with MDD have abnormal interpersonal patterns and negative implicit schemas. However, no mediating effect of attachment relationships and interpersonal trust was found.

INTRODUCTION

Major depressive disorder (MDD) is a common mood disorder with a high incidence and high disease burden.[1] Low mood and diminished interest are the main symptoms of MDD.[2] As an important treatment focus for MDD, many psychotherapy theories emphasise the importance of implicit self-schema and other-schema,[3–5] which refer to the information and organisation mode about oneself or others.[6] For example, Beck, the founder of cognitive therapy pointed out that patients with MDD had negative perceptions of self, others and the world (ie, core beliefs) that are automatic and unconscious.[3] 'I am unlovable' and 'I am incompetent' are two common self-schemas in MDD.[7] However,

the evidence about the characteristics of implicit self-schema in patients with MDD has been inconsistent, and few studies have focused on the implicit other-schema in MDD. Thus, the characteristics of implicit schemas are not clear. Furthermore, how implicit schemas affect depression is also poorly understood.

Most previous studies have focused on explicit self-schema in patients with MDD. They have found that these patients associated themselves more with negative traits (ie, negative self-schema), while healthy individuals had a positive self-schema.[8–11] A meta-analysis suggested that negative self-schema measured by self-report questionnaires was significantly correlated with depressive symptoms.[8] Furthermore, Shestyuk and colleagues,[9] using the self-referential processing task that asks participants to decide whether adjectives projected on a screen are self-descriptive or not, also found that patients with MDD believed that negative words were more suitable to describe themselves and responded to negative words more quickly than healthy controls (HCs). The methods mentioned above actually measure explicit schemas, and there is some evidence indicating that explicit schemas and implicit schemas can be discrepant.[12] Though some studies have used the implicit association test (IAT) to measure implicit self-schema in MDD, the results have been inconsistent.[13] For example, Romero and colleagues[14] found a significant difference in implicit self-schema between patients with MDD and the healthy group, while Lemmens and colleagues[15] did not find similar results. Therefore, the characteristics of implicit self-schema in MDD are not evident. Moreover, although recent research (Chatav et al,[16] Wild and Dozois[17]) has begun to emphasise the role of other-schema in MDD and the notion that it is more negative, the evidence from empirical studies is lacking.[18] Thus, it is necessary to explore the characteristics of implicit self-schema and other-schema in MDD.

Furthermore, few empirical studies have focused on the pathway that implicit schemas influence depression. According to Bowlby's attachment theory, perceptions and subjective experiences about oneself and others—the self-schema and other-schema—are shaped during interpersonal interactions with caregivers at a young age.[19] These schemas then cause individuals to form varying adult attachment styles in intimate relationships by influencing the organisation and processing of information.[20] To be more specific, attachment anxiety develops when patients with MDD have a negative self-schema such as 'I am unlovable', and attachment avoidance develops when they have a negative other-schema such as 'others are caustic'.[21] The attachment style then guides different aspects of the individual's interpersonal patterns, including excessive reassurance-seeking, negative feedback-seeking, sensitivity to rejection from others, lack of interpersonal trust and so on.[22] Research findings indicate that former attachment relationships predict future interpersonal trust[23] and that abnormal interpersonal patterns are not only significantly associated with
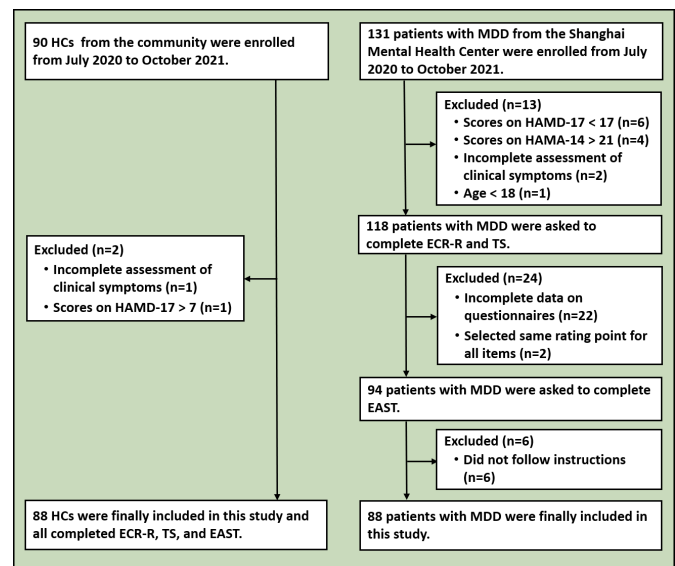

