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Discrepancy between objective and subjective cognition and its association with the trajectory of symptoms and functioning in depressive patients

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Original Article

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Abstract

Background. Discrepancy between objective and subjective cognitive deficit is common among patients with major depressive disorders (MDDs) and may play a key role in the mechanism linking cognition with recovery of symptom and psychosocial function. This study, therefore, explores the cognitive discrepancy, and its association with the trajectory of symptoms and functioning over a 6-month period.

Methods. We used data from the Prospective Research Observation to Assess Cognition in Treated patients with MDD (PROACT) study, from which 598 patients were included. Cognitive discrepancy scores were computed using a novel methodology, with positive values indicating more subjective than objective deficit (i.e. 'underestimation') and negative values indicating more objective than subjective difficulties (i.e. 'overestimation'). Linear growth curve models were employed to examine the association of the cognitive discrepancy with the trajectory of depressive symptoms, psychosocial function, and quality of life.

Results. About 68% of patients displayed disproportionately more objective than subjective cognitive deficit at baseline, and the mean cognitive discrepancy score was −1.4 (2.7). Overestimation was associated with a faster decrease of HDRS-17 ($\beta = -0.46$, $p = 0.002$) and a faster decrease of psychosocial function in social life ($\beta = -0.13$, $p = 0.013$) and family life ($\beta = -0.12$, $p = 0.026$), and a greater improvement of EQ-5D utility score ($\beta = 0.01$, $p < 0.001$).

Conclusion. We found a lower sensitivity of cognitive deficit at baseline and its decrease was associated with better health outcomes. Our findings have clinical implications of the necessity to assess both subjective and objective cognition for identification and categorization and to incorporate cognitive and psychological therapies for optimized treatment outcomes.

Introduction

Major depressive disorder (MDD) is a highly prevalent, debilitating and heterogeneous disorder that affects more than 120 million population worldwide, representing one of the leading causes of disability (World Health Organization, 2011). The symptoms of MDD typically include mood disturbances, low self-esteem, incoherent thinking, lack of interest and concentration and restricted psychomotor activity, etc. (Edition, 2013; Saragoussi et al., 2018). Cognitive deficits such as forgetfulness, inattention, slowness, or indecision are common in patients with MDD, and have long been considered to be influenced by the depressive symptoms and associated with impairment of psychosocial function and quality of life (QOL) (Lam, Kennedy, McIntyre, & Khullar, 2014; Rock, Roiser, Riedel, & Blackwell, 2014). Several studies based on objective neuropsychological assessment have identified that depression is associated with low cognitive performance in attention, memory, processing speed, and executive functions (Snyder, 2013). And such cognitive dysfunction could have an impact on occupational productivity and contribute to disability (Clark, DiBenedetti, & Perez, 2016; Jaeger, Berns, Uzelac, & Davis-Conway, 2006). In addition to objective measurements, cognitive function could also be assessed based on individual's subjective impression of performance. Research using a subjective cognitive scale also found that depression severity was positively correlated with patient's self-reported cognitive complaints (Sumiyoshi et al., 2019), which was an independent and significant predictor of subsequent functional impairment (Haro, Hammer-Helmich, Saragoussi, Ettrup, & Larsen, 2019).

Despite the fact that both objective and subjective cognitive deficits were commonly reported among patients with MDD, previous studies found very weak or no correlations between them (Baeza-Velasco et al., 2020; Miskowiak et al., 2016). Most of the objective cognitive functions were assessed by neuropsychological tests, which quantified cognitive capacity across different cognitive domains. By contrast, the subjective cognitive function was measured based on self-reported experience of cognitive difficulties, reflecting individual's self-perceived dysfunction. Depressive symptoms and psychosocial function were not only shaped by objective cognitive deficits but also were affected by self-relevant or mood-congruent cognitive bias. Therefore, the lack of relationship between objective and subjective cognitive function among patients with MDD has been considered to be associated with clinical symptoms and prognosis (Rnic et al., 2021). For example, unipolar disorder patients with greater depression severity, younger age, and longer illness duration are more sensitive and tend to overestimate their cognitive impairment, and such a negative bias was associated with more socio-occupational difficulties and lower quality of life (Petersen, Porter, & Miskowiak, 2019). Additionally, negative interpretation biases of cognitive function was associated with more severe symptoms among depressed individuals (Lee, Mathews, Shergill, & Yiend, 2016), and such negative biases have also been argued as a predictor of the onset of future depressive episodes (LeMoult & Gotlib, 2019).

Recently, increasing evidence indicated the substantial clinical value of monitoring change of cognition in predicting antidepressant treatment response (Ang et al., 2022). The discrepancy between objective and subjective cognitive deficit may play a key role in the mechanism linking cognitive ability with recovery of depressive symptom and psychosocial function (Rnic et al., 2021). Cognitive models of depression suggested that depressed individuals tended to interpret ambiguous information in a negative manner, and such a negative appraisal style was linked to stress-related dysfunction. However, whether underestimation or overestimation represents a risk factor underlying MDD-related impairment and is associated with better recovery are still not fully understood. Investigating the discrepancy between objective and subjective measures of cognitive functioning could provide important implications for future clinical interventions targeting cognitive alterations in depression (Serra-Blasco et al., 2019). This study, therefore, aims to examine the objective and subjective cognitive discrepancy in patients with depression using a novel methodology, and its association with the trajectory of symptoms, psychosocial function, and quality of life over a 6-month period, based on a non-interventional, prospective cohort study in China. We hypothesized that a positive cognitive discrepancy (patient displayed more cognitive than subjective deficit) would be associated with faster improvement and better treatment outcomes.

Methods

Patients and study design

The study used data from The Prospective Research Observation to Assess Cognition in Treated patients with MDD (PROACT) study, which was an epidemiological, non-interventional, prospective, cohort study that conducted at 15 sites in four regions (North, South, East, and West) of China mainland between March 2016 and July 2017. Participants were Chinese outpatients aged 18–65 years, with a diagnosis of MDD based on the International Classification of Diseases and Related Health Problems 10th Revision (ICD-10), and must initiate a new antidepressant monotherapy at the baseline visit (whether as first-line or switch of antidepressant therapy) as decided by the treating physician. Depressive symptoms were assessed by the Mini International Neuropsychiatric Interview and MDD and were further confirmed as a total score ⩾17 on the Hamilton Depression Rating Scale-17 Items (HDRS-17). Exclusion criteria included comorbid any psychotic or bipolar disorders, comorbid alcohol or substance dependence; use of combination therapy (currently using more than one antidepressant or adjunctive antipsychotics or mood stabilizers); pregnancy; breastfeeding; or acute suicidality. Patients in this cohort were observed for 6 months after the initiation of new antidepressant monotherapy. After baseline investigation, they were followed up at 1, 2, and 6 months with usual clinical practice. The detailed information of the study design has been reported elsewhere (Wang et al., 2019).

All patients provided written informed consent for participation. The PROACT study was in accordance with the International Conference on Harmonization Good Clinical Practices guidelines and with the ethical principles of the Declaration of Helsinki. It was approved by the independent ethics committee of each study site.

