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Stages of psychological change among patients with non-alcoholic fatty liver disease in China: a national cross-sectional study

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ABSTRACT

Objectives Non-alcoholic fatty liver disease (NAFLD) is becoming the leading cause of chronic liver disease worldwide. However, treatment of NAFLD is potentially influenced by psychological conditions. Using the simplified version of the University of Rhode Island Change Assessment (URICA-SV) scale, this study aimed to evaluate the stage of psychological change as a prerequisite to refining implementation strategies for psychological change.

Design A multicentre cross-sectional survey.

Setting Ninety hospitals in China.

Participants 5181 patients with NAFLD were included in this study.

Outcome measures All patients completed the URICA-SV questionnaire and were assigned to one of the three stages of change (precontemplation, contemplation or action) according to their readiness scores. A stepwise multivariate logistic regression analysis was used to identify independent factors associated with the stage of psychological change.

Results A total of 4832 (93.3%) patients were included in the precontemplation stage and only 349 (6.7%) considered making a change or preparing to make one. There were significant differences in gender (Cohen's d=0.039, p=0.005), age (Cohen's d=−0.327, p<0.001), waist circumference (Cohen's d=0.143, p=0.003), alanine transaminase (Cohen's d=0.347, p=0.001), triglyceride (Cohen's d=0.351, p=0.002), body mass index (BMI; Cohen's d=0.039, p=0.005), proportion of hyperlipidaemia (Cohen's d=−0.327, p<0.001) and cardiovascular disease (Cohen's d=0.068, p=0.001) and chronic liver disease questionnaire-Non-Alcoholic Fatty Liver Disease overall score (Cohen's d=−0.420, p<0.001) between patients with NAFLD in the precontemplation stage and those in the contemplation/action stage. Logistic regression identified BMI (HR 0.659, 95% CI 0.469 to 0.928, p=0.017), cardiovascular disease (HR 2.161, 95% CI 1.089 to 4.287, p=0.027) and triglyceride (HR 0.751, 95% CI 0.591 to 0.955, p=0.020) as independent factors predicting psychological change.

Conclusions The results demonstrated that very few patients with NAFLD presented psychological condition in the stage of psychological change. Psychological condition was found to be significantly related to BMI, cardiovascular disease and triglyceride factors. Integrated diversity considerations for evaluating psychological change are necessary.

INTRODUCTION

Non-alcoholic fatty liver disease (NAFLD) is a liver disease associated with metabolic diseases such as obesity, type 2 diabetes mellitus and hypertension. In recent years, NAFLD has been identified as a leading cause of chronic liver disease worldwide and as a potentially progressive course leading to cirrhosis, hepatocellular carcinoma (HCC) and liver transplantation. This may bring health issues and financial burden to the patients, their families and the society as a whole. More seriously, NAFLD might even become the main cause of liver transplantation in the near future, making it an alarming public health problem.

Unfortunately, the public health problem of NAFLD is undermined due to low public awareness and limited knowledge of the disease. Previous studies have reported that...
lifestyle changes with healthy diet and adequate physical activity are the primary treatments for NAFLD. However, most patients lack the self-discipline to make lifestyle changes. More than half of patients with NAFLD have poor compliance with this treatment. Excitingly, a stage of change model can guide physicians in tailoring appropriate interventions for patients at different stages of change and help them make changes in their behaviour. This behavioural change intervention is especially useful in motivating lifestyle modification for chronic disease management, disease prevention and addictions. Several studies have reported that psychological factors and readiness for behavioural change were related to the treatment outcome of NAFLD. Thus, when managing patients with NAFLD, more attention should be focused on patients’ psychological factors and readiness for behavioural change.