Figure 1 Flowchart for the enrollment.HCs, healthy controls; MDD, major depressive disorder; HAMD-17, Hamilton Depression Rating Scale-17; HAMA-14, Hamilton Anxiety Scale-14; ECR-R, Experiences in Close Relationships Inventory-Revised Edition; TS, Trust Scale; EAST, Extrinsic Affective Simon Task.

depressive symptoms[24] but also are risk and maintenance factors for depression.[25] Thus, negative implicit schemas from early experiences may influence the formation of adult attachment relationships, which, in turn, may affect the trust in interpersonal interactions and ultimately lead to depression.

The primary aim of our study was to explore the characteristics of implicit self-schema and other-schema in MDD. Based on this, we also examined the chain-mediating effect of attachment relationships and interpersonal trust. We proposed the following hypotheses: (1) Patients with MDD have negative implicit schemas, while HCs have positive implicit schemas; (2) Compared with HCs, patients with MDD have more attachment avoidance and attachment anxiety in intimate relationships, with less interpersonal trust in interpersonal relationships; (3) The attachment relationship and interpersonal trust have a chain-mediating effect on implicit schemas and depressive symptoms.

METHODS
Participants
From July 2020 to October 2021, 131 patients with MDD were recruited from the Psychological Counseling Department of Shanghai Mental Health Center (figure 1). The inclusion criteria for the patients were as follows: (1) diagnosed as MDD according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), and experiencing current episodes; (2) scores of the Hamilton Depression Rating Scale-17 (HAMD-17) ≥17 and the Hamilton Anxiety Scale-14 (HAMA-14) ≤21; (3) 18–55 years old; (4) junior high school education or above; (5)

not received psychiatric medication or taken medication irregularly and then stopped taking medication for 8 or more weeks; (6) not received systematic psychological treatment in the past 6 months; (7) not colour-blind with sufficient visual and auditory abilities to complete the tasks and (8) signed the informed consent. The exclusion criteria for patients were as follows: (1) currently suffering from serious physical diseases; (2) serious suicide risk; (3) psychotic disorders or accompanied by psychotic symptoms; (4) comorbidity of psychoactive substance dependence or abuse, personality disorders, mental retardation, and so on, and (5) previous manic episodes. Of the total patient enrollees, 13 were excluded for failure to meet the inclusion criteria, and another 30 patients were later excluded for failure to complete the testing according to requirements. Finally, 88 patients with MDD were included in the final analysis.

At the same time, 90 HCs were recruited from the community with the following inclusion criteria: (1) no history of any mental disorders and with scores for HAMD-17 <7 and HAMA-14 <7; (2) 18–55 years old; (3) junior high school education or above; (4) no history of psychiatric drug use; (5) no history of any mental disorders across three family generations; (6) not colour-blind with sufficient visual and auditory abilities to complete the tasks and (7) signed the informed consent. Two HC enrollees were excluded because one did not complete the assessment of clinical symptoms, and one had HAMD-17 scores >7. The HC group ultimately included 88 subjects. The Ethics Committee of Shanghai Mental Health Center approved the study protocol, and the study was carried out according to the tenets of the Declaration of Helsinki. Written, informed consent of all subjects was obtained after receiving a complete description of the study.

