



Cognitive behavioral therapy (CBT) anxiety management and reasoning bias modification in young adults with anxiety disorders: A real-world study of a therapist-assisted computerized (TACCBT) program Vs. “person-to-person” group CBT

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ABSTRACT

Computerized cognitive behavioral therapy (cCBT) appears to be a therapeutic strategy that is as effective as person-to-person CBT in the treatment of adults and young people with anxiety disorders. The aim of our controlled study was to evaluate the following in young adult users affected by anxiety disorders: (1) the feasibility of our simple “prototype” of a therapist-assisted computerized cognitive behavioral therapy (TacCBT); and (2) the effectiveness of two different interventions—group CBT and TacCBT—in an “enriched” format for anxiety management and reasoning bias modification as compared to a control group. Psychopathology, global functioning, and cognitive flexibility were examined in 13 users undergoing TacCBT and compared to those receiving “person-to-person” group CBT (CBT Group, $n = 25$), which controlled for their psychopharmacological treatment. Users were included in the arms of our real-world study on the basis of their treatment preferences. Twelve subjects were included in a Treatment as Usual (TAU) group. Following the intervention, all groups showed a significant improvement in symptoms. Both CBT groups showed an improvement in cognitive flexibility with respect to TAU, in addition to a reduction of their reasoning overconfidence. Our preliminary results show the benefits of the TacCBT program and highlight its advantages.

1. Introduction

Anxiety disorders are the most common type of mental health problems, and they are characterized by impaired personal and social functioning and low quality of life (Carta et al., 2015; Saris et al., 2017). Furthermore, anxiety disorders are often related to other problems, including depressive symptoms, cognitive difficulties (attentional biases, memory dysfunction, and cognitive and metacognitive vulnerabilities), and substance abuse (Roy-Byrne et al., 2008; McLean et al., 2011). Many studies show that Cognitive Behavioral Therapy (CBT) is an effective therapeutic strategy for a wide variety of mental disorders, as it is a preferential treatment for anxiety disorders with significant and positive long-term outcomes in youth (Wootton et al., 2015). Different treatment formats (individual CBT and group CBT) do not appear to lead to differences in short- and long-term outcomes, which shows similar effect sizes (Saavedra et al., 2010; Kodal et al., 2018).

The pathogenic mechanisms underlying the onset and maintenance

of an anxiety disorder mainly includes information processing biases (Beck and Clark, 1997). CBT is typically conducted to help subjects identify recurring thoughts and dysfunctional patterns of reasoning and interpretation of reality, to replace and/or integrate them with more functional convictions (Beck and Haigh, 2014). Some authors have reported that anxiety may increase paranoid ideation, which may be mediated by the jumping to conclusions (JTC) reasoning bias (Giusti et al., 2018; Lincoln et al., 2010).

In anxiety disorders, the goal to reach a more objective evaluation of situations has to take into account cognitive biases, such as overgeneralization or maximization of danger, based on a JTC “cognitive appraisal”. A “premature”, and biased attention to threat leads to the activation of the primary threat appraisal system with hypervigilance and autonomic hyperarousal, and recruitment of excessive worry as the secondary appraisal strategy trigger and perpetuate anxiety states (Beck and Clark, 1997).

Giusti et al. (2018) showed clinical and cognitive evidence of the

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effectiveness of an “enriched” cognitive-behavioral group intervention for anxiety management addressed to improve symptoms, social functioning, and cognitive flexibility (i.e., the ability to recognize the fallibility of his/her own beliefs and convictions in terms of the detection of inaccurate reasoning). In their study, the authors found that even young anxious adults showed low cognitive flexibility and tendency to jump to conclusion, both of which have been investigated extensively in individuals with psychosis. Cognitive flexibility represents a form of metacognitive function that encompasses the evaluation and correction of distorted beliefs and misinterpretations, ability for accurate introspection, recognition of fallibility, and limitations of one’s thoughts, objectivity, reflection, and openness to corrective feedback (Beck et al., 2004). Therefore, cognitive flexibility may represent a crucial variable; good cognitive flexibility is associated with self-regulatory and adaptable behavior. It could be a useful indicator in individuals with anxiety disorders to facilitate cognitive restructuring, to promote better accuracy in the evaluation of neutral stimuli and integration of new information, and to respond to challenges, such as to follow an innovative treatment. The Beck Cognitive Insight Scale, BCIS, has been reported to be a valid measure to assess cognitive flexibility (Beck et al., 2004).