The University of Rhode Island Change Assessment (URICA) scale is a well-known, valid and commonly used instrument for assessment of stage of change. Various studies have indicated that a four-factor structure consisting of 32 items reflects stage-related behavioural changes in patients. This four-factor structure can be divided into precontemplation, contemplation, action and maintenance. To date, URICA has been widely applied to a range of problems, such as dysphonia, smoking cessation, exercise and weight control, and self-management of chronic diseases, to assess patients’ readiness for change and ensure preventive and treatment interventions are tailored to their readiness for change. However, URICA is long and often time-consuming, which may weaken patient compliance. Thus, it is essential to have a relatively simple questionnaire which also ensures the feasibility of the study. According to our knowledge, no known studies have reported the stages of psychological change among patients with NAFLD. Therefore, it is worth assessing the stages of psychological change of patients with NAFLD, using a simplified questionnaire based on URICA, and thus provide therapeutic practices that match patients’ stage of psychological change. This study investigated whether variables related to demographics and clinical characteristics were independently associated with the stage of psychological change that patients with NAFLD were currently at. The study also identified independent factors for psychological change.

Methods

Study design and participants

This national multicentre cross-sectional survey was conducted in 90 hospitals in China (from 1 March to 1 August 2019) using the convenience sampling method. Patients with NAFLD were recruited from outpatient departments or wards by clinicians who were also the researchers of this study. Patients included in this study were 18 years of age and older and had confirmed diagnosis of NAFLD. Patients over 80 years of age or were pregnant were ineligible for this study. Other exclusion criteria were patients with cognitive impairment, neurological deficits, or medical or psychological illness. Patients with other liver injuries or with hepatic steatosis, liver decompensation or HCC were excluded as well. All patients provided written informed consent.

Procedures

The patients completed a questionnaire on demographic characteristics and the simplified version of URICA (URICA-SV) offline. The researchers then evaluated the data obtained from the questionnaire.

Questionnaire (the simplified version of URICA)

A questionnaire on demographic characteristics was used to collect information on demographics and medical history.

Readiness for psychological change was assessed using a questionnaire containing a brief list of physical health behaviour states, the URICA-SV (online supplemental table S1). URICA-SV consists of 12 items divided into four subscales: precontemplation, contemplation, action and maintenance, which represent the four stages of change of psychological condition, respectively, with three items for each stage. All items described personal feelings about the problems that arise at the beginning of treatment or in life. A 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used to rate each item. Patients chose the grade that best described their current feelings (1=’Not at all like me’, 2=’Not very much like me’, 3=’Somewhat like me’, 4=’Fairly much like me’ and 5=’Very much like me’).

The score for each stage was added to obtain the average score. Subsequently, a readiness score, defined as a continuous construct that represents readiness for change, was calculated by summing the average scores from the contemplation, action and maintenance stages and then subtracting the precontemplation average score. The stage of psychological change was dichotomised by dividing the readiness scores into three states: precontemplation (<8), contemplation (8.01–11.99) and action (>12).

Cronbach’s alpha coefficient and split-half reliability were used to check the internal consistency of the questionnaire (online supplemental table S1). For each subscale, Cronbach’s alpha coefficients higher than 0.7 were considered acceptable. The internal consistency of the URICA-SV is good, with coefficient alphas ranging from 0.801 to 0.933 for the four subscales. These results reflect the reliability of the questionnaire.

Statistical analysis

Continuous variables were expressed as median (range) and mean (SD), and categorical variables were expressed as frequency (proportion). The demographic and clinical characteristics of the patients are summarised descriptively. Comparison of continuous variables between precontemplation and contemplation/action for patients with NAFLD was done using t-test. X² test or Fisher’s exact
test was used to analyse the categorical variables between precontemplation and contemplation/action for patients with NAFLD. Variables with \( p < 0.05 \) were evaluated in a stepwise multivariate logistic regression analysis to determine the independent factors associated with readiness. Coefficient of determination (0–1) was calculated using Nagelkerke \( R^2 \) to test the fitting of the regression equation. The larger the coefficient of determination, the higher the fitting degree of model prediction. A two-sided \( p < 0.05 \) was considered statistically significant. All statistical analyses were conducted using SPSS V.23.0 software.