Clinical psychological assessments

All subjects were administered a battery of five tests by graduate students majoring in clinical psychology who have undergone training in testing. The Mini-International Neuropsychiatric Interview (MINI), HAMD-17 and HAMA-14 were used to assess clinical symptoms. According to HAMD-17 scoring, 0–6 indicates no depression, 7–17 indicates mild depression, 18–24 indicates moderate depression and 25–52 indicates severe depression. The Experiences in Close Relationships Inventory—Revised Edition (ECR-R)[26] was used to measure the attachment relationship of all subjects. It includes 36 items with two dimensions: attachment anxiety refers to the model of self with the fear of being rejected and abandoned; anxiety avoidance refers to the model of others with the fear of being close to and dependent on others. The score range of each item is 0–7 points, with higher scores indicating more attachment anxiety or avoidance. Cronbach's α is 0.86 and 0.81 for attachment anxiety and attachment avoidance, respectively. The Trust Scale (TS)[27] is an 18-item questionnaire used to measure three dimensions: predictability (TS-P), dependence (TS-D) and faith (TS-F). Predictability refers to the degree of belief that the behaviour of a partner can be predicted. Dependence refers to the belief
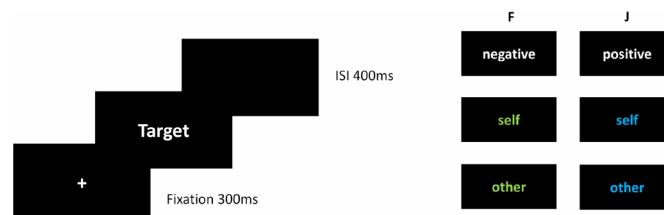

Figure 2 Extrinsic Affective Simon Task. ISI, interstimulus interval; F, participants were instructed to press 'F' on the keyboard if the target was a white negative word, a green self-word or a green other-word; J, participants were instructed to press 'J' on the keyboard if the target was a white positive word, a blue self-word or a blue other-word.

that partners can be counted on. Faith refers to the confidence that partners are willing to take responsibility and care for themselves. The TS was used to measure interpersonal trust. The score range of each item is 0–7 points, with higher scores indicating more interpersonal trust. Cronbach's α of TS is 0.79. All of the research instruments mentioned above were Chinese-translated versions with good reliability and validity. Among them, HAMD, HAMA and TS came from the handbook of rating scales for mental health,[28] MINI was translated by Si and colleagues[29] and ECR-R was translated by Lu and colleagues.[30]

Behavioural paradigm

Extrinsic Affective Simon Task (EAST)[31] (figure 2) is a paradigm developed from IAT and can measure self-schema and other-schema simultaneously. The experimental materials included attribute words (positive words and negative words) and object words (self-words and other-words) shown on a screen. The attribute words were presented with white lettering on black background. According to the valence (positive or negative), participants were asked to press 'F' with the left hand or 'J' with the right hand, pairing 'F' with negative words and 'J' with positive words. Object words were presented in blue or green, that is, 2 (blue or green)×2 (self-words or other-words) conditions: blue self-words, blue other-words, green self-words and green other-words. According to the colour of the words, participants were asked to press 'F' or 'J', pairing 'F' with green and 'J' with blue. In this way, 'F' represented both negative words and green, and 'J' represented both positive words and blue. Green was implicitly linked to negative words, and blue was implicitly linked to positive words. Finally, four indexes of implicit schemas were measured: positive self-words, negative self-words, positive other-words and negative other-words.

The attribute words were 12 adjectives describing personality traits: 6 positive words (nice, warm, lovely, kind, excellent, capable) and 6 negative words (terrible, incompetent, useless, evil, lame, disgusting). Object words included four self-words (I, myself, me and self) and four other-words (dad, mom, partner and lover). All words were presented in Chinese, and the corresponding Chinese words are 美好的, 温暖的, 可爱的, 善良的, 优秀

的, 能干的, 糟糕的, 无能的, 没用的, 罪恶的, 差劲的, 讨厌的, 我, 自己, 本人, 自我, 爸爸, 妈妈, 伴侣, 恋人.