Although CBT appears to be the elective treatment for anxiety disorders, there may be several barriers to CBT delivery, such as insufficient therapists, stigmatization, geographical distance, temporal inflexibility, long waiting times, and high costs (Hedman et al., 2016; Olthuis et al., 2016). To overcome this problem, computer-based cognitive behavioral therapy (cCBT) has been proposed for the treatment of anxiety disorders. This has led, over the past 15 years, to a significant development in computerized and/or internet-based psychological interventions (Andersson, 2016). According to a recent meta-analysis, cCBT appears to be as effective as standard person-to-person CBT in the treatment of adults and young people (Olthuis et al., 2016; Adelman et al., 2014). Furthermore, users who have taken part in a cCBT program experience more long-term benefits with more significant symptom reduction.

Several cCBT studies have included a therapist to assist the users, which is associated with more significant and more positive outcomes compared to the waiting list control (Adelman et al., 2014). Therapist behaviors, including task reinforcement, task prompting, self-efficacy shaping, and empathetic utterances, appear to have an impact on symptoms and program completion (Paxling et al., 2013).

We implemented a computer program comprising a therapist-assisted CBT intervention for young adults affected by anxiety disorders to offer a more attractive way to administer treatment to a population prone to using smartphones, personal computers, and the internet (Bianchini et al., 2017). The availability of two different treatment deliveries (person-to-person or computer-interface-based intervention) can expand users’ choices based on their individual preference, upon which the users’ personal characteristics can address the application of a psychotherapy program—something that is crucial to the progression of treatment efficacy (Norcross and Wampold, 2011).

Both treatments used an “enriched” CBT program that demonstrated efficacy in young adults with anxiety disorder and cognitive biases (Giusti et al., 2018). The “add-on” of cognitive flexibility modules was aimed to reduce the cognitive biases related to “hasty” judgments and decisions under conditions of uncertainty and to reduce the difficulty of accepting new elements disconfirming the misperception of dangerous threats. We thought that the specific visual stimuli (vignettes, photos, cartoons, images, etc.), reported the two modules in our “young version” (Ussorio et al., 2016), could increase the internalization of the learned alternative cognitive schemas.

The present study aimed to evaluate:

- (1) the feasibility of a simple “prototype” of therapist-assisted computerized Cognitive Behavioral Therapy (TacCBT) in young adults affected by anxiety disorders;
- (2) the effectiveness of our therapist-assisted computerized CBT

compared to the group CBT intervention, both “enriched” in their format for anxiety management and reasoning bias modification, on anxious symptoms, personal and social functioning, and cognitive flexibility.

We hypothesized that the TacCBT program would have the same efficacy as the group CBT and that some of our participants would choose our TacCBT based on their better cognitive flexibility compared to the users wanting a more traditional way of group CBT delivery; we also predicted that their cognitive flexibility could further improve by the end of the intervention.

2. Materials and methods

2.1. Study design

The study was conducted at the service TRIP - Psychosocial Rehabilitation Treatment, Early Interventions in Mental Health, University Unit, at the University of L’Aquila (Italy). The study included 50 subjects suffering from anxiety disorders who were consecutively referred in an 8-month period (September 2018 through April 2019). Each user was evaluated by a psychiatrist through the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (SCID-5) (First et al., 2017). Subjects diagnosed as affected by anxiety disorders were included in the study.

2.2. Participants

A total of 50 users with the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) diagnosis of anxiety disorder participated in the current study. The inclusion criteria were: (1) age 18–40 years, (2) diagnosis in axis I of the anxiety disorder, and (3) fluency and literacy in Italian. The exclusion criteria were: (1) positive history of a head injury with loss of consciousness, (2) IQ < 70, and (c) inability to provide informed consent to treatment.

The demographic and clinical characteristics of the sample are reported in Table 1.