**RESULTS**

**Demographic and clinical characteristics**

The study recruited 5181 patients from 90 hospitals in China between March and August 2019. The mean body mass index (BMI) and triglyceride of all patients were 27.7±6.0 kg/m² and 2.4±2.1 mmol/L, respectively. Almost half of the patients (45.6%) had a BMI in the range of 24–28 kg/m², and about one-third had not received any treatment. The most common physically related comorbidity was hyperlipidaemia (37.7%), followed by hypertension (24.1%), diabetes (16.8%), cardiovascular disease (8.6%) and depression (2.9%) (table 1).

**URICA-SV analysis**

The scores on the URICA-SV subscales and the distribution of each stage are displayed in table 2. Among the four subscales, the mean subscale score was highest in the precontemplation subscale (3.37±1.10) and lowest in the contemplation subscale (2.39±0.96). All the mean scores of the four subscales were mainly around 2–3 on the 5-point Likert scale, showing disagreement or uncertainty of most patients’ attitudes towards these problems. The mean readiness score was 4.16 (SD=1.37), indicating most patients (n=4832, 93.3%) were mainly distributed in the precontemplation stage. Only 349 (6.7%) patients scored in the contemplation/action stage, indicating they were...
either preparing to make or are actively making psychological changes.

### Characteristics of NAFLD based on the stage of change

The distribution of each stage was considerably different for patients with NAFLD, with over 90% of patients (n=4832) being in the precontemplation stage (Table 3). There was a higher proportion of men with NAFLD in the precontemplation stage (66.3%) compared with the contemplation/action stage (59.0%; Cohen’s d=0.039, p=0.005). Nevertheless, the age of the patients in the precontemplation stage (43.5±13.2) was younger than those in the contemplation/action stage (48.0±14.3; Cohen’s d=−0.327, p<0.001). Compared with the contemplation/action stage, there was a higher proportion of patients with BMI ≥28 kg/m² (36.0% vs 28.4%; Cohen’s d=0.056, p<0.001) in the precontemplation stage, as well as higher waist circumference (92.3±17.2 vs 90.1±13.2; Cohen’s d=0.143, p=0.003), triglyceride (2.5±2.2 vs 1.9±1.0; Cohen’s d=0.351, p<0.001) and alanine transaminase (ALT) (53.9±47.8 vs 40.6±25.7; Cohen’s d=0.347, p=0.001). In addition, comorbidities were significantly different between patients in the precontemplation stage and those in the contemplation/action stage.

