Predictors of Treatment and Adherence Outcomes in Internet-based Cognitive Behavioral Therapy for Social Anxiety in China

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Abstract:

Background: Although internet-based cognitive behavior therapy (ICBT) is an effective treatment approach for social anxiety disorder (SAD), a substantial proportion of patients do not achieve clinically significant improvement. More research is needed to identify which factors predict treatment adherence and outcomes.

Objective: The aims of this study were to (1) identify demographic and clinical factors that are associated with treatment adherence and outcomes in ICBT for social anxiety in China, (2) explore whether a low-intensity therapist support approach results in improved treatment adherence or outcomes and (3) adopt qualitative methods to explore motivating factors and barriers of adherence as well as other potentially enhancing strategies.

Methods: Data were collected within the context of a previously published study, in which participants (N=255) were assigned to either therapist-guided ICBT (N=183) or self-guided ICBT (N=72) groups. The Chinese version of the Social Phobia Scale (SPS) and Social Interaction Anxiety Scale (SIAS) were completed at both pre- and post-treatment. Treatment adherence and outcomes were analyzed using a two-step linear and logistic regression approach. Clinical and demographic characteristics were examined. Qualitative data concerning motivating factors and barriers to adhere to ICBT were obtained.

Results: No significant group differences were found for treatment adherence or outcomes ($P$s > .05). Participants diagnosed with Social Anxiety Disorder were significantly less likely to dropout (OR 0.531, $P$ = .03). Furthermore, older participants ($B$ = 0.17, SE = 0.04, $P$ = .008) and participants with a diagnosis of SAD ($B$ = 0.16, SE = 0.44, $P$ = .01) tended to complete more modules. Participants who completed more modules ($B$ = 0.24, SE = 0.03, $P$ = .01) and participants who identified as female ($B$ = -0.20, SE = 0.18, $P$ = .04) reported greater improvements on the SIAS.

Conclusions: Motivating factors and barriers to adherence, clinical implications, limitations, and future directions are discussed. Several recommendations are proposed for future research: (1) identify and evaluate more effective forms of low-intensity therapist support for enhancing treatment outcomes and adherence in ICBT for SAD; (2) include larger, more diverse samples; and (3) develop a coherent theoretical model of treatment adherence in online interventions.

Keywords: Internet treatment; ICBT; Social anxiety; Predictors; Adherence; Outcome

Introduction

Traditional in-person psychotherapies are insufficient to address mental health needs around the world [1]. Among the mental health conditions, Social Anxiety Disorder (SAD), also
known as Social Phobia, is one of the most prevalent mental disorders in Western countries [2]. It has an early onset [3, 4], follows a chronic course if not treated [5], and is associated with a significant impairment in quality of life [6]. Although the 12-month prevalence of SAD in China is much lower than in many Western countries, it still translates into an enormous number of people [7].

Internet-based interventions are a potentially feasible solution to closing the large gap between mental health treatment need and actual treatment delivery, especially in low- and middle-income countries [8]. In the last decade, Internet-based cognitive behavior therapy (ICBT) for SAD, which is a highly promising approach to increasing accessibility and availability to treatment, has been developed and validated in Western countries [9-11] as well as in China [12]. SAD is one of the disorders for which ICBT has the strongest empirical support [13, 14]. However, a substantial proportion of patients do not achieve clinically significant improvement. In studies on ICBT for SAD, clinically significant change rates range between 40-60%, which means approximately half of the participants did not achieve significant improvements [14]. The few studies on predictors of treatment outcomes in ICBT for SAD yielded inconsistent findings [13]. As such, it remains unclear which patients and patient characteristics are associated with benefiting most from this particular treatment delivery method.