Measures

Subjective and objective cognitive function

The objective cognitive function was evaluated using the Digit Symbol Substitution Test (DSST). The DSST is a neuropsychological coding test that requires the patient to substitute simple symbols for digits. The score was calculated based on the number of correct symbols substituted for digits during a 90-second period. The DSST score ranges from 0 to 133 with a higher score reflecting better cognitive performance. The DSST assesses cognitive performance across several domains including those found to be impaired in patients with MDD, such as executive function, processing speed, and attention. The DSST has shown sensitivity to the presence of cognitive dysfunction as well as to change in cognitive function, and offers promises as a clinical decision-making tool for monitoring treatment effects in MDD (Jaeger, 2018; McIntyre et al., 2013).

The subjective cognitive function was evaluated by the 20-item Perceived Deficits Questionnaire-Depression (PDQ-D), which assessed self-perceived deficit over the past week across four domains of cognitive function: attention/concentration, prospective memory, retrospective memory, and planning/organization. Every domain consisted of five questions that rated 0 to 4, yielding a total score ranging from 0 to 80. A higher score indicate greater perceived cognitive difficulties. The Chinese version of the PDQ-D has shown good psychometrical validity to evaluate subjective cognitive ability in patients with MDD (Shi et al., 2017).

The objective and subjective cognitive function was measured at baseline, 2 months, and 6 months in the follow-up period.

Depressive symptoms, psychosocial function, and quality of life

Depressive symptoms were assessed by clinicians using the Hamilton Depression Rating Scale (HDRS-17). The HDRS-17 evaluates the severity of patient's psychological and somatic depressive symptoms over the past 7 days through a semi-structured interview. The total score of HDRS-17 ranges from 0 to 52, with a higher score indicating greater severity of depressive symptoms (Hamilton, 1960). The Sheehan Disability Scale (SDS) was used to assess patient's psychosocial function. The SDS is a

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brief self-report questionnaire that evaluates functional impairment during the past week across three domains: work/school, social life/leisure activities, and family life/home duties (Sheehan & Sheehan, 2008). The severity of impairment in each domain is rated on a 0–10 scale, with a higher score indicating greater impairment. Patient's quality of life was assessed by EuroQoL 5-Dimensions Questionnaire (EQ-5D), which is a widely used self-reported instrument that encompasses five health dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) (Group, 1990). Based on coefficients derived from regression results in a Chinese population, we computed the EQ-5D utility index. The utility score ranges from 0 to 1, with 0 indicates a state equivalent to being dead, and 1 indicates perfect health. Depressive symptoms, psychosocial function, and quality of life were measured at baseline, 2 months, and 6 months in the follow-up period.

Statistical procedure

Cognitive discrepancy score

The discrepancy between objective and subjective cognitive function was measured based on previous statistical methodology proposed by Miskowiak et al. (2016). This methodology computes cognitive 'sensitivity' scores reflecting the degree of discrepancy between patient's subjective cognitive difficulties that are measured by self-rating questionnaires and objective deficits on the neuropsychological tests. The methodology assumes that complete accuracy of insight into individual's cognitive function would lead to the same rank ordering between subjective evaluation and objective performance level. Therefore, the sensitivity score was calculated as continuous variables with the value ranging from −10 to 10. The negative score indicated that the objective cognitive deficit was disproportionately worse than subjective cognitive difficulties (i.e. 'overestimation'), and the −10 represents the maximum 'overestimation', suggesting that the patient performed the worst on objective test but reported the least subjective cognitive deficit. Oppositely, the positive score indicated that the patients disproportionately reported worse cognitive function than the cognitive performance in objective test (i.e. 'underestimation'), and accordingly, +10 represents the maximum 'underestimation', suggesting that the patient reporting the worst subjective cognitive difficulties but displayed the least objective cognitive deficits. A value of 0 reflects complete accordance between subjective and objective cognitive functioning. The cognitive discrepancy score was calculated at baseline, 2 months, and 6 months using the available data (the DSST and the PDQ-D score) at each time point accordingly.

Specifically, the cognitive discrepancy score was computed by first z-transforming raw scores on objective neuropsychological test (DSST) and subjective cognitive deficits (PDQ-D). Because lower scores on PDQ-D reflect better performance, we inversed the z scores for the PDQ-D measure to ensure unidirectionality of objective and subjective scores before computing the sensitivity score. The detailed calculation procedures of cognitive sensitivity scores were provided elsewhere (Miskowiak et al., 2016).

Statistical analysis

Descriptive statistics were conducted to report the distribution in sociodemographic, clinical characteristics, and objective-subjective cognitive discrepancy at baseline. Repeated-measures analysis of variance (ANOVA) and paired samples t tests were performed to investigate any possible differences of depressive symptoms, psychosocial function, and quality of life between overestimated patients and underestimated patients. We used linear growth curve models to examine the relationship between objective and subjective cognitive discrepancy and the trajectory of depressive symptoms, psychosocial function, and quality of life over the 6-month study period. The two-level hierarchical linear model had three occasions of measurement of outcomes (depressive symptoms, psychosocial function, and quality of life) (level 1) nested within individuals (level 2). Each patient's outcome scores over the baseline, 2 months, and 6 months were a function of time (month since baseline). The intercepts (baseline outcome scores) and slopes (monthly rate of change in outcome scores) were specified as random at level 2, which included the individual-level predictors of outcome and trajectory (objective-subjective cognitive discrepancy and covariates). Covariates include age group, gender, marital status, residence, educational level, employment status, tobacco use, type of episode, suicidal attempt in whole life, psychotherapy use, concomitant mental and physical conditions, and antidepressant use. All statistical analyses were performed using STATA version 16.0 for Mac (Stata Corp, College Station, TX, USA).

Results

Demographics and disease history of patients at baseline

Of 1008 patients enrolled, 666 (66.1%) completed the 6-month visit. A total of 598 patients with valid DSST assessments at baseline were included in the statistical analyses. In the analyzed population, the mean age was 36.5 (S.D. = 12.0) years, 69% of patients were female, 491 (82%) patients were from urban sites and 45.2% had a degree of university or above. The mean HDRS-17 score, SDS score, and EQ-5D utility score at baseline were 23.3 (4.4), 17.4 (7.1), and 0.73 (0.14), respectively. About 68% of patients displayed more objective than subjective cognitive deficit at baseline (overestimation), and the mean cognitive discrepancy score was −1.4 (2.7). Other sociodemographic and clinical characteristics of the analyzed population are displayed in Table 1.