### Table 3: Characteristics of NAFLD based on the stage of change

<table>
<thead>
<tr>
<th></th>
<th>Precontemplation (n=4832)</th>
<th>Contemplation/action (n=349)</th>
<th>(t/\chi^2)</th>
<th>P value</th>
<th>Cohen’s d/phi/Cramer V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3205 (66.3)</td>
<td>206 (59.0)</td>
<td>7.718</td>
<td>0.005</td>
<td>0.039^N</td>
</tr>
<tr>
<td>Female</td>
<td>1627 (33.7)</td>
<td>143 (41.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, years‡</td>
<td>43.5±13.2</td>
<td>48.0±14.3</td>
<td>5.769</td>
<td>&lt;0.001</td>
<td>−0.327^M</td>
</tr>
<tr>
<td>Waist circumference, cm‡</td>
<td>92.3±17.2</td>
<td>90.1±13.2</td>
<td>2.958</td>
<td>0.003</td>
<td>0.143^S</td>
</tr>
<tr>
<td>Laboratory values‡</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALT, U/L</td>
<td>53.9±47.8</td>
<td>40.6±25.7</td>
<td>3.459</td>
<td>0.001</td>
<td>0.347^M</td>
</tr>
<tr>
<td>Triglyceride, mmol/L</td>
<td>2.5±2.2</td>
<td>1.9±1.0</td>
<td>3.153</td>
<td>0.002</td>
<td>0.351^M</td>
</tr>
<tr>
<td>BMI group*† (kg/m²)</td>
<td></td>
<td></td>
<td>16.49</td>
<td>&lt;0.001</td>
<td>0.056^N</td>
</tr>
<tr>
<td>&lt;24</td>
<td>886 (18.3)</td>
<td>92 (26.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24–28</td>
<td>2205 (45.6)</td>
<td>158 (45.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥28</td>
<td>1741 (36.0)</td>
<td>99 (28.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comorbidities†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>756 (16.8)</td>
<td>45 (13.8)</td>
<td>1.951</td>
<td>0.162</td>
<td>0.020^N</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1097 (24.1)</td>
<td>94 (28.7)</td>
<td>3.456</td>
<td>0.063</td>
<td>0.027^N</td>
</tr>
<tr>
<td>Hyperlipidaemia</td>
<td>1869 (42.0)</td>
<td>86 (28.3)</td>
<td>22.12</td>
<td>&lt;0.001</td>
<td>0.068^N</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>375 (8.6)</td>
<td>39 (12.1)</td>
<td>4.769</td>
<td>0.029</td>
<td>0.032^N</td>
</tr>
<tr>
<td>Depression</td>
<td>128 (2.9)</td>
<td>7 (2.2)</td>
<td>0.558</td>
<td>0.455</td>
<td>0.011^N</td>
</tr>
<tr>
<td>Therapeutic regimen†</td>
<td></td>
<td></td>
<td>95.262</td>
<td>&lt;0.001</td>
<td>0.136^N</td>
</tr>
<tr>
<td>No treatment</td>
<td>1424 (29.5)</td>
<td>188 (53.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet/exercise</td>
<td>2331 (48.2)</td>
<td>94 (26.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drug</td>
<td>1059 (21.9)</td>
<td>66 (18.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgery</td>
<td>18 (0.4)</td>
<td>1 (0.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disease severity†</td>
<td></td>
<td></td>
<td>2.772</td>
<td>0.250</td>
<td>0.024^N</td>
</tr>
<tr>
<td>Simple fatty liver</td>
<td>4338 (95.5)</td>
<td>323 (97.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NASH</td>
<td>177 (3.9)</td>
<td>10 (3.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>28 (0.6)</td>
<td>0 (0.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLDQ-NAFLD overall score‡</td>
<td>5.6±0.9</td>
<td>6.0±1.0</td>
<td>−7.433</td>
<td>&lt;0.001</td>
<td>−0.420^M</td>
</tr>
</tbody>
</table>

Comparison of continuous variables between the precontemplation and contemplation/action groups was done using t-test. Comparison of categorical variables between the precontemplation and contemplation/action groups was done using \(\chi^2\) test or Fisher’s exact test. *Belongs to the Cohen’s d; others belong to the Cohen’s w (Cramer V). Alphanumeric N indicates null effect size; alphanumeric S indicates small effect size; alphanumeric M indicates medium effect size; alphanumeric L indicates large effect size. †Data presented in n (%). ‡Data presented in mean±SD.

ALT, alanine transaminase; BMI, body mass index; CLDQ-NAFLD, Chronic Liver Disease Questionnaire-Non-Alcoholic Fatty Liver Disease; NAFLD, non-alcoholic fatty liver disease; NASH, non-alcoholic steatohepatitis.
stage and those in the contemplation/action stage. The proportion with hyperlipidaemia was much higher in the precontemplation stage (42.0%) than in the contemplation/action stage (28.3%; Cohen’s d=0.068, p<0.001), and also had higher number of patients who received surgery (18 vs 1; Cohen’s d=0.136, p<0.001), but a lower proportion of cardiovascular disease (8.6% vs 12.1%; Cohen’s d=0.032, p=0.029) and lower overall score on the Chronic Liver Disease Questionnaire-Non-Alcoholic Fatty Liver Disease (CLDQ-NAFLD) (5.6±0.9 vs 6.0±1.0; Cohen’s d=−0.420, p<0.001). However, the number of patients with diabetes, hypertension or depression showed no significant differences between the precontemplation stage and the contemplation/action stage.