Some of the factors that have been found to be associated with treatment outcomes in ICBT include demographic (e.g., age, gender, educational level, and employment status) and clinical (e.g., severity of symptoms, and comorbid diagnosis) characteristics [15-17]. However, findings are inconsistent. For example, employment status (i.e., working full-time) was associated with positive outcomes in ICBT for SAD in one study [16], but not another [15]. In terms of clinical characteristics, one study found higher intensity of baseline SAD symptoms predict more symptom improvement [17] while another study found the opposite [16]. Similarly, although comorbid depression was associated with lower treatment response in ICBT for SAD [16], another study reported no association between comorbid depression and treatment outcomes [17]. These equivocal results may be due to differences in populations, treatments and outcome measures (e.g., diagnosis-free status, clinical significant improvement, post-treatment level of social anxiety). However, differences across studies may also be due to differences in treatment engagement, including attrition (drop out) and adherence (the extent to which the patient’s behavior matches agreed recommendations from the prescriber [18]).

Treatment adherence is one of the most important issues faced by developers of web-based CBT interventions. For example, aggregate mobile analytics data from more than 150 thousand downloads of the “PTSD Coach” showed that only about 15% used the app the following week [19]. Importantly, adherence to ICBT predicted treatment outcomes in several studies [15, 16, 20]. However, some studies do not report a clear association between treatment adherence and outcomes [17, 21]. In internet-based treatments, adherence refers to the extent to which individuals make use of the content of the Internet intervention [22], and is often operationalized as the number of modules or exercises completed [23]. An interrelated but conceptually distinct construct is attrition or dropout, which is often operationalized as failing to complete the research trial protocol and assessments [22]. Many users of internet-based interventions do not complete the intervention in its entirety [23, 24]. Consequently, adherence in ICBT needs to be examined not only as an outcome predictor but also as an outcome itself, whose predictors need to be identified and investigated.
Research has shown certain demographic and clinical factors to be associated with adherence in ICBT [15, 17, 25-28]. However, again, studies have yielded equivocal results possibly due to differences in sample sizes, participant characteristics, definitions of adherence, treatment modality, and targeted symptoms. For example, some studies found that females [15, 25] and older individuals [26, 28] were more likely to adhere to ICBT, whereas others have found that gender and age were unrelated to adherence [26-28], or even that younger individuals were more adherent [25, 27]. Occupational status consistently was unrelated to adherence in ICBT for SAD [15, 27] as well as other symptoms [24, 29]. However, there have been mixed results on the relationship between level of education and adherence [15, 25, 27]. In terms of clinical symptoms, pre-treatment social anxiety symptom severity does not typically predict adherence in ICBT [15, 17, 26-28]. Nonetheless, one study of a large community-based sample reported greater adherence among individuals with higher baseline anxiety symptom severity [25].

A number of studies on ICBT have tested the efficacy of different approaches to enhance adherence [10, 20]. A common strategy used is therapist support or guidance. Several meta-analyses show superiority of therapist-guided versus self-guided ICBT in terms of dropout rates, adherence to treatment, and efficacy [30-32]. However, some studies have reported no significant differences between self- versus therapist-guided ICBT on treatment adherence and outcomes in social anxiety [10]. One important discussion related to this strategy focuses on identifying the minimum effective dose of support and guidance needed to enhance not only treatment adherence, but also treatment outcomes [33]. More research is needed to understand how treatment adherence is related to treatment outcomes in ICBT, as well as the variables associated with improved adherence. The present study contributes to this body of literature. Specifically, the aims of the present study were to (1) identify demographic and clinical factors associated with treatment adherence and outcomes in an online intervention for social anxiety in China, (2) explore whether a low-intensity therapist support approach results in improved treatment adherence or outcomes, and (3) adopt qualitative methods to explore motivating factors and barriers of adherence as well as other potential enhancing strategies.

**Method**

**Study design**

This was a study with a repeated measurements design investigating predictors of study dropouts, adherence to treatment and symptom outcomes in a sample of participants (N=255) who received treatment within the context of a previously published study [12]. Participants were assigned to a therapist-guided ICBT group, a self-guided ICBT group or to a waitlist control group. Outcome measurements were completed at pre-, mid- and post-treatment. A significant interaction effect of group by time was found with both active treatments (therapist-guided and self-guided treatment) being superior to a waiting-list control group regarding to social anxiety...
measures. No significant differences were found between the therapist-guided and self-guided treatment conditions.

All dependent variables were assessed at both pre- and post-treatment, and potential predictors were assessed at baseline. This study received ethics approval from the Committee for Protecting Human and Animal Subjects in the Department of Psychology at Peking University.