Distribution of subjective and objective cognitive discrepancy across sociodemographic and clinical characteristics

The proportion of overestimated patients and the cognitive discrepancy score were significantly higher among patients with older age. About 80 and 100% of patients aged 35–55 and 55–65 were overestimated and the mean cognitive discrepancy scores of these two groups were −2.4 (2.5) and −4.1 (2.1), respectively. Similarly, the proportion of overestimated patients and the cognitive discrepancy score were also higher among patients who are married/living as a couple or divorce/separated/widowed, among patients with rural residence, lower educational level, unemployed status, no suicidal attempts in whole life, and concomitant anxiety disorders and somatic conditions (all p values < 0.05). No significant difference of the subjective-objective cognitive discrepancy was observed across tobacco use status, different episodes of depression, history of suicidal attempts, and antidepressant use (all p values > 0.05) (Table 1). The association between sample characteristics and cognitive discrepancy score at baseline are provided in Appendix Table A1. Advanced ages, male, concomitant mental disorder conditions, a higher DSST score, a higher

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Table 1. Sample characteristics at baseline

	N(%)/mean (s.d.)	Objective cognitive function (DSST score) (mean [s.d.])	Subjective cognitive function (PDQ-D score) (mean [s.d.])	Cognitive discrepancy score (mean [s.d.])	Overestimation (*N* (%)/mean [s.d.])	Underestimation (*N* (%)/mean [s.d.])
Total sample	**598 (100%)**	50.2 (16.4)	33.7 (16.2)	−1.4 (2.7)	407 (68.1%)	191 (31.9%)
Age group						
18–26	123 (20.6%)	60.8 (14.3)	38.0 (15.9)	0.4 (2.4)	59 (48.0%)	64 (52.0%)
26–35	175 (29.3%)	55.9 (14.0)	36.1 (15.6)	−0.4 (2.2)	97 (55.4%)	78 (44.6%)
36–55	240 (40.1%)	45.3 (14.7)	30.5 (16.4)	−2.4 (2.5)	191 (79.6%)	49 (20.4%)
56–65	60 (10.0%)	31.4 (9.3)	30.2 (14.4)	−4.1 (2.1)	60 (100%)	0 (0.0%)
Gender						
Male	188 (31.4%)	49.9 (15.4)	32.1 (15.4)	−1.6 (2.6)	135 (71.8%)	53 (28.2%)
Female	410 (68.6%)	50.3 (17.0)	34.5 (16.4)	−1.3 (2.8)	272 (66.3%)	138 (33.7%)
Marital status						
Single	198 (33.1%)	59.1 (14.0)	37.1 (15.2)	0.1 (2.2)	102 (51.5%)	96 (48.5%)
Married/living as a couple	371 (62.0%)	45.8 (15.8)	32.0 (16.3)	−2.1 (2.6)	284 (76.6%)	87 (23.4%)
Divorced/ separated/ widowed	29 (4.9%)	44.9 (15.7)	31.9 (17.8)	−2.2 (3.4)	21 (72.4%)	8 (27.6%)
Residence						
Rural	107 (17.9%)	40.2 (16.3)	30.5 (15.8)	−3.0 (2.8)	88 (82.2%)	19 (17.8%)
Urban	491 (82.1%)	52.4 (15.7)	34.4 (16.2)	−1.0 (2.6)	319 (65.0%)	172 (35.0%)
Educational level						
No degree	134 (22.4%)	39.1 (14.1)	31.6 (14.3)	−3.0 (2.5)	115 (85.8%)	19 (14.2%)
High school, junior college	194 (32.4%)	46.2 (14.7)	33.8 (17.1)	−1.8 (2.8)	141 (72.7%)	53 (27.3%)
University, post graduate school, or above	270 (45.2%)	58.6 (14.4)	34.7 (16.3)	−0.3 (2.3)	151 (55.9%)	119 (44.1%)
Employment status						
Employed	426 (71.2%)	53.5 (15.4)	34.4 (16.4)	−0.9 (2.6)	266 (62.4%)	160 (37.6%)
Unemployed	172 (28.8%)	42.2 (16.5)	31.9 (15.5)	−2.6 (2.7)	141 (82.0%)	31 (18.0%)
Tobacco use						
Smoker	107 (17.9%)	49.7 (15.5)	33.3 (13.9)	−1.5 (2.5)	72 (67.3%)	35 (32.7%)
Non-smoker	491 (82.1%)	50.3 (16.7)	33.8 (16.6)	−1.4 (2.8)	335 (68.2%)	156 (31.8%)
First episode	343 (57.4%)	51.0 (16.8)	32.6 (15.9)	−1.4 (2.7)	239 (69.7%)	105 (30.3%)
Recurrence	255 (42.6%)	49.1 (16.0)	35.3 (16.4)	−1.3 (2.8)	168 (65.9%)	87 (34.1%)
Suicidal attempt in whole life						
Yes	15 (2.5%)	53.4 (15.8)	39.8 (17.3)	−0.2 (2.2)	7 (46.7%)	8 (53.3%)
No	583 (97.5%)	50.1 (16.5)	33.6 (16.1)	−1.4 (2.8)	400 (68.6%)	183 (31.4%)
Current psychotherapy use						
Yes	20 (3.3%)	62.4 (15.8)	30.6 (16.1)	−0.3 (2.6)	11 (55.0%)	9 (45.0%)
No	578 (96.7%)	49.8 (16.4)	33.8 (16.2)	−1.4 (2.8)	396 (68.5%)	182 (31.5%)
Concomitant anxiety disorder						
Yes	140 (23.4%)	44.2 (17.2)	30.8 (14.5)	−2.5 (2.6)	115 (82.1%)	25 (17.9%)
No	458 (76.6%)	52.0 (15.9)	34.6 (16.5)	−1.0 (2.7)	292 (63.8%)	166 (36.2%)

(*Continued*)

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Table 1. (*Continued.*)

	N(%)/mean (s.d.)	Objective cognitive function (DSST score) (mean [s.d.])	Subjective cognitive function (PDQ-D score) (mean [s.d.])	Cognitive discrepancy score (mean [s.d.])	Overestimation (*N* (%)/mean [s.d.])	Underestimation (*N* (%)/mean [s.d.])
Concomitant somatic conditions: chronic medical conditions						
Yes	95 (15.9%)	42.8 (16.4)	33.9 (19.0)	−2.2 (2.9)	71 (74.7%)	24 (25.3%)
No	503 (84.1%)	51.6 (16.1)	33.7 (15.6)	−1.2 (2.7)	336 (66.8%)	177 (33.2%)
Concomitant somatic conditions: functional syndromes						
Yes	183 (30.6%)	45.1 (15.3)	31.1 (16.2)	−2.3 (2.5)	148 (80.9%)	35 (19.1%)
No	415 (69.4%)	52.5 (16.5)	34.9 (16.0)	−1.0 (2.7)	259 (62.4%)	156 (37.6%)
Antidepressant use						
TCA use	0 (0.0%)	–	–	–	–	–
SSRI use	384 (64.2%)	51.0 (16.5)	34.2 (15.8)	−1.2 (2.7)	259 (67.5%)	125 (32.5%)
SNRI use	152 (25.4%)	47.9 (16.7)	33.5 (17.2)	−1.7 (3.0)	103 (67.8%)	49 (32.2%)
Other antidepressant use	62 (10.4%)	50.9 (15.7)	31.2 (15.7)	−1.6 (2.6)	45 (72.6%)	17 (27.4%)
HDRS-17 score	23.3 (4.4)	–	–	–	23.3 (4.5)	23.3 (4.3)
SDS score	17.4 (7.1)	–	–	–	15.8 (7.2)	20.2 (6.0)
EQ-5D utility score	0.73 (0.14)	–	–	–	0.74 (0.14)	0.71 (0.13)

PDQ-D, Perceived Deficits Questionnaire-Depression; DSST, Digit Symbol Substitution Test; HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire; SSRI, selective serotonin reuptake inhibitor; TCA, tricyclic antidepressant; SNRI, selective serotonin and norepinephrine reuptake inhibitors.

HDRS-17 score, a higher SDS score, and a lower EQ-5D utility score were associated with a higher cognitive discrepancy score.