There were four blocks with 44 trials in each. The 12 attribute words were presented once in each block, and 8 object words were presented in blue and green twice in each block. All words were presented randomly. Reaction time (RT) and accuracy were measured as the EAST performances. The RT below 300 ms was calculated as 300 ms, and the RT above 3000 ms was calculated as 3000 ms. The RT for words presented in green minus the RT for words presented in blue was used as the EAST effect. A larger EAST effect indicated a more positive implicit schema.

Statistical analyses

SPSS 24.0 was used for statistical analyses. The main statistical methods included paired sample t-test, analysis of covariance (ANCOVA) and Pearson correlation. Paired sample t-test was used to compare the RT for positive words and negative words within two groups. ANCOVA was used to explore the differences between two groups for the perspective of implicit schemas and interpersonal patterns. Furthermore, the chain mediation model was conducted with bootstrap in Amos 24.0 to explore whether implicit schemas affect depressive symptoms through the attachment relationship and interpersonal trust. We performed 5000 bootstrap resamples. Indexes and standards of model fit included comparative fit index (CFI) >0.90, Tucker-Lewis index (TLI) >0.90 and root mean square error of approximation (RMSEA) <0.08, χ^2/df <3. The confidence interval (CI) was set to 95%.

RESULTS
Demographic and clinical characteristics

Figure 1 presents the enrolment of subjects in this study. Demographic and clinical data of patients with MDD and HCs are presented in table 1. There were no significant differences in education (F=2.091, p=0.150) and gender (χ^2=0.645, p=0.411) between the two groups, while the age of patients with MDD was older (F=9.513, p=0.002). Therefore, age was used as a covariable. Patients with MDD scored higher on HAMD-17 (F=2522.431, p<0.001) and HAMA-14 (F=1387.654, p<0.001) than HCs. The patients' illness severity categorisation included 4 with mild depression, 72 with moderate depression and 12 with severe depression.

Characteristics of the attachment relationship and interpersonal trust

ANCOVA was conducted to compare the scores on ECR-R and TS between groups (table 1). The results indicated that in ECR-R, patients with MDD had significantly higher scores on attachment anxiety (F=82.150, p<0.001) and attachment avoidance (F=23.192, p<0.001) than HCs. In TS, patients with MDD scored significantly lower than HCs on predictability (F=30.297, p<0.001), dependence (F=39.728, p<0.001) and faith (F=60.997, p<0.001).

Characteristics of self-schema and other-schema

Paired sample t-test (table 2) was conducted on the RT in patients with MDD and HCs, respectively. The results indicated that there was no significant difference between the RT for positive (ie, blue) self-words and that for negative (ie, green) self-words in patients with MDD (t=−1.056, p=0.294). But the RT for positive other-words was significantly greater than that for negative other-words (t=2.943, p=0.004) in patients with MDD. Among HCs, the RT for positive self-words and positive other-words was lower than for negative self-words (t=−3.286, p=0.001) and negative other-words (t=−2.482, p=0.015), respectively.

ANCOVA was performed to explore the difference in implicit schemas between the two groups. The results (table 1) indicated that there was no significant difference

Table 1 Demographic and clinical characteristics, scale scores and EAST effect of patients with MDD and HCs

	MDD	HCs	F/χ^2	P value
Age (years), mean (SD)	27.00 (5.17)	24.92 (3.64)	9.513	0.002
Education (years), mean (SD)	16.10 (1.67)	16.43 (1.34)	2.091	0.150
Female (%)	72.73	67.05	0.645	0.411
HAMD-17, mean (SD)	21.67 (3.08)	2.50 (1.82)	2522.431	<0.001
HAMA-14, mean (SD)	16.39 (3.21)	2.05 (1.65)	1387.654	<0.001
Attachment anxiety, mean (SD)	79.39 (22.48)	51.72 (17.45)	82.150	<0.001
Attachment avoidance, mean (SD)	62.47 (20.91)	49.22 (17.89)	23.192	<0.001
TS-P, mean (SD)	26.61 (5.78)	31.16 (4.93)	30.297	<0.001
TS-D, mean (SD)	24.35 (7.22)	30.70 (5.70)	39.728	<0.001
TS-F, mean (SD)	21.25 (6.52)	28.89 (6.20)	60.997	<0.001
Self-EAST, mean (SD)	13.93 (123.76)	37.09 (105.88)	1.795	0.182
Other-EAST, mean (SD)	−35.61 (113.51)	23.51 (88.83)	13.051	<0.001