Selection of participants

A detailed description of recruitment of participants can be found in the previously published trial [12] on which this study was based. Participants in the present study included the following: (1) participants from the previous study [12], (2) individuals with SAD and other comorbid anxiety disorders who were excluded from the original study, and (3) additional participants recruited after the publication of the original study. A total of 255 persons met all inclusion and exclusion criteria. **Table 1** presents the characteristics of the participants.

Treatment

All participants received access to the same Internet-based intervention program, which was developed by the last author and his colleagues [10, 34], and which follows the well-established cognitive-behavioral model by Clark and Wells [35]. It is comprised of 8 text-based lessons completed over 8 weeks, each with a specific topic, and some homework and practice exercises.

One hundred eighty-three participants were assigned to the self-guided condition. They received the intervention as described above without any support or contact from a therapist during the 8-week treatment period. Seventy-two participants were assigned to the therapist-guided condition. They received the self-help program plus regular weekly email contact with a therapist. Therapists were graduate students from the Department of Clinical Psychology, Peking University, who were under CBT-training and were supervised by two CBT-trained clinical psychologists (TK & ML). If participants in this group had questions about the content of the intervention or difficulties understanding or applying the skills, they could contact their therapists. Finally, if therapists did not receive emails from participants or if participants did not make weekly progress in the program, the therapists would write an email with an encouragement to continue working on the program.
Dependent variables

Study dropouts

Dropout was defined as failure to complete outcome assessments based on the intent-to-treat sample size of the intervention group. Participants who were allocated to the intervention but never started the intervention were also counted as dropouts.

Adherence to treatment

Adherence was operationalized as number of completed modules of the intervention, ranging from 0 to 8. This information was recorded online at the administration website of the ICBT trial.

Outcome

The Chinese version of the Social Phobia Scale (SPS) and the Social Interaction Anxiety Scale (SIAS) were used as primary outcome measures [36, 37]. These measures assess social anxiety related concerns about being scrutinized or judged during routine activities, as well as fear in social interaction situations. The SPS contains 20 items, is rated on a 0-4 scale, and yields total scores between 0 and 80. The SIAS contains 19 items, is rated on a 0-4 scale, and yields total scores between 0 and 76. Both scales have good psychometric properties, including high internal consistency (Cronbach’s α was 0.90 for SPS and 0.87 for SIAS) and good test-retest reliability (0.85 for SPS and 0.86 for SIAS) [36].

For the analyses, residual gain scores were calculated, which account for measurement error of repeated administration of the instruments and the initial differences between individuals at pretreatment [38]. The residual gain scores were calculated using the formula $z_2 - (z_1 \times r_1^2)$ [38], where $z_2$ is the Z-transformed posttreatment score and $z_1$ is the transformed pretreatment score, and $r_1^2$ is the Pearson correlation between pre- and post-assessments. Residual gain scores were reversed so that higher scores would indicate greater improvement.
Potential Predictors

Clinical characteristics

Diagnostic assessment was conducted during the selection of participants using the Chinese version of the Mini International Neuropsychiatric Interview [39]. The investigated potential clinical predictors of dropout and adherence were social anxiety disorder diagnosis, comorbid major depression or dysthymia, and a comorbid anxiety disorder. The latter two were included as potential predictors for treatment outcome. Social anxiety disorder diagnosis was excluded since pretreatment social anxiety level was controlled by utilizing residual gain scores.

Demographic characteristics

Demographic data were collected during screening of participants. The following demographic characteristics were investigated as potential predictors of dropout, adherence and outcome: age, gender, ethnicity, occupational status, educational level, and monthly income.

Qualitative Data

In order to investigate motivating factors and barriers to adhere to the treatment, qualitative interviews were conducted post treatment. Twenty-four participants answered the following open-ended questions: (1) “What made you enroll in our program?” (2) “Why did you finish the modules and homework?” (3) “What kind of problems did you have that made it difficult for you to complete the entire intervention?” (4) “If you had difficulties engaging in our program, did you try to overcome the difficulties? If so, how?” (4) “How do you think our intervention could be improved to help you engage better?” Interviews were audio recorded and transcribed. Content analysis, an approach used to classify text into categories to reveal conceptual themes, was adopted to analyze the open-ended answers from the qualitative interviews.