Cognitive function, symptoms, function, and QOL across 6 months

Table 2 describes the mean score of cognitive function, symptoms, function, and QOL of samples across 6 months. The DSST score increased from 50.2 at baseline to 61.5 at 6 months. The PDQ-D score decreased from 33.7 at baseline to 17.9 at 6 months. The discrepancy score decreased from −1.4 at baseline to −2.1 after 6 months, and the proportion of overestimated patients increased from 68.1% at baseline to 79.7% after 6 months, indicating a faster improvement of subjective than objective cognitive function. There were also improvements of depressive symptoms, function, and QOL across 6 months.

Difference of depressive severity, psychosocial functioning, and QOL between overestimation and underestimation groups over a 6-month follow-up

Table 3 describes the mean scores of HDRS-17, SDS, and EQ-5D utility among overestimated patients and underestimated patients at baseline, 2 months, and 6 months. First, at baseline, there was no significant difference in HDRS-17 score that was observed between overestimated patients and underestimated patients. A significantly higher level of psychosocial function impairment ($p < 0.001$) and a lower quality of life ($p = 0.02$) were observed among underestimated patients in comparison to their overestimated counterparts. However, after 2 months and 6 months, HDRS-17 score ($p < 0.001$), SDS score ($p < 0.001$), and EQ-5D utility score ($p < 0.001$) were all significantly higher among underestimated patients compared to that among overestimated patients.

Table 2. Cognitive function, symptoms, function, and QOL at baseline, 2 months, and 6 months

	Baseline (*N* = 598)	2 months (*N* = 474)	6 months (*N* = 428)
Objective cognitive function (DSST score)	50.2 (16.5)	58.3 (15.7)	61.5 (16.6)
Subjective cognitive function (PDQ-D score)	33.7 (16.2)	22.7 (15.8)	17.9 (15.3)
Cognitive discrepancy score	−1.4 (2.7)	−1.5 (2.5)	−2.1 (2.4)
Overestimation (*N*(%))	407 (68.1%)	340 (71.7%)	341 (79.7%)
HDRS-17 score	23.3 (4.4)	10.4 (6.2)	6.7 (5.6)
SDS score	17.4 (7.1)	9.5 (7.2)	6.7 (7.0)
EQ-5D utility score	0.73 (0.14)	0.86 (0.13)	0.90 (0.13)

PDQ-D, Perceived Deficits Questionnaire-Depression; DSST, Digit Symbol Substitution Test; HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire.

Figures 1–3 provide the scatter plots and fitted line that show the relation between the cognitive discrepancy score and

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Table 3. Symptoms, function and QOL by cognitive discrepancy style at baseline, 2 months, and 6 months

	Baseline (*N* = 598)			2 months (*N* = 474)			6 months (*N* = 428)		
	Overestimation (*N* = 407)	Underestimation (*N* = 191)	*F* (*p* value)	Overestimation (*N* = 340)	Underestimation (*N* = 134)	*F* (*p* value)	Overestimation (*N* = 341)	Underestimation (*N* = 87)	*F* (*p* value)
HDRS-17 score	23.3 (4.5)	23.3 (4.3)	0.00 (0.998)	9.5 (5.4)	13.5 (6.7)	56.3 (<0.001)	6.0 (4.6)	10.9 (7.5)	69.7 (<0.001)
SDS score	15.8 (7.2)	20.2 (6.0)	44.82 (<0.001)	7.6 (6.2)	14.4 (7.2)	105.6 (<0.001)	5.1 (5.7)	13.1 (8.3)	115.3 (<0.001)
EQ-5D utility score	0.74 (0.14)	0.71 (0.13)	5.45 (0.020)	0.88 (0.12)	0.80 (0.14)	52.5 (<0.001)	0.92 (0.11)	0.80 (0.17)	73.1 (<0.001)

HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire.

HDRS-17 score, SDS score, and EQ-5D utility score. There was no significant correlation between the cognitive discrepancy score and HDRS-17 score at baseline (Pearson coefficient: $r = -0.025$, $p = 0.553$; Fig. 1a). We observed that the baseline cognitive discrepancy score was positively correlated with the 6-month HDRS-17 score (Pearson coefficient: $r = 0.166$, $p < 0.001$; Fig. 1b). However, for psychosocial function, the baseline cognitive discrepancy score was positively correlated with both baseline (Fig. 2a, $r = 0.362$, $p < 0.001$) and 6-month (Fig. 2b, $r = 0.218$, $p < 0.001$) SDS score. Similarly, the baseline cognitive discrepancy score was negatively correlated with the EQ-5D utility score at both baseline (Fig. 3a, $r = -0.109$, $p = 0.008$) and 6 months (Fig. 3b, $r = -0.148$, $p < 0.001$).

Association between subjective and objective cognition discrepancy and outcome variables (depressive symptom, psychosocial function, and quality of life)

Table 4 presents results from the linear growth curve models of the association between cognitive discrepancy style and trajectories of HDRS-17 score, SDS score, and EQ-5D utility score. After adjusted for sociodemographic and clinical characteristics, overestimation was associated with a lower baseline score of HDRS-17 (Model 1, $\beta = -2.4$, $p < 0.001$) and SDS (Model 2, $\beta = -5.19$, $p < 0.001$), and a higher baseline EQ-5D utility score (Model 3, $\beta = 0.05$, $p < 0.001$) in comparison to underestimation. Additionally, overestimation was associated with a faster decrease of HDRS-17 (Model 1, $\beta = -0.46$, $p = 0.002$) and a greater improvement of EQ-5D utility score (Model 3, $\beta = 0.01$, $p < 0.001$). No significant association between cognitive discrepancy style and the trajectory of SDS score was observed. However, we further conducted analysis on different domains of SDS (Appendix Table A2), overestimation was associated with a faster decrease of impairment in function of social life (Model 8, $\beta = -0.13$, $p = 0.013$) and family life (Model 9, $\beta = -0.12$, $p = 0.026$). Similar associations between cognitive discrepancy style and the trajectories of outcome variables were also observed in models that adjusted for objective cognitive function (Appendix Table A4).

Table 5 presents results from the linear growth curve models of the association between the cognitive discrepancy score and the trajectory of HDRS-17 score, SDS score, and EQ-5D utility score. After adjusted for sociodemographic and clinical characteristics, the cognitive discrepancy score was positively associated with the baseline score of HDRS-17 (Model 4, $\beta = 0.65$, $p < 0.001$) and SDS (Model 5, $\beta = 1.61$, $p < 0.001$), and was negatively associated with the baseline EQ-5D utility score (Model 6, $\beta = -0.02$, $p < 0.001$). And an increase of the cognitive discrepancy score was positively associated with the change of HDRS-17 (Model 4, $\beta = 0.08$, $p < 0.001$) and negatively associated with the change of EQ-5D utility score (Model 6, $\beta = -0.002$, $p < 0.001$). No significant association between the cognitive discrepancy score and the trajectory of SDS score was observed. However, we further conducted analysis on different domains of SDS (Appendix Table A3), the cognitive discrepancy score was positively associated with the changes of score in function of family life (Model 12, $\beta = -0.02$, $p = 0.016$). Similar associations between the cognitive discrepancy score and the trajectories of outcome variables were also observed in models that adjusted for objective cognitive function (Appendix Table A5).