EAST, Extrinsic Affective Simon Task; HAMA-14, Hamilton Anxiety Scale-14; HAMD-17, Hamilton Depression Rating Scale-17; HCs, healthy controls; MDD, major depressive disorder; SD, standard deviation; TS-D, dependence dimension of Trust Scale; TS-F, faith dimension of Trust Scale; TS-P, predictability dimension of Trust Scale.

Table 2 Reaction time (ms) of patients with MDD and HCs in Extrinsic Affective Simon Task

		Positive	Negative	t	P value
Self-words, mean (SD)	MDD	873.01 (281.33)	886.94 (269.67)	−1.056	0.294
	HCs	678.75 (144.06)	715.84 (161.27)	−3.286	0.001**
Others-words, mean (SD)	MDD	907.85 (281.78)	872.24 (265.34)	2.943	0.004**
	HCs	686.21 (152.73)	709.71 (169.64)	−2.482	0.015*

*p<0.05, **p<0.01.
HCs, healthy controls; MDD, major depressive disorder; SD, standard deviation.

in the EAST effect of self-words (self-EAST) between patients with MDD and HCs (F=1.795, p=0.182). Patients with MDD had a significantly lower EAST effect of other-words (other-EAST) than HCs (F=13.051, p<0.001). No difference was found in the accuracy rate within the groups through paired sample t-test and between the groups through ANCOVA (all p-values>0.05).

The mediation model

Pearson's correlation analysis was performed to analyze the correlation between variables (table 3). For the total sample, the results indicated that the EAST effect of other-words was significantly correlated with attachment avoidance, interpersonal trust and HAMD-17 (all p-values<0.05). In addition, there were significant

Table 3 Pearson's correlation matrix between variables

	HAMD-17	Self-EAST	Other-EAST	Attachment anxiety	Attachment avoidance	TS-P	TS-D	TS-F
Total sample								
HAMD-17	1							
Self-EAST	−0.105	1						
Other-EAST	−0.276***	0.142	1					
Attachment anxiety	0.598***	−0.015	−0.129	1				
Attachment avoidance	0.348***	−0.004	−0.168*	0.361***	1			
TS-P	−0.413***	0.085	0.166*	−0.440***	−0.354***	1		
TS-D	−0.458***	0.063	0.162*	−0.480***	−0.442***	0.689***	1	
TS-F	−0.539***	−0.012	0.207*	−0.504***	−0.429***	0.604***	0.797***	1
MDD								
HAMD-17	1							
Self-EAST	−0.014	1						
Other-EAST	0.026	0.072	1					
Attachment anxiety	0.267*	0.098	0.115	1				
Attachment avoidance	0.136	0.005	−0.171	0.211*	1			
TS-P	−0.163	0.074	0.137	−0.311**	−0.205	1		
TS-D	−0.168	0.091	0.051	−0.311**	−0.326**	0.618***	1	
TS-F	−0.142	−0.098	0.059	−0.227*	−0.219*	0.547***	0.739***	1
HC								
HAMD-17	1							
Self-EAST	−0.064	1						
Other-EAST	−0.126	0.190	1					
Attachment anxiety	0.158	−0.018	−0.089	1				
Attachment avoidance	0.164	0.066	0.043	0.250*	1			
TS-P	−0.119	0.017	−0.045	−0.252*	−0.338**	1		
TS-D	−0.086	−0.084	0.036	−0.309**	−0.392***	0.636***	1	
TS-F	−0.254*	−0.046	0.099	−0.397***	−0.453***	0.466***	0.749***	1