Statistical Analysis

Statistical analyses were conducted using SPSS version 20.0. Linear and logistic regression analyses were performed adopting the two-step approach proposed by de Graaf, Hollon, and Huibers [40] by first identifying significant single univariate predictors, and subsequently adding
those simultaneously into a final multiple regression model. In the first step, the models were built in two blocks where the first block was the predictor and the second block was treatment group status (self-guided vs therapist-guided) and the interaction term (group [ ] predictor). Potential moderators were investigated if the interaction term was significant. In the second step, significant predictors from the initial univariate analyses were analyzed together in a final multiple regression model using backward deletion.

**Results**

**Participants**

Baseline background characteristics and diagnoses for both groups are presented in Table 1. No significant group differences were found for age, gender, ethnicity, educational level and monthly income. Only occupational status differed significantly between the two groups.

<table>
<thead>
<tr>
<th>Table 1. Description of participants and group differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Mean age, yrs (SD)</td>
</tr>
<tr>
<td>Range, yrs</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Women</td>
</tr>
<tr>
<td>Men</td>
</tr>
<tr>
<td>Occupational status</td>
</tr>
<tr>
<td>Full time student</td>
</tr>
<tr>
<td>Employed</td>
</tr>
<tr>
<td>Unemployed</td>
</tr>
<tr>
<td>Educational level</td>
</tr>
<tr>
<td>High school or shorter</td>
</tr>
<tr>
<td>University</td>
</tr>
<tr>
<td>Postgraduate</td>
</tr>
<tr>
<td>Missing value</td>
</tr>
<tr>
<td>Monthly income</td>
</tr>
<tr>
<td>none</td>
</tr>
<tr>
<td>&lt;2000RMB</td>
</tr>
</tbody>
</table>
2000 – 3000RMB  13  5
3001 – 5000RMB  33  5
5001 – 8000RMB  23  3
8001 – 15000RMB  15  5
>15001RMB  6  0
Missing value  9  23

Diagnosis

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>N</th>
<th>χ²</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased social anxiety symptoms</td>
<td>54</td>
<td>25</td>
<td>1</td>
<td>.18</td>
</tr>
<tr>
<td>Social Anxiety Disorder</td>
<td>50</td>
<td>17</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Comorbid Depression or Dysthymia</td>
<td>33</td>
<td>18</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Comorbid Anxiety Disorder</td>
<td>21</td>
<td>9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Comorbid Depression or Dysthymia and Anxiety Disorder</td>
<td>25</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

In the post treatment qualitative interview, 24 participants (16 female, 8 male, mean age =27.54 ±7.23) were included. Ten (42%) participants were from self-guided group and 14 (58%) were from therapist-guided group.

Predictors of dropout (Failure to complete outcome assessment)

One hundred and nine of 183 (59.6%) participants in the self-guided group and 39 of 72 (54%) participants in the therapist-guided group failed to complete assessments at post-treatment. No significant group difference were found for the odds of dropout (OR 0.802, P = .43). However, those who were diagnosed with Social Anxiety Disorder were significantly less likely to dropout compared to their counterparts (OR 0.531, P = .03). There were no other significant predictors of dropout.

Predictors of adherence

Participants completed 4.1 modules (SD = 3.3) on average. No group differences were found for the number of completed modules (t253 = 1.04, P = .30). Average completed modules were 4.0
(SD = 3.2) for the self-guided group and 4.4 (SD = 3.5) for the therapist-guided group, respectively. Figure 1 depicts the nonusage attrition curve. Plotted are number of completed modules against the proportion of remaining participants completing them.

![Figure 1. Percentage of Module Completion](image)

The first-step analysis showed that there were no significant moderators ($P$s $>$ .05). Univariate linear regression analyses showed that older participants with SAD diagnosis were significantly more likely to complete more modules in general. None of the other investigated predictors (gender, occupational status, educational level, and monthly income) reached significance, although occupational status approached significance. Results of the univariate regression analyses predicting the number of completed modules are presented in Table 2.