**Logistic regression analysis**

Subsequently, variables including gender, age, ALT, triglyceride, BMI (waist circumference was excluded due to its highly positive association with BMI), hyperlipidaemia, cardiovascular disease, therapeutic regimen and CLDQ-NAFLD overall score were evaluated using stepwise multivariate logistic regression analysis. The Nagelkerke $R^2$ of the regression equation was 0.086. The results revealed that BMI (HR 0.659, 95% CI 0.469 to 0.928, p=0.017), cardiovascular disease (HR 2.161, 95% CI 1.089 to 4.287, p=0.0127) and triglyceride (HR 0.751, 95% CI 0.591 to 0.955, p=0.020) were independent factors for psychological change, either in the precontemplation stage or in the contemplation/action stage (table 4).

**DISCUSSION**

NAFLD is an accelerating health challenge and is currently considered the most common metabolic liver disease. Lifestyle intervention is the most recommended effective treatment approach for NAFLD. However, its management requires strict supervision from healthcare providers. It is the first premise to grasp the mental states of patients with NAFLD in order to improve compliance. Therefore, assessing the stage of psychological change is of great value in predicting the self-management initiatives of patients with NAFLD. Using the URICA-SV, this study provided information on the stages of patients’ psychological change when receiving an intervention for NAFLD. Data from this study indicated that most patients were in the precontemplation stage, suggesting that they had inadequate psychological preparation for an intervention. This study also found that BMI, cardiovascular disease and triglyceride were significantly associated with psychological change.

A previous study suggested that more than half of patients with NAFLD had psychological denial of the disease, were angered or upset after the diagnosis, were resistant to treatment, or gave up, which potentially impeded treatment for NAFLD. This result was consistent with the present study, which showed that over 90% of patients were in the precontemplation stage, suggesting that most patients were either unaware of their problems or were aware of their problems but had no intention of changing their behaviours or were coerced into changing. Social support, personal emotion and self-efficacy may affect psychological changes in patients with NAFLD and thus influence therapeutic adherence. A recent study suggested that psychological denial was related to low perceived social support in patients with non-alcoholic steatohepatitis. Funuyet-Salas et al also indicated that depressive symptoms and low self-efficacy predicted poor willingness to change behaviours and thus resulted in poor adherence to treatment.

At the same time, this study also found that the characteristics of patients in the precontemplation stage were significantly different from those in the contemplation/action stage by gender, age, obesity and BMI. Overall, men showed less willingness to change their behaviours, which is consistent with previous knowledge. Men were less likely to engage in behavioural changes associated with health and longevity than women, as unhealthy behaviours are usually signs of masculinity and are tools men use to negotiate power and status in society. Concerning BMI and obesity, higher BMI and presence of obesity were related to poor willingness to change behaviours, which is similar to previous findings. Patients with these factors were more likely to be in the precontemplation stage. Additionally, older patients had higher determination scores (ie, willingness to change behaviour), which agrees with previous studies.}

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**Table 4** Logistic regression analysis of the stage of psychological change of patients with NAFLD

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wald</th>
<th>SEM</th>
<th>HR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>5.718</td>
<td>0.174</td>
<td>0.659 (0.469 to 0.928)</td>
<td>0.017</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>4.860</td>
<td>0.350</td>
<td>2.161 (1.089 to 4.287)</td>
<td>0.027</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>5.445</td>
<td>0.123</td>
<td>0.751 (0.591 to 0.955)</td>
<td>0.020</td>
</tr>
</tbody>
</table>

Variables with p<0.05 were evaluated in a stepwise multivariate logistic regression analysis to determine the independent factors associated with readiness, including gender, age, ALT, triglyceride, BMI, hyperlipidaemia, cardiovascular disease, therapeutic regimen and CLDQ-NAFLD overall score.