Upon entry in the study, 70% of the sample were undergoing psychopharmacological treatment, which included selective serotonin reuptake inhibitor, SSRIs (average dosage 20 mg/day escitalopram), noradrenergic and specific serotonin antidepressants, NaSSA (average dosage 30 mg/day mirtazapine), and benzodiazepine (BZs) (average dosage 0.50 mg/day alprazolam).

2.3. Instruments

The following instruments were administered to all subjects upon entry in the study, and they were re-administered at the end of the study (after 3 months).

2.3.1. Psychopathology

2.3.1.1. State and Trait Anxiety Inventory (STAI-Y1 and STAI-Y2). State and Trait Anxiety Inventory (STAI) (Spielberger et al., 1983) includes two forms: the Y-1 module (state anxiety levels) and the Y-2 module (trait anxiety). Both scales are composed of 20 items, each of which is assigned a score from “never” to “always”; a high score is associated with greater severity in symptoms (range: 20–80; cut-off = 40).

2.3.1.2. Self-rating Anxiety Scale (SAS). Self-Rating Anxiety Scale (SAS) (Zung, 1971) comprises 20 items investigating anxious symptomatology and 5 items investigating well-being (the latter require reversed scores). The items are evaluated on a 4-point Likert scale (ranging from 1 = “nothing or only for a short time” to 4 = “continuously or most of the time”). Higher scores are associated with greater severity of symptoms.

Table 1
Demographic and clinical characteristics of 50 young adult users with anxiety disorders participating to the study.

	CBT group (n = 25)	TacCBT group (n = 13)	TAU group (n = 12)	
Gender (%)				
Male	40	38.5	41.7	
Female	60	61.5	58.3	
Age, mean (sd)	25.92 (3.94)	25.46 (8.64)	28.75 (6.48)	
Education, mean years (sd)	15.64 (2.59)	14.62 (2.56)	13.25 (0.86)**	F = 4.426 (d.f. 2); p = .017
Marital status (%)				
Single	96	84.6	75	
Married	–	15.4	25	
Divorced	4	–	–	
Working conditions (%)				
Unemployed	4	23.0	8.4	
Employed	32	30.8	33.3	
Student	64	46.2	58.3	
Diagnosis (DSM-5) (%)				Chi-square = 13.011 (d.f. 4); p = .011
Generalized Anxiety Disorder	44	38.5	41.7*	
Social Anxiety Disorder	–	15.4	41.7	
Panic Disorder	56	46.2	16.7	
Length of illness, mean years (sd)	2.38 (1.77)	2 (2.11)	0.92 (0.28)	
Medication (%)				Chi-square = 30.886 (d.f. 6); p < .001
SSRIs & BZs	52	–	25**	
SSRI	32	15.4	66.7	
NaSSA	4	–	–	
No psychopharmacological treatment	12	84.6	8.3	

Abbreviations: BZs: Benzodiazepines; CBT, cognitive-behavioral therapy; TacCBT, computerized cognitive-behavioral therapy; DSM-5, Diagnostic and Statistical Manual of Mental Disorders, Five Edition; NaSSA: Noradrenergic and Specific Serotonergic Antidepressants SSRIs: Selective Serotonin Reuptake Inhibitors.

* p < .05.

** p < .01.

2.3.2. Personal and social functioning

World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0; Italian VERSION).

The World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) (Bedirhan Üstün et al., 2010) is structured into six domains: (1) Cognition; (2) Mobility; (3) Self-care; (4) Getting along; (5) Life activities; and (6) Participation. We used the version of WHODAS 2.0 that comprised 36 questions. The items are articulated on a 5-level Likert scale, where 1 corresponds to “no difficulty” and 5 to “very difficult or I could not do it”. A high score indicates greater difficulty in different areas. In the current study, the mean domain scores were used only for “Getting along”, “Life activities”, and “Participation”.

2.3.3. Cognitive flexibility

2.3.3.1. Beck Cognitive Insight Scale (BCIS). The BCIS (Beck et al., 2004) assesses cognitive flexibility. This 15-item questionnaire investigates two domains: self-reflectiveness (self-reflectivity: the ability to observe reality in an objective way) and self-certainty (self-confidence and self-belief). The index score is obtained by subtracting the score obtained from the items of self-confidence (range: 0–18) to the items of self-reflectivity (range: 0–27). In this study, we used a cut-off index of 4 as suggested by Martin et al. (Martin et al., 2010). In their study, BCIS was used to assess cognitive insight to discriminate non-psychiatric young individuals and those with psychosis. A cut-off score of 4 showed good specificity, and correctly identified 72% of the young subjects. Low BCIS scores are associated with greater cognitive impairment.