**Table 2. Univariate regression analyses predicting number of completed modules**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Beta</th>
<th>SE</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.17</td>
<td>0.04</td>
<td>.006</td>
</tr>
<tr>
<td>Gender (male)</td>
<td>0.03</td>
<td>0.49</td>
<td>.60</td>
</tr>
<tr>
<td>Occupational status (student)</td>
<td>-0.12</td>
<td>0.42</td>
<td>.05</td>
</tr>
<tr>
<td>Occupational status (employed)</td>
<td>0.09</td>
<td>0.42</td>
<td>.14</td>
</tr>
<tr>
<td>Educational level</td>
<td>-0.09</td>
<td>0.43</td>
<td>.21</td>
</tr>
<tr>
<td>Monthly income</td>
<td>0.06</td>
<td>0.12</td>
<td>.37</td>
</tr>
<tr>
<td>Diagnosis (SAD)</td>
<td>0.16</td>
<td>0.45</td>
<td>.009</td>
</tr>
<tr>
<td>Comorbid diagnoses 1 (depression/dysthymia)</td>
<td>0.11</td>
<td>0.45</td>
<td>.09</td>
</tr>
<tr>
<td>Comorbid diagnoses 2 (comorbid anxiety disorder)</td>
<td>0.01</td>
<td>0.50</td>
<td>.95</td>
</tr>
</tbody>
</table>

In the second-step analysis, the multiple regression model retained age ($B = 0.17$, $SE = 0.04$, $P = .008$) and SAD diagnosis ($B = 0.16$, $SE = 0.44$, $P = .01$) as significant predictors of adherence ($R^2 = .05$, $F = 7.13$, $P = .001$). Older participants and participants with a diagnosis of SAD tended to complete more modules.
Predictors of residual gain scores of SIAS and SPS

In the first-step analysis, no significant moderator was found ($Ps > .05$). Univariate linear regression analyses showed that gender and number of completed modules were significant predictors for residual gain score of SIAS. Age and comorbid anxiety disorder diagnosis were marginally significant for the residual gain score of SPS. None of the other investigated predictors were significant. Results are presented in Table.  

**Table 3. Univariate regression analyses predicting residual gain score of SIAS/SPS**

<table>
<thead>
<tr>
<th>Predictors</th>
<th>SIAS (n=107)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>SE</td>
<td>$P$</td>
<td>Beta</td>
<td>SE</td>
<td>$P$</td>
<td>Beta</td>
<td>SE</td>
<td>$P$</td>
</tr>
<tr>
<td>Age</td>
<td>-0.15</td>
<td>0.02</td>
<td>.12</td>
<td>-0.19</td>
<td>0.02</td>
<td>.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (male)</td>
<td>-0.23</td>
<td>0.18</td>
<td>.017</td>
<td>-0.11</td>
<td>0.18</td>
<td>.26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational status (student)</td>
<td>0.13</td>
<td>0.17</td>
<td>.19</td>
<td>0.16</td>
<td>0.17</td>
<td>.10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational status (employed)</td>
<td>-0.07</td>
<td>0.17</td>
<td>.47</td>
<td>-0.10</td>
<td>0.17</td>
<td>.31</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Educational level</td>
<td>0.06</td>
<td>0.16</td>
<td>.58</td>
<td>0.11</td>
<td>0.16</td>
<td>.32</td>
<td></td>
<td></td>
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<tr>
<td>Monthly income</td>
<td>0.06</td>
<td>0.05</td>
<td>.56</td>
<td>-0.04</td>
<td>0.05</td>
<td>.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis (comorbid depression/dysthymia)</td>
<td>0.11</td>
<td>0.18</td>
<td>.28</td>
<td>0.02</td>
<td>0.18</td>
<td>.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis (comorbid anxiety disorder)</td>
<td>-0.18</td>
<td>0.20</td>
<td>.07</td>
<td>-0.19</td>
<td>0.19</td>
<td>.06</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of completed modules</td>
<td>0.27</td>
<td>0.03</td>
<td>.005</td>
<td>0.14</td>
<td>0.03</td>
<td>.15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the second-step analysis, the multiple regression model retained gender ($B = -0.20$, $SE = 0.18$, $P = .04$) and number of completed modules ($B = 0.24$, $SE = 0.03$, $P = .01$) as significant predictors of residual gain score for SIAS ($R^2 = .11$, $F = 6.35$, $P = .002$). Participants who identified as female and those who competed more modules reported greater improvement in SIAS scores.