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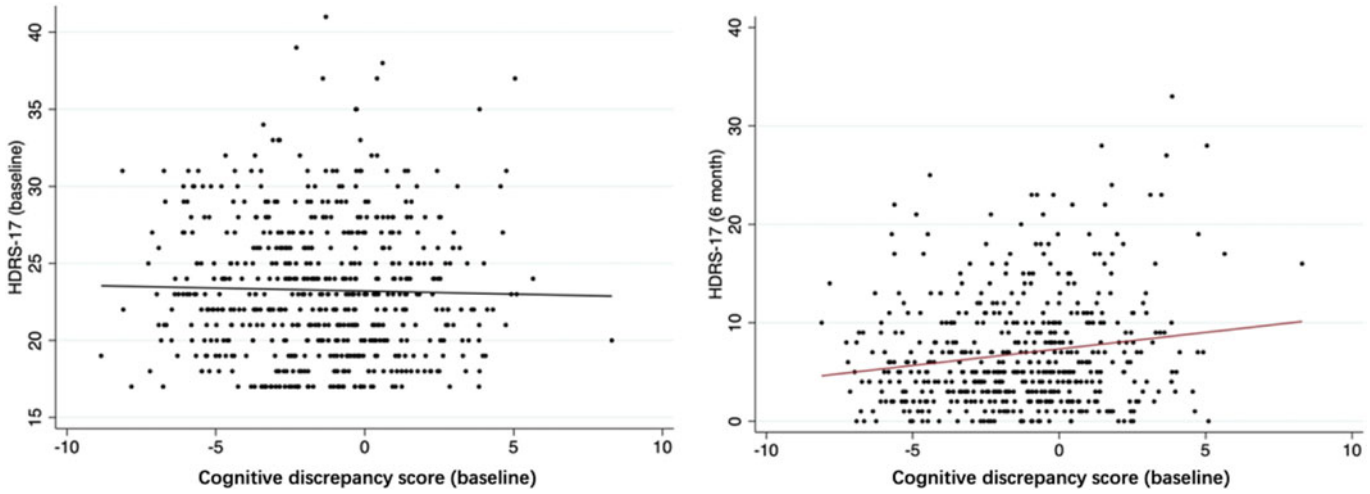

Figure 1. (a) Cognitive discrepancy score and depressive symptoms (HDRS-17) at baseline (left). (b) Cognitive discrepancy score at baseline and depressive symptoms (HDRS-17) at 6 months (right).

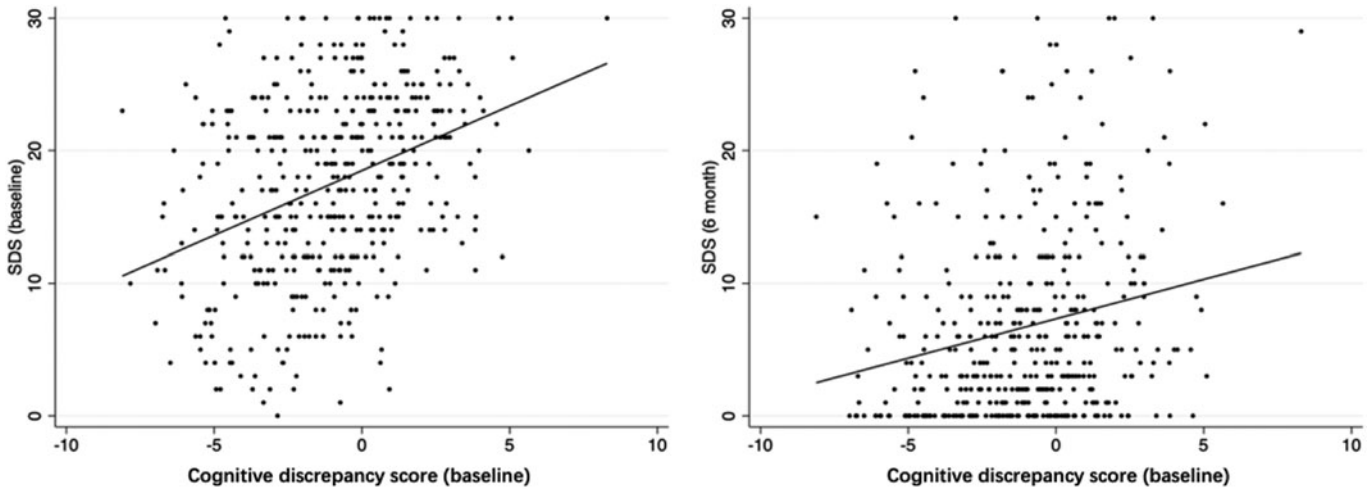

Figure 2. (a) Cognitive discrepancy score and psychosocial function (SDS) at baseline (left). (b) Cognitive discrepancy score at baseline and psychosocial function (SDS) at 6 months (right).

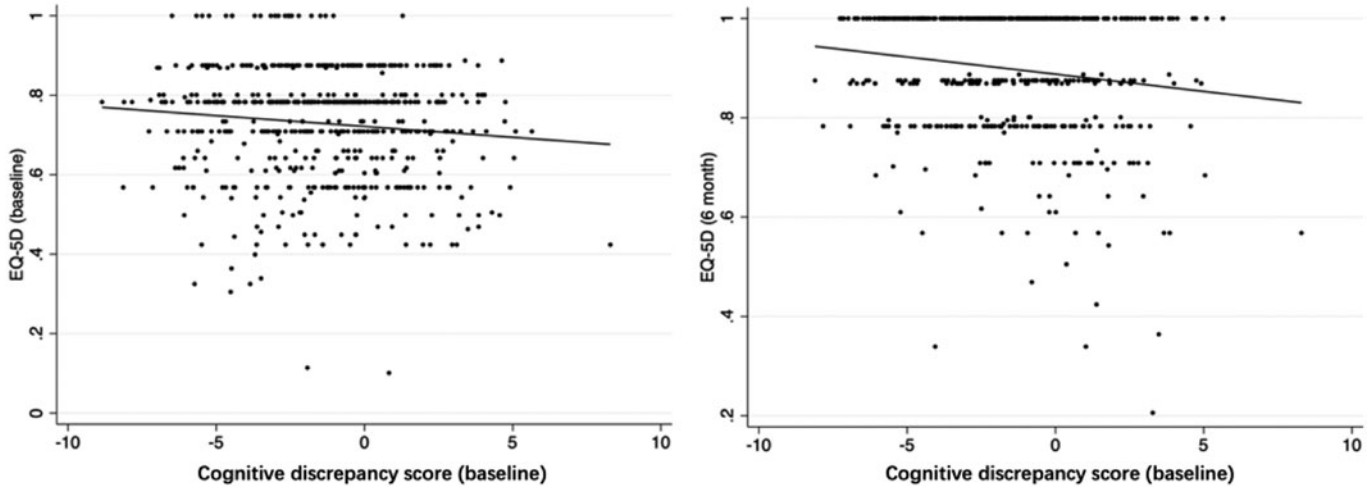

Figure 3. (a) Cognitive discrepancy score and quality of life (EQ-5D) at baseline (left). (b) Cognitive discrepancy score at baseline and quality of life (EQ-5D) at 6 months (right).