2.4. Procedures

At the beginning at the study, progressively recruited participants were allocated to three treatment conditions: (1) “person-to-person” CBT group and drug treatment (CBT; n = 25); (2) TacCBT group and drug treatment (TacCBT; n = 13); and (3) TAU group (TAU n = 12). Pharmacological treatment was proposed to all the participants and was

prescribed on the basis of clinical judgment and the user preference. All subjects provided written informed consent to participate in the study. The controlled study was approved by the Internal Review Board of University of L'Aquila (authorization no. 4717). The assignment to the three different conditions was “quasi sperimentale”, which was based mainly on the users' preferences and on logistic problems, due to accessibility to the service (the CBT groups were conducted in the afternoon 4–6 p.m. every Monday, whereas the TacCBT was available 5 days per week).

2.4.1. “Enriched” CBT for anxiety management and reasoning bias modification training

The CBT for anxiety management and reasoning bias modification training was based on the manuals for the therapists and users by Andrews et al. (Andrews et al., 2003). Two modules (2–7) focused on the “Jumping to conclusion” bias and Module 3 focused on “Modifying one's conviction”, bias against disconfirmatory evidence (BADE) of the metacognitive training was also included (Moritz and Woodward, 2007) in our modified transdiagnostic “young version” (Ussorio et al., 2016). All session contents of the CBT program are shown in Table 2.

2.4.1.1. “Person-to-person” group CBT. Each intervention of the “person-to-person” group CBT included 5–6 users and was delivered by a Psychiatric Rehabilitation Technician (A.S.) and a clinical psychologist (L.G.) for a period of 3 months (12 sessions, each lasting 90 min). The training was administered once a week.

2.4.1.2. Therapist-assisted CBT (TacCBT). The TacCBT was developed by A.S. through an internet platform, Moodle, which is a “Virtual clinic”. They could access to the virtual clinic only when they were in the service.

The TacCBT adopted the same content of the group CBT, which was adapted to software, as reported in Table 2. On the computerized platform, the different sessions were loaded in “slideshow” mode (.jpg format) for the theoretical part. Audio files were also loaded and could

Table 2

Session contents of the “Enriched” CBT for anxiety management and reasoning bias modification training (Ussorio et al., 2016; Andrews et al., 2003; Moritz and Woodward, 2007).

	Session content
Sessions 1–2 Orient the patient to CBT/psychoeducation	Orient the patient to CBT Psychoeducation about the common signs and symptoms of anxiety disorders Set initial treatment plan/goals Homework assignment: (1) Read the user's manual section on anxiety disorders (2) Monitor the achievement of established weekly goals
Sessions 3–4 Anxiety management strategies	Acquire specific relaxation skills Explain the rationale for relaxation strategies Deep breathing Muscle relaxation Homework assignment: (1) Read the user's manual section on specific relaxation skills (2) Daily diary of deep breathing exercises (3) Daily diary of muscle relaxation exercises
Sessions 5–8 Cognitive therapy/thinking strategies	Introducing the cognitive model Explain the rationale for examining thinking patterns Review the relationship between thoughts, feelings, and behavior Explain the ABC model (activating event, beliefs, emotional and behavioral consequences) Identifying maladaptive thoughts and beliefs Focus on ‘jumping to conclusions’ bias Bias against disconfirmatory evidence, BADE Suggest or generate alternative, more functional thoughts/beliefs Challenge of self-injurious thoughts and feelings through Cognitive Restructuring form Homework assignment: 1) Read the user's manual section on specific problematic thinking styles 2) Daily diary of unpleasant situations 3) Daily diary of maladaptive thoughts and beliefs 4) Practice with the cognitive restructuring module
Sessions 9–11 Structured problem solving	Introduce rationale and when to problem-solve Explain the steps to effective structured problem-solving and practice Homework assignment: 1) Read the user's manual section on structured problem-solving 2) Daily schedule of applied problem-solving for practical problems
Session 12 Relapse prevention	Prepare a relapse prevention plan Strategies for encouraging generalization and maintenance

be downloaded by the users. Each session lasted approximately 60 min. Additionally, for this type of intervention, the user was given a working manual containing homework worksheets, and the therapist filled out a weekly diary to monitor therapy progress.