*p<0.05, **p<0.01, ***p<0.001.
EAST, Extrinsic Affective Simon Task; HAMD-17, Hamilton Depression Rating Scale-17; HCs, healthy controls; MDD, major depressive disorder; TS-D, dependence dimension of Trust Scale; TS-F, faith dimension of Trust Scale; TS-P, predictability dimension of Trust Scale.
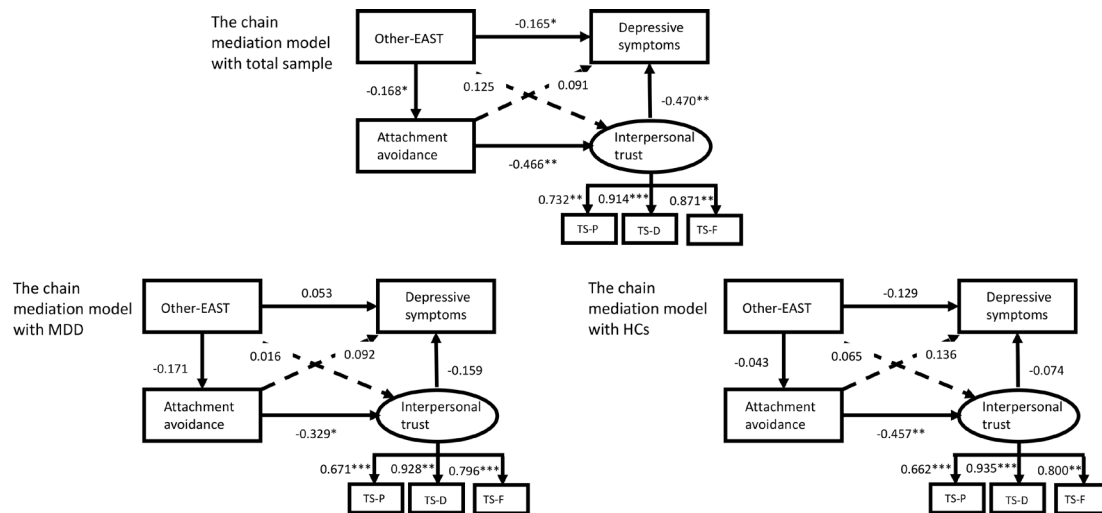
Figure 3 The chain mediation model and standardised regression coefficients. TS-P, predictability dimension of Trust Scale; TS-D, dependence dimension of Trust Scale; TS-F, faith dimension of Trust Scale; EAST, Extrinsic Affective Simon Task; MDD, major depressive disorder; HCs, healthy controls. *p<0.05, **p<0.01, ***p<0.001.

correlations among attachment relationships, interpersonal trust and HAMD-17 (all p-values<0.001), but no significant correlations were found between the EAST effect of self-words and other variables (all p-values>0.05). For MDD, attachment anxiety was significantly correlated with HAMD-17, attachment avoidance and three dimensions of interpersonal trust (all p-values<0.05). However, attachment avoidance was only significantly correlated with dependence and faith dimensions of interpersonal trust (all p-values<0.05). For HCs, significant correlations were observed among the two dimensions of attachment relationship and the three dimensions of interpersonal trust, also between the faith dimension of interpersonal trust and HAMD-17 (all p-values<0.05). When patients with MDD and HCs were analysed separately, neither the EAST effect of self-words nor the EAST effect of other-words was significantly correlated with the other variables (all p-values>0.05).

Based on the results of correlation analysis, bootstrap was conducted to verify the chain-mediating effect of other-EAST on depressive symptoms through attachment avoidance and interpersonal trust (figure 3). For the total sample, the results indicated that the direct effect of other-EAST on depressive symptoms was significant (p=0.015). The indirect effect of other-EAST on depressive symptoms through attachment avoidance and interpersonal trust (other-EAST→attachment avoidance→interpersonal trust→depressive symptoms) was also significant (−0.037, 95% CI: −0.090 to −0.008). But the indirect effect of other-EAST on depressive symptoms through attachment avoidance (other-EAST→attachment avoidance→depressive symptoms) was not significant (−0.015, 95% CI: −0.062 to 0.008). In addition, no significant indirect effect of other-EAST on depressive symptoms through interpersonal trust (other-EAST→interpersonal trust→depressive symptoms) was observed (−0.059, 95% CI: −0.135 to 0.004). The results of model fitting indexes

showed that the model fitting degree was good (χ^2=10.4, df=6, χ^2/df=1.73, CFI=0.989, TLI=0.973, RMSEA=0.065). However, when bootstrap was conducted with patients with MDD and HCs separately, the 95% CIs for all paths contained zero, indicating that the mediating effect was insignificant.