**Qualitative Data**

Content analyses of the answers to the open-ended questions in the qualitative interview revealed several conceptual themes regarding motivational factors and barriers to adherence as well as potential enhancement strategies.

Motivating factors included: a) strong baseline motivation to improve social anxiety, b) confidence in the ICBT program due to its affiliation with Peking University, c) integration of motivational interviewing techniques, d) perceived improvement during the intervention, and e) therapist support.

Challenges to treatment adherence included: a) the time commitment required to complete the program, b) increased anxiety during exposure exercises, c) stigma associated with having mental health problems, d) lack of perceived effectiveness of the intervention, e) insufficient peer- and therapist support, f) lack of opportunities to complete homework and exposure assignments, g) lengthy reading materials, and h) lack of user-friendliness of the ICBT website.
Potential enhancing strategies suggested by the participants included: a) more frequent and personalized support from the therapist, b) utilization of multimedia techniques (e.g., images, audio, videos) to present intervention materials, c) forming peer support groups and online forums, d) utilization of reminders, and e) improving user-friendliness and accessibility of the ICBT website.

Discussion

Effectiveness data obtained in a previous study [12] was utilized to investigate predictors of treatment adherence and outcomes in the context of self-guided and therapist-guided ICBT for social anxiety in China. We examined whether therapist support resulted in improved treatment adherence or outcomes, namely to test the moderation effect of intervention condition. Consistent with some previous studies [10, 41], we did not find significant group difference in outcomes (residual gain scores of SIAS and SPS) between participants in the self-guided and therapist-guided ICBT intervention groups.

Although previous research suggests treatment engagement is improved when patients are guided by trained coaches or therapists [23, 31], no significant effects were found for therapist guidance on treatment dropout or the number of completed modules. One possible explanation is that the intensity of therapist guidance provided in our study was insufficient to enhance outcomes. For example, most emails were not personalized, therapists were students, and the average amount of time spent responding to participants was approximately 15 minutes per week per participant. Some researchers have posited that the isolated nature of online interventions make it easier for participants to disengage [42]. Potential enhancing strategies suggested by participants in our study included a) more frequent and targeted support from the therapists and b) forming peer support groups and online forums. Thus, more research is needed to determine what type of support and the level of support is needed to achieve significant and clinically meaningful differences in treatment engagement and outcomes.

With regard to predictors of outcomes, neither comorbid depression/dysthymia or other anxiety disorders were predictive of treatment outcomes, which replicates results from previous studies of predictors of ICBT for SAD [17, 21], including a review of predictors of outcomes in face-to-face CBT for SAD [43]. Both women and participants with greater adherence (completing more modules) demonstrated the greatest improvements in SIAS score but not SPS score. Age (older participants) and comorbid anxiety disorders approached significance as predictors of improvement in SPS score (P < .06) but not SIAS score. Although the two scales are usually highly correlated, they in fact measure different aspects of social anxiety. The SPS assesses fears of being scrutinized during routine activities (eating, drinking, writing, etc.), while the SIAS assesses fears of more general social interaction [37]. The difference in outcome measures might be a possible explanation of equivocal results also found in previous researches [15-17].

In the present study, SAD diagnosis was associated with lower dropout and higher adherence rates. However, several studies found pre-treatment social anxiety symptom severity to not be predictive of adherence to ICBT [15, 17, 26-28]. Our results were in line with one earlier
study composed of a larger community-based sample [25]. One possible explanation is that those with less social anxiety symptoms may have experienced less benefit from the intervention (due to floor effects) and thus dropped out. On the other hand, participants with SAD diagnosis might be more motivated to improve than those without SAD diagnosis, and thus were more adherent. Though pre-treatment motivation was not included in our study, previous research has shown there to be a significant correlation between motivation and adherence [44].