The TacCBT for anxiety management was provided individually with therapist support during all sessions and through other technological strategies (i.e., e-mail, Skype, and What's App) between weekly sessions. The therapist provided technological support and positive corrective feedback. Each session included homework assignments (see Table 2), and the therapist monitored the homework and treatment adherence. The mean time spent by the therapist working with each TacCBT user was 20 min per session. The therapist could simultaneously help more than one user to work on his/her program even if they were in different stages of the therapy, which optimized his/her own time.

2.4.2. Treatment As Usual group (TAU)

Subjects in the TAU group received drug treatment and bimonthly clinical consultation, including psychoeducation on the common signs and symptoms of anxiety disorders, and on their drug regimen, lifestyle recommendations, and simple CBT strategies (i.e., identification and monitoring of individual goal).

2.5. Statistical analysis

One way analyses of variance (ANOVA) and Chi-square analyses were conducted to examine baseline differences among groups about demographic and clinical variables. Because of the skewed distribution of anxiety disorders in each group, we examined whether the treatment outcomes in different diagnostic groups could be predicted or

moderated. Therefore, we considered diagnostic group as an additional independent variable in our model and as a factor for assessing between the subjects (diagnostic group \times time \times treatment condition). Psychopathological, functioning, and cognitive skills variables used a general linear model for repeated measures with a factor between subjects (TacCBT vs CBT vs TAU) and within factor subjects (Pre-treatment–T0 vs Post-treatment–T1) controlling for psychopharmacological treatment. The estimated effect size (η^2p) was calculated. We adopted a level of significance of $p < .05$. We investigated the cognitive flexibility using the cut-off BCIS index value (low cognitive flexibility, ≤ 4 ; high cognitive flexibility, > 4). Statistical analyses were performed using SPSS 16.0 (SPSS Inc., Chicago, IL, USA).

3. Results

No statistically significant differences among the groups about the distribution of age, sex, marital status, working conditions, and length of illness were found, being that our sample comprised only young subjects—mainly single, female students with a relatively short duration of illness. A statistically significant difference was found with respect to the number of education years, with a higher education level for subjects belonging to the CBT group. Clinical data indicated that specific diagnosis of anxiety did not moderate the treatment efficacy of symptoms of anxiety as measured by the SAS, STAY 1, STAI Y 2, or that of social functioning when measured by “getting alone,” “life activities,” and “participation” domains of the WHODAS questionnaire, or by the measures of cognitive flexibility. Namely, in both treatment conditions, participants with different diagnoses (PD, GAD, SAD) showed similar rates of variables changes. Statistically significant differences were found among groups concerning the distribution of

anxiety diagnoses and psychopharmacological treatment. Almost 60% of subjects belonging to the CBT group were diagnosed with Panic Disorder, showing the TAU had a higher proportion of the Social Anxiety Disorder diagnosis (> 40%). More than 80% of subjects belonging to TacCBT Group were not undergoing psychopharmacological treatment, whereas 92% of subjects belonging to TAU group were undergoing psychopharmacological treatment.

All participants completed the CBT program, except for one user (a 40-year old woman) who was included in TacCBT intervention program. She asked to participate in the person-to-person CBT program after completing two TacCBT sessions, as she reported that she was not particularly skilled with the computer, although enthusiastic about the “new therapies.”

3.1. Psychopathology

At baseline, all subjects reported a large level of psychopathological symptoms, as shown by the range scores above the cut-off value (SAS mean score of total sample: 48.88 > cutoff: 45; STAI-Y1 mean score of total sample: 52.52 > cutoff: 40; STAI-Y2 mean score of total sample: 53.54 > cutoff: 40). At baseline no statistically significant difference was found among the groups with regard to symptoms, as measured by the SAS and STAI-Y2 scales. Anxiety symptoms regarding the transient status of stress, as measured by STAI-Y1, showed higher scores for the CBT group compared to other groups ($F = 4.792$; $p = .013$; CBT vs TacCBT = mean difference 11.960; $p = .023$).