DISCUSSION
Main findings
A body of research indicates that patients with MDD have negative explicit self-schema,[8–11] whereas the characteristics of implicit schemas are waiting to be verified. The current study primarily aimed to explore the characteristics of implicit self-schema and other-schema in MDD. Notably, the findings demonstrated that, unlike HCs, patients with MDD lacked a positive self-schema and had a negative other-schema.

In terms of implicit self-schema, EAST results showed no difference between RT for positive self-words and negative self-words in MDD. However, HCs responded faster to positive self-words than negative self-words. The results suggested that HCs had a positive self-schema, while patients with MDD lacked a positive self-schema. Behavioural evidence and event-related potential evidence from previous studies also found similar results.[10 11 14 32] For behavioural evidence, the implicit self-schema was measured mainly through IAT, and RT results showed that self-schema in MDD was more negative than that in HCs.[14 32] For event-related potential evidence, a smaller N400 amplitude for positive words was found in HC.[10] Besides, patients with MDD showed a smaller N400 amplitude for negative words than HCs.[11] Considering that N400 would occur with semantic inconsistency, the above results indicated that when positive words were associated with the self in MDD, the degree of semantic inconsistencies was higher.[11]

However, other studies did not find differences in implicit self-schemas between patients with MDD and HCs.[12 15 33–35] The inconsistency may be related to the sample size and whether participants were given a diagnosis or not. For instance, the sample sizes of currently depressed patients were less than 30 in some studies.[33–35] Monsonet and colleagues[12] recruited 505 undergraduates; those who scored in the top 25% of the Beck Depression Inventory were included in the depression group, implying that the researchers may have included participants who did not meet the diagnostic criteria for MDD. Suppose the absence of a diagnosis contributes to the inconsistent results. In that case, we may assume that the characteristic of implicit self-schema in subclinical depression groups differs from that in patients diagnosed with MDD. If so, the implicit schemas may be potential auxiliary diagnosis indexes or early identifiers of high-risk populations. More research is needed to confirm this possibility.

In terms of implicit other-schema, we observed that patients with MDD responded faster to negative other-words than positive other-words. In contrast, HCs responded faster to positive other-words than negative other-words. Furthermore, other-EAST in MDD was smaller than that in HCs. It indicated that HCs had a positive other-schema, while patients with MDD had a negative other-schema. It is a novel finding. Because to the best of our knowledge, it is the first study investigating the characteristics of implicit other-schema in MDD. And our results provided evidence for the dyadic partner-schema model of relationship distress and depression proposed by Wild and Dozois[17] recently, which emphasised that negative other-schema in MDD guides the perception and interpretation of others' behaviours in interpersonal situations, leading to relationship distress and depression. Our findings are also consistent with Beck's suggestion that patients with MDD have a negative view of others.[3] However, the other-words used in this study were dad, mom, partner and lover, which may lack representativeness. Therefore, different and more representative other-words can be considered in future studies to investigate further the characteristics of implicit other-schema in MDD.

Consistent with previous studies,[36 37] we also found that patients with MDD had higher attachment anxiety, attachment avoidance and lower interpersonal trust. Although we obtained significant results between other-schema, attachment avoidance, interpersonal trust and depressive symptoms when correlation and chain mediation analyses were performed with the total sample, no significant results were found when the analyses were performed separately in the two groups; this finding is inconsistent with our hypothesis. Furthermore, no correlation was found between implicit self-schema and depressive symptoms. Nevertheless, there are several explanations for these insignificant results.