*Precontemplation vs contemplation/action.

ALT, alanine transaminase; BMI, body mass index; CLDQ-NAFLD, Chronic Liver Disease Questionnaire-Non-Alcoholic Fatty Liver Disease; NAFLD, non-alcoholic fatty liver disease.
study showed no significant difference in the number of patients with diabetes, hypertension and depression between the precontemplation stage and the contemplation/action stage. Despite multiple studies suggesting that NAFLD was closely associated with type 2 diabetes, hypertension and depression, no evidence has shown that the proportion of patients with type 2 diabetes, hypertension or depression was related to the stage of psychological change of patients with NAFLD. The small sample size of patients with depression might affect the statistical results. Therefore, the relationship between depression and the stage of psychological change among patients with NAFLD still needs further validation. Furthermore, the stepwise multivariate logistic regression analysis demonstrated that BMI, cardiovascular disease and triglyceride were independent factors for psychological change. The URICA-SV questionnaire provided a stage-of-change profile for psychological conditions. Compared with URICA, the URICA-SV questionnaire, which has 12 items, can be understood by a larger number of patients and caregivers with little explanation. The assessment can usually be completed in a short time, improving patient compliance, especially among those in the precontemplation stage who often terminate participation in studies beforehand, as had been observed in another short version of URICA.32

To date, there has been no effective treatment for NAFLD. Lifestyle intervention plays a pivotal role in NAFLD treatment but requires patient initiative and strong personal will. The URICA-SV is an effective tool to evaluate the stage of psychological change of patients with NAFLD and can be understood easily and completed quickly. Furthermore, this study indicated an inadequate readiness to make psychological change among patients with NAFLD. Therefore, improving the psychological readiness of patients with NAFLD can directly affect the quality of lifestyle interventions, which plays a decisive role in the treatment of NAFLD.

This study also has several limitations. Only patients with NAFLD were included in this study, which limited the generalisability of the results to other populations. The cross-sectional design of the study prevented exploration of the long-term evolution of the results, particularly for exploratory and confirmatory factor analyses. Finally, the lower regression coefficients in this study indicated that the fit of the model prediction was limited and the results therefore need to be confirmed by further research.

CONCLUSION
In general, the findings from this investigation indicated that the URICA-SV might hold some promise as an effective assessment tool for stages of psychological change. This study suggested that most patients with NAFLD were in the precontemplation stage, which indicates that developing clinical care for people with NAFLD through individual programmes and specific treatment strategies is essential. Furthermore, BMI, cardiovascular disease and triglyceride were found to be independent factors for psychological change. Therefore, incorporating BMI, cardiovascular disease and triglyceride as higher risk factors for evaluating psychological change might be beneficial in distinguishing the stage of change.

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Contributors RH, J-GF, HR and LW were involved in the conception and design of the work. RH, HR and LW contributed to analysis and interpretation of the data. RH drafted the manuscript. RH, J-GF, J-PS, Y-MM, B-YW, J-MZ, LGL, B-HZ, Z-SZ, Y-DX, Y-NV, L-JL, LL, HR and LW participated in the acquisition of data and read and revised the whole manuscript. HR and LW are the guarantors for this study. All authors have read and approved the final manuscript.

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Competing interests RH has received speaking fees from Bristol Myers Squibb, Gilead and AbbVie. LW has received research support and/or consulting fees from AbbVie, Bristol Myers Squibb, Gilead, Roche and Novartis.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study was conducted according to the principles of Good Clinical Practice and the provisions of the Declaration of Helsinki. Ethics approval was obtained from the medical ethics committee of the Institutional Review Board of Peking University People’s Hospital (2018PHB259-01).
Influence of psychological biomarkers on therapeutic adherence


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