In the present study, older age was associated with better adherence. Evidence from previous studies was mixed, with almost an equal number of studies finding either older age or younger age to be associated with higher adherence [25-28]. Two studies found them to be unrelated [10, 28]. In a recent review of predictors of adherence [23], the authors identified discrepancies between what were considered "older" vs "younger" participants across different studies to be driving the inconsistent findings related to the association between age and adherence rates. According to their findings, middle aged adults (i.e., aged >25) had the highest adherence rates. These findings were consistent with our own, as the mean age of our sample was 25.6.

Consistent with previous research on ICBT for SAD [15, 27] and other symptoms [24, 29], occupational status was not related to adherence. However, in our study, student status approached significance. That is, non-student participants showed a tendency to be more adherent than students. This finding makes sense, considering the fact that students in China have more access to mental health services than non-students [45]. Accordingly, non-student participants might have valued the intervention more, as they may have perceived mental health resources to be scarcer.

Several limitations of this study should be acknowledged, which may also help outline opportunities and directions for future research. Firstly, dropout (failure to complete outcome assessment) rate was high in our study. Although it is not unusual for ICBT studies to have high dropout rates [19, 24], it limits the reliability and validity of our results regarding the predictors of dropout, adherence and outcomes. More research is needed in order to understand the best strategies for recruiting and retaining subjects in online interventions in non-Western, low- and middle-income contexts. Secondly, it should be noted that our findings are based on a relatively small, homogenous sample. Future studies with larger samples and more variability in terms of demographics, clinical characteristic and therapy processes may be able to identify other variables associated with treatment adherence and outcomes. Thirdly, our study examined a small number of the many possible predictors of dropout, adherence and outcome. It was beyond the scope of our study to examine all the predictors that have been identified in the literature. Thus, investigating additional factors such as treatment credibility, chronicity, earlier experiences of treatment are warranted. Fourthly, follow-up data were not included in our study and thus we were not able to examine predictors of long-term effectiveness of ICBT for social anxiety. Since an earlier study indicated that predictors for short-term and long-term improvements might be different [46], future studies should include more follow-up data and identify factors associated with maintenance of symptom improvement.

Finally, this study was only exploratory in nature, serving to generate hypotheses for clinicians and researchers. Researchers have pointed to the potential of a range of other theoretical models to increase adherence focusing on technology (e.g., Persuasive System Design [47]) or the individual, including the health belief model, the protection motivation theory, the
theory of reasoned action, the theory of planned behavior, the social-cognitive theory, and models based on self-efficacy [48]. However, a coherent theory-driven, evidence-based model for understanding treatment engagement in online interventions is needed [49]; such a model would help researchers and clinicians evaluate and develop individualized and targeted interventions.

In conclusion, female participants and those who were more adherent to the protocol reported better treatment outcomes, while older participants and those with a diagnosis of SAD reported higher adherence. Treatment and adherence outcomes for self-guided and therapist-guided ICBT for social anxiety were not found to be significantly different. Research is needed to explore support using different providers (e.g., peers), mediums (e.g., video chat), formats (e.g., group), intensity (e.g., higher frequency and duration of contact) or foci (e.g., validation or motivational interviewing).

Acknowledgement

This study was funded by National Social Science Foundation of China (Project number: 15ZDB139) and by China Scholarship Council awarded to the first author. The authors would like to acknowledge Prof. Dr. Alexander L. Gerlach and Dr. Yang Sun for their kind guidance and support in the writing of the manuscript. The second author would also like to thank the James B. Duke International Travel Fellowship for funding his activities related to this project. The study sponsors had no role in the design of the study; in the collection, analysis, and interpretation of the data; in the writing of the report; and in the decision to submit the article for publication.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Abbreviations

ICBT: internet-based cognitive behavior therapy
CBT: cognitive behavior therapy
SAD: social anxiety disorder
SPS: Social Phobia Scale
SIAS: Social Interaction Anxiety Scale