At the end of the treatment, all subjects showed significant improvement concerning anxious symptoms, as measured by the SAS and STAI-Y1 total scores, leading to a significant “main effect” only for time. The TacCBT Group showed greater improvement in psychopathology as measured by the STAI-Y2 total score when compared to the CBT and TAU groups with a significant group \times time interaction (Table 3).

3.2. Social and personal functioning

Upon entry in the study, our total young adults sample showed a mild level of social and personal functioning impairment, as measured by the WHODAS 2.0 questionnaire (“Getting along” mean score = 1.25, SD = 0.96; “Life activities” mean score = 1.41, SD = 1.22; “Participation” mean score = 1.56, SD = 1.18). At baseline, statistically significant differences among the three groups were found in social and personal functioning as measured by the WHODAS 2.0 domains in “Getting along”. This showed worse functioning of the TacCBT and CBT groups compared to the TAU group ($F = 9.858$; $p = .000$; TacCBT vs CBT = mean difference 0.7362; $p = .037$; TacCBT vs TAU = mean difference 1.4694; $p = .000$; CBT vs TAU = mean difference 0.7332; $p = .045$).

Compared to other groups, the TacCBT group reported higher scores in the “Life activities” ($F = 8.460$; $p = .001$; TacCBT vs TAU = mean difference 1.7635; $p = .000$; CBT vs TAU = mean difference 0.9755; $p = .038$) and “Participation” domains ($F = 9.157$; $p = .000$; TacCBT vs TAU = mean difference 1.7527; $p = .000$; CBT vs TAU = mean difference 0.9719; $p = .029$).

Both the CBT and TacCBT groups showed significant improvement in social and personal functioning compared to the TAU group, as measured by two of the three considered domains of the WHODAS instrument. Specifically, the TacCBT Group showed greater improvement in the “Participation” domain compared to the other groups, with significant group \times time interaction; the CBT group showed greater improvement in the “Getting along” domain with significant group \times time interaction compared to other groups (Table 3).

3.3. Cognitive flexibility

At baseline, all subjects reported a borderline BCIS-Index value (BCIS-Index = 4.5; SD = 5.1), with mean scores in the “Self-

reflectiveness” domain (13.36; SD = 4.52) and high mean scores in the “Self-certainty” domain (9.18; SD = 2.78), suggesting, on one side, good abilities of accurate introspective recognition of fallibility and limitations of one’s thoughts and, on the other side, although moderate, negative convictions of overconfidence and early acceptance of incorrect ideas.

At the time of entry in the study, no statistically significant difference among the three groups regarding “Self-certainty” and “Self-reflectiveness” domains was found.

At the end of the study, the BCIS-Index value of the total sample showed an increase (BCIS-Index = 5.28; SD = 4.3), with a statistically significant rise attributable of the two CBT groups (ANOVA: CBT groups mean value = 6.13, SD = 4.17; TAU = 2.58, SD = 3.84; $F = 6.827$; $p = .012$).

Both CBT groups showed significant improvement in the “Self-certainty” domain as measured by the BCIS instrument (Table 3).

4. Discussion

The present study aimed to investigate the feasibility of a simple prototype of TacCBT applied in the clinical context of young people with anxiety disorders and to assess its effectiveness compared to a person-to-person (CBT) program.

At the end of the study, all three groups showed a significant improvement in symptoms, whereas both CBT groups showed an improvement in social functioning and cognitive flexibility compared to the TAU group. Disconfirming our hypothesis, at the beginning of the study, cognitive flexibility did not address the choice of the TacCBT.

In the present study, after three months of participation in the study, all subjects showed improvement in symptomatology. Both the CBT and TAU groups showed a good recovery from anxious symptomatology, which may be attributed to the psychopharmacological treatment in 92% of the subjects included in the TAU group.

In the TacCBT group, only 15% of the subject accepted the prescription of antidepressants. In fact, after a short psychoeducational presentation on the evidence-based treatment recommendations, our young users