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Table 4. Latent growth curve model on the association of cognitive discrepancy style with the trajectory of depressive symptom, psychosocial function, and quality of life

	HDRS-17 score (Model 1[a])		SDS score (Model 2[a])		EQ-5D utility score (Model 3[a])	
	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value
Time of assessment	−2.08 (0.13)	<0.001	−1.28 (0.13)	<0.001	0.02 (0.002)	<0.001
Cognitive discrepancy style						
Underestimation	Ref		Ref		Ref	
Overestimation	−2.4 (0.48)	<0.001	−5.19 (0.56)	<0.001	0.05 (0.10)	<0.001
Cognitive discrepancy style × time of assessment						
Underestimation × time of assessment	Ref		Ref		Ref	
Overestimation × time of assessment	−0.46 (0.14)	0.002	−0.27 (0.15)	0.075	0.01 (0.003)	<0.001

HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire.
[a]All models were adjusted for age, gender, residence, marital status, education, employment status, tobacco use, current psychotherapy use, first-episode or recurrent depression, suicide attempts, concomitant mental disorder condition, concomitant mental disorder and somatic condition, and antidepressant use.

Table 5. Latent growth curve model on the association of cognitive discrepancy score with the trajectory of depressive symptom, psychosocial function, and quality of life

	HDRS-17 score (Model 4[a])		SDS score (Model 5[a])		EQ-5D utility score (Model 6[a])	
	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value
Time of assessment	−2.19 (0.07)	<0.001	−1.27 (0.07)	<0.001	0.02 (0.001)	<0.001
Cognitive discrepancy score	0.65 (0.09)	<0.001	1.61 (0.11)	<0.001	−0.02 (0.002)	<0.001
Cognitive sensitivity score × time of assessment	0.08 (0.02)	<0.001	0.04 (0.02)	0.097	−0.002 (0.0004)	<0.001

HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire.
[a]All models were adjusted for age, gender, residence, marital status, education, employment status, tobacco use, current psychotherapy use, first-episode or recurrent depression, suicide attempts, concomitant mental disorder condition, concomitant mental disorder and somatic condition, and antidepressant use.

Discussion

In this study, we investigated the discrepancy between objective and subjective cognitive function among patients with depression and its association with the trajectory of depressive symptoms, psychosocial function, and quality of life over 6-month follow-up. To our knowledge, this study was the first to examine whether such discrepancy predicted the following clinical and functional outcomes based on a novel statistical method that quantifying degree and direction of the objective and subjective cognitive function disparity. Overall, we found that a substantial proportion of patients with depression tended to display more objective than subjective cognitive deficit. Consistent with our hypothesis, lower sensitivity of cognitive deficit, as well as its decrease were strong predictors of faster recovery of symptoms and function, and greater improvement of quality of life.

First, about 68.1% of patients with MDD in our cohort displayed more objective than subjective cognitive deficit at baseline and this proportion increased to 79.7% after 6 months. This was inconsistent with the result from past similar research, most of which found that patients with depression tended to underestimate their cognitive performance. For example, one study based on the Danish cohort of unipolar disorder found that about 60 and 40% of patients were underestimated and overestimated, indicating that the majority displayed more subjective than objective cognitive impairment (Petersen et al., 2019). Cultural differences may partially explain the inconsistency. The comparison study of the subjective cognitive function between the United States and China suggested that Chinese adults gave a lower level of severity of cognitive impairment than the US respondents did (Wu, 2016). Besides, the difference in clinical characteristics of the sample and the disparity of objective and cognitive measures used between studies could also contribute to the inconsistency. A majority of patients (57%) in our study was in first-episode depression, the proportion of which was much higher for the above-mentioned Danish cohort (Petersen et al., 2019), suggesting that the relatively less severity of MDD of our cohort as one possible reason. One study comparing the discrepancy score between different cognitive domains revealed that the direction and degree of sensitivity varies across the domains of impairment, with a substantially greater proportion of overestimation in attention and processing speed among patients with unipolar disorder (Miskowiak et al., 2016). The present study assessed the objective cognitive function by DSST, which is designed to measure processing speed, visual perception, and attention. In most of these domains, patients were particularly unaware of cognitive deficit and problems and thus resulted in a higher proportion of overestimated discrepancy of cognitive function. Another possible reason could be the intentionally downplaying of cognitive deficit or the underperformance in objective cognitive test among patients with depression (Reese & Cherry, 2004). It has been suggested that older patients with depressive symptoms may worry about dementia and engage in defensive denial of their cognitive problems in a subjective scale (Aschwanden et al., 2022). And individual with motivation-related depressive symptoms (lack of interest or loss of energy, etc.) were more likely to underperform

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in cognitive test and resulting in lower objective performance compared to subjective rating (Bäckman, Hill, & Forsell, 1996).

We observed a significantly higher cognitive discrepancy score at baseline among patients with younger age, single marital status, urban residence, and lower educational background. Greater sensitivity in younger patients was also reported by a study on cohort of unipolar disorders patients, with the observation of more prevalent cognitive complaints in younger patients than that in older counterparts (Petersen et al., 2019; Srisurapanont et al., 2015). Cognitive deficits in younger patients may be more pronounced due to the impediment on educational attainment and interpersonal functioning (Jaeger et al., 2006). Another explanation is that older patients are less aware of their cognitive deficit because of their spontaneous coping strategies for cognitive decline with aging (Stern, 2002). There are also possibilities that the strong age gradient in the proportion of over-estimators could be caused by the measures and methodology, and thus the age-corrected cognitive discrepancy scores were calculated and used for supplementary analyses (Appendix Tables A6–A10). Additionally, overestimation was more pronounced among patients with less advantaged socioeconomic status (SES) may be result from their low cognitive reserve or few subjective cognitive complaints since they encountered less cognitive challenges in interpersonal and working environment in comparison to their higher SES counterparts. Finally, our observation that no difference of depressive symptoms between overestimated and underestimated patients at baseline was surprising given the previous study reported that greater depression severity was associated with a higher sensitivity score. Nevertheless, supplementary analysis on the association between sample characteristics and cognitive discrepancy score at baseline showed that a greater severity of depressive symptoms, a higher level of psychosocial dysfunction, and a lower level of quality of life were associated with more negative appraisals of cognitive function, which may indicate that patients who tend to underestimate their cognitive function were potentially in poorer mental and physical status in comparison to their counterparts with overestimation.

As expected, the lower sensitivity of cognitive deficit at baseline, and the decrease of sensitivity were strong predictors of faster recovery of symptoms and function, and greater improvement of quality of life. This finding is consistent with a recent study on escitalopram treatment outcome of patients with MDD, which reported that increases in self-appraisals of cognitive function were positively associated with treatment response or remission status (Rnic et al., 2021). Although it is still unclear whether such discrepancy precedes or follows the change of depressive symptoms, several prospective studies have found that negative self-referential biases predicted the onset or relapse of depressive disorders, suggesting a greater possibility of cognitive bias as a precursor (LeMoult & Gotlib, 2019). According to the positive appraisal style theory of resilience (Kalisch, Müller, & Tüscher, 2015), a positively biased self-evaluation of cognitive abilities is protective when an individual is confronted with a stressor (Schwert, Stohrer, Aschenbrenner, Weisbrod, & Schröder, 2018), and thus lead individuals to feel more capable and engage into various activities that are potentially helpful to the improvement of symptoms and function. Additionally, prior findings of other health outcomes showed that the higher sensitivity score was correlated to greater perceived stress and more socio-occupational difficulties (Delbaere, Close, Brodaty, Sachdev, & Lord, 2010; Robinson et al., 2014). This may further explain the relatively slower recovery and improvement of function and quality of life among underestimated patients with MDD. Besides the above explanation, from the psychological perspective, there's also another possibility that people who underestimated their cognitive function may tend to be sensitive and report a higher level of depressive symptoms and other dysfunctions. Overall, the present finding indicated that the degree and direction of the discrepancy could facilitate the treatment decision-making and represent useful markers of treatment response for clinicians, and more importantly, a worthwhile target for assessment and intervention to optimize improvement of symptoms and functioning. Cognitive-therapeutic intervention to change appraisal values and thus to improve emotional behavior should also be recommended for patients with MDD.