First, although Tariq and colleagues[8] found significant correlations between explicit self-schema and depressive symptoms, existing research suggested that implicit schemas and explicit schemas could be inconsistent in MDD.[12] Trait paranoia has been associated with the discrepancy between implicit and explicit self-schema.[38] Therefore, the possibility exists that trait paranoia influenced the relationship between implicit self-schema and depressive symptoms in the current study.

Second, the insignificant correlation between implicit self-schema and depressive symptoms was in agreement with some existing findings.[12 15 39] Only Dentale and colleagues[40] found that implicit self-schema and depressive symptoms were significantly correlated. Notably, the depressed participants in their study were suicidal inpatients, and patients and HCs were combined in the correlation analysis.[40] Meanwhile, other studies did not indicate the intensity of suicidal ideation in the depressed group.[12 15 39] Lou and colleagues suggested that the severity of depression and suicidal ideation might contribute to the discrepancy among results.[13]

Third, though significant correlation and mediating effect were found in the total sample, it is noteworthy that no significant results were found in MDD. Given that only 13.64% of patients with severe depression and 4.55% of patients with mild depression were included in the current study, restriction of range might contribute to the negative results in MDD.

Finally, differences among the specific objects referred to by the three variables involved in the mediation model—other-schema, attachment relationships and interpersonal trust— might also influence the results. For example, in EAST, the other-schema related to parents and lovers, and the ECR-R measured the attachment relationships with lovers. In TS, it focused on the interpersonal trust with general peers.

In conclusion, future studies may consider the effects of trait paranoia and suicidal ideation on the relationship between implicit schemas and depressive symptoms. Also, patients with different levels of depression severity should be recruited to clarify the mediation model. In addition, it is necessary to explain further how other-schema affects the attachment relationships and interpersonal trust between patients with MDD and specific groups of people (eg, parents, lovers and general peers). Studies such as these will help to deepen the focus on psychotherapeutic interventions.

Limitations

First of all, most of the patients in the current study were moderately depressed. The lack of patients with mild and severe depression may affect the correlation between implicit schemas and depression. Therefore, it is necessary to recruit patients in the future with varying symptoms and severity to clarify the pathway of how implicit schemas influence depression. Second, only questionnaires and behavioural paradigms were used in this study. The negative implicit schemas in MDD, especially the negative other-schema, can be further confirmed by adding electrophysiological techniques. Third, the

other-words we used were dad, mom, partner and lover, which means that the negative other-schema we observed in MDD was specifically targeted at the family members mentioned above. More representative other-words could further verify whether patients with MDD also have negative schemas about groups other than family members. Fourth, although the current study proposed a possible path (based on the existing but insufficient evidence) that implicit schemas influence depression, no significant results were found. Therefore, the model in the current study can be revised and validated again in the future. For example, one possible modification could be implicit schemas→interpersonal trust→attachment relationships→depression. Finally, although patients with the comorbidity of personality disorders were excluded from the current study, participants' personality traits might likewise influence their interpersonal patterns, such as interpersonal trust. Therefore, future studies may consider controlling the effects of personality traits.

Implications

The current study further clarified the characteristics of implicit self-schema in MDD and identified the presence of negative implicit other-schema in MDD. Our results provide additional evidence for psychotherapeutic techniques that focus on self-schema and other-schema. For example, in recent years, Lemma and colleagues[5] developed dynamic interpersonal therapy based on theories such as attachment theory. They aimed to identify and interfere with implicit self-schema and other-schema in MDD, helping patients build more positive implicit schemas and alleviate depression. Future studies should further explore the changes in implicit schemas as depressive symptoms change throughout the illness and after the completion of psychotherapy to elucidate the value of implicit schemas as a focus of psychotherapeutic interventions.

ORCID iD
Jiayu Yao http://orcid.org/0000-0001-8802-6907

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Jiayu Yao obtained a bachelor's degree from Central China Normal University in China in 2020. In the same year, she became a postgraduate student at the Shanghai Mental Health Center, Shanghai Jiao Tong University School of Medicine in Shanghai, China. She is majoring in clinical psychology with research interests in mood disorders and psychotherapy.