Limitations

Several limitations should be noticed when interpreting our findings. First, our sample consisted of patients with MDD, thus the absence of a healthy control group excludes the potential for us to compare the objective-subjective discrepancy of cognition between healthy individuals and those with depression. Second, the cohort largely consisted of well-educated urban residents in China, and thus the present finding cannot necessarily be extrapolated to the background population of Chinese patients with MDD. Third, the present study was also subject to attrition bias since about 40% of the total enrolled patients being lost to follow-up at month 2. Nevertheless, there was no significant difference of baseline clinical and sociodemographic characteristics between the total population and the samples of analysis, suggesting that the impact of attrition bias on our results was minor. Additionally, there may be potential limitation for the methodology to calculate the cognitive discrepancy score, since 100% of patients with MDD aged 56–65 overestimated their cognitive function. Future studies are needed to explore the feasibility and limitations of different methodologies on cognitive discrepancy are needed. Despite of the above limitations, the main strengths of this study included the application of a novel methodology to explore the association between the subjective and objective cognitive discrepancy and the trajectory of symptoms and function based on an on-interventional, prospective cohort with a wide range of assessments.

Conclusion

The present study provided a comprehensive investigation on the discrepancy of subjective and objective cognitive and its potential role on the trajectory of recovery of symptoms, functioning, and quality of life. We found a lower sensitivity of cognitive deficit at baseline and its decrease was associated with better recovery of multiple outcomes for patients with MDD. Our findings have clinical implications of the necessity to assess both subjective and objective cognition among patients with MDD for further identification and categorization, as well as to incorporate cognitive and psychological therapies to address negative bias of cognitive function for optimized treatment outcomes.

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Appendix

Table A1. Linear regression model on the association between sample characteristics and cognitive discrepancy score

	Cognitive discrepancy score		
	Coefficient	s.e.	*p* value
Age group (ref = 18–25)			
26–35	−0.28	(−0.82 to 0.27)	0.324
36–55	−1.10	(−1.76 to −0.43)	0.001
56–65	−1.96	(−3.04 to −0.87)	<0.001
Gender (ref = female)			
Male	−0.55	(−0.93 to −0.17)	0.004
Marital status (ref = single)			
Married or living as a couple	0.09	(−0.43 to 0.61)	0.737
Divorced	0.02	(−0.89 to 0.94)	0.957
Widowed	−2.01	(−4.54 to 0.53)	0.120
Living area (ref = rural)			
Urban	0.04	(−0.48 to 0.55)	0.884
Educational level (ref = no degree/diploma, elementary school, middle school)			
High school, junior college	0.09	(−0.41 to 0.58)	0.735
University, post graduate school or above	0.25	(−0.25 to 0.75)	0.33
Job status (ref = unemployed)			
Employed	0.21	(−0.32 to 0.73)	0.436
Tobacco use (ref = non-smoker)			
Smoker	0.06	(−0.40 to 0.51)	0.807
Medical history			
First episode (ref = recurrence)	−0.23	(−0.57 to 0.11)	0.179
Suicidal attempt in whole life (ref = no)	0.44	(−0.54 to 1.40)	0.374
Current psychotherapy use (ref = no)	−0.07	(−1.03 to 0.88)	0.885
Concomitant mental disorder condition (ref = no)	−0.49	(−0.95 to −0.03)	0.038
Concomitant somatic conditions: chronic medical conditions (ref = no)	0.31	(−0.19 to 0.80)	0.228
Concomitant somatic conditions: functional syndromes (ref = no)	−0.29	(−0.70 to 0.12)	0.168
Antidepressant use			
SSRI use (ref = no)	0.24	(−0.31 to 0.80)	0.390
SNRI use (ref = no)	0.25	(−0.36 to 0.86)	0.416
Other antidepressant use	–	–	
DSST score	0.09	(0.07–0.10)	<0.001
HDRS-17 score	0.05	(0.01–0.10)	0.011
SDS score	0.1	(0.08–0.13)	<0.001
EQ-5D utility score	−2.16	(−3.61 to −0.71)	0.004

HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire; SSRI, selective serotonin reuptake inhibitor; TCA, tricyclic antidepressant; SNRI, selective serotonin and norepinephrine reuptake inhibitors.

Table A2. Latent growth curve model on the association of cognitive discrepancy style with the trajectory of functional impairment in work, social life, and family life (subscales of SDS)

	Work (Model 7[a])		Social life (Model 8[a])		Family life (Model 9[a])	
	Coefficient (s.e.)	*p* value	Coefficient (s.e.)	*p* value	Coefficient (s.e.)	*p* value
Time of assessment	−0.46 (0.05)	<0.001	−0.40 (0.05)	<0.001	−0.38 (0.05)	<0.001
Cognitive discrepancy style						
Underestimation	Ref		Ref		Ref	
Overestimation	−1.61 (0.21)	<0.001	−1.60 (0.19)	<0.001	−1.76 (0.20)	<0.001
Cognitive discrepancy style × time of assessment						
Underestimation × time of assessment	Ref		Ref		Ref	
Overestimation × time of assessment	−0.09 (0.06)	0.127	−0.13 (0.05)	0.013	−0.12 (0.05)	0.026

[a]All models were adjusted for age, gender, residence, marital status, education, employment status, tobacco use, current psychotherapy use, first-episode or recurrent depression, suicide attempts, concomitant mental disorder condition, concomitant mental disorder and somatic condition, and antidepressant use.

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Table A3. Latent growth curve model on the association of cognitive discrepancy score with the trajectory of functional impairment in work, social life, and family life (subscales of SDS)

	Work (Model 10[a])		Social life (Model 11[a])		Family life (Model 12[a])	
	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value
Time of assessment	−0.46 (0.03)	<0.001	−0.41 (0.03)	<0.001	−0.39 (0.03)	<0.001
Cognitive discrepancy score	0.48 (0.04)	<0.001	0.54 (0.04)	<0.001	0.55 (0.04)	<0.001
Cognitive discrepancy score × time of assessment	0.01 (0.01)	0.142	0.01 (0.007)	0.067	0.02 (0.008)	0.016

[a]All models were adjusted for age, gender, residence, marital status, education, employment status, tobacco use, current psychotherapy use, first-episode or recurrent depression, suicide attempts, concomitant mental disorder condition, concomitant mental disorder and somatic condition, and antidepressant use.

Table A4. Latent growth curve model on the association of cognitive discrepancy style with the trajectory of depressive symptom, psychosocial function, and quality of life (adjusted for objective cognitive function [DSST score])[a]

	HDRS-17 score		SDS score		EQ-5D utility score	
	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value
Time of assessment	−1.90 (0.12)	<0.001	−1.01 (0.13)	<0.001	0.01 (0.002)	<0.001
Cognitive discrepancy style						
Underestimation	Ref		Ref		Ref	
Overestimation	−3.31 (0.48)	<0.001	−6.15 (0.54)	<0.001	0.07 (0.10)	<0.001
Cognitive discrepancy style × time of assessment						
Underestimation × time of assessment	Ref		Ref		Ref	
Overestimation × time of assessment	−0.44 (0.14)	0.002	−0.30 (0.15)	0.048	0.01 (0.003)	<0.001

HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire.
[a]All models were adjusted for age, gender, residence, marital status, education, employment status, tobacco use, current psychotherapy use, first-episode or recurrent depression, suicide attempts, concomitant mental disorder condition, concomitant mental disorder and somatic condition, antidepressant use, and objective cognitive function.

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Table A5. Latent growth curve model on the association of cognitive discrepancy score with the trajectory of depressive symptom, psychosocial function, and quality of life (adjusted for objective cognitive function [DSST score])[a]

	HDRS-17 score		SDS score		EQ-5D utility score	
	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value
Time of assessment	−1.79 (0.07)	<0.001	−0.71 (0.07)	<0.001	0.01 (0.001)	<0.001
Cognitive discrepancy score	1.14 (0.09)	<0.001	2.19 (0.10)	<0.001	−0.03 (0.002)	<0.001
Cognitive discrepancy score × time of assessment	1.00 (0.02)	<0.001	0.07 (0.02)	<0.001	−0.002 (0.0004)	<0.001

HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire.
[a]All models were adjusted for age, gender, residence, marital status, education, employment status, tobacco use, current psychotherapy use, first-episode or recurrent depression, suicide attempts, concomitant mental disorder condition, concomitant mental disorder and somatic condition, antidepressant use, and objective cognitive function.

Table A6. Subject-objective cognitive discrepancy (age-corrected) by age groups at baseline

	Cognitive discrepancy score (age-corrected) (mean [S.D.])	Overestimation (age-corrected) (*N*(%))	Underestimation (age-corrected) (*N*(%))
Total sample	−0.74 (2.31)	364 (60.9%)	234 (39.1%)
Age group			
18–26	−0.74 (2.24)	77 (62.6%)	46 (37.4%)
26–35	−0.86 (2.20)	108 (61.7%)	67 (38.3%)
35–55	−0.73 (2.38)	142 (59.2%)	98 (40.8%)
55–65	−0.74 (2.52)	37 (61.7%)	23 (38.3%)

Table A7. Cognitive function (age-corrected), symptoms, function, and QOL at baseline, 2 months, and 6 months

	Baseline (*N* = 598)	2 months (*N* = 474)	6 months (*N* = 428)
Objective cognitive function (DSST score)	50.2 (16.5)	58.3 (15.7)	61.5 (16.6)
Subjective cognitive function (PDQ-D score)	33.7 (16.2)	22.7 (15.8)	17.9 (15.3)
Cognitive discrepancy score (age-corrected)	−0.7 (2.3)	−1.5 (2.5)	−2.1 (2.4)
Overestimation (*N*(%)) (age-corrected)	364 (60.9%)	385 (81.2%)	343 (80.1%)
HDRS-17 score	23.3 (4.4)	10.4 (6.2)	6.7 (5.6)
SDS score	17.4 (7.1)	9.5 (7.2)	6.7 (7.0)
EQ-5D utility score	0.73 (0.14)	0.86 (0.13)	0.90 (0.13)

HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire.

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Table A8. Symptoms, function, and QOL by cognitive discrepancy style (age-corrected) at baseline, 2 months, and 6 months

	Baseline ($N = 598$)			2 months ($N = 474$)			6 months ($N = 428$)		
	Overestimation ($N = 364$)	Underestimation ($N = 234$)	F (p value)	Overestimation ($N = 385$)	Underestimation ($N = 89$)	F (p value)	Overestimation ($N = 343$)	Underestimation ($N = 85$)	F (p value)
HDRS-17 score	23.0 (4.4)	23.7 (4.5)	0.1 (3.29)	9.5 (5.6)	14.2 (7.2)	46.5 (<0.001)	5.7 (4.6)	10.7 (7.3)	61.2 (<0.001)
SDS score	15.7 (7.1)	19.9 (6.4)	41.3 (<0.001)	8.3 (6.5)	14.9 (7.5)	70.0 (<0.001)	5.1 (5.7)	13.1 (8.3)	109.0 (<0.001)
EQ-5D utility score	0.74 (0.14)	0.71 (0.14)	6.0 (0.015)	0.87 (0.12)	0.80 (0.13)	27.7 (<0.001)	0.92 (0.11)	0.82 (0.16)	51.5 (<0.001)

HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire.

Table A9. Latent growth curve model on the association of cognitive discrepancy style (age-corrected) with the trajectory of depressive symptom, psychosocial function, and quality of life

	HDRS-17 score (Model 1[a])		SDS score (Model 2[a])		EQ-5D utility score (Model 3[a])	
	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value
Time of assessment	−1.92 (0.12)	<0.001	−0.90 (0.13)	<0.001	0.01 (0.002)	<0.001
Cognitive discrepancy style						
Underestimation	Ref		Ref		Ref	
Overestimation	−4.64 (0.44)	<0.001	−6.68 (0.51)	<0.001	0.07 (0.10)	<0.001
Cognitive discrepancy style × time of assessment						
Underestimation × time of assessment	Ref		Ref		Ref	
Overestimation × time of assessment	−0.32 (0.13)	0.014	−0.36 (0.15)	0.013	0.01 (0.003)	<0.001

HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire.
[a]All models were adjusted for age, gender, residence, marital status, education, employment status, tobacco use, current psychotherapy use, first-episode or recurrent depression, suicide attempts, concomitant mental disorder condition, concomitant mental disorder and somatic condition, and antidepressant use.

Table A10. Latent growth curve model on the association of cognitive discrepancy score (age-corrected) with the trajectory of depressive symptom, psychosocial function, and quality of life

	HDRS-17 score (Model 4[a])		SDS score (Model 5[a])		EQ-5D utility score (Model 6[a])	
	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value	Coefficient (S.E.)	*p* value
Time of assessment	−1.80 (0.07)	<0.001	−0.68 (0.07)	<0.001	0.01 (0.001)	<0.001
Cognitive discrepancy score	1.59 (0.07)	<0.001	2.33 (0.10)	<0.001	−0.03 (0.002)	<0.001
Cognitive sensitivity score × time of assessment	0.03 (0.01)	0.026	0.05 (0.02)	0.039	−0.002 (0.0004)	<0.001

HDRS-17, Hamilton Depression Rating Scale; SDS, The Sheehan Disability Scale; EQ-5D, EuroQoL 5-Dimensions Questionnaire.
[a]All models were adjusted for age, gender, residence, marital status, education, employment status, tobacco use, current psychotherapy use, first-episode or recurrent depression, suicide attempts, concomitant mental disorder condition, concomitant mental disorder and somatic condition, and antidepressant use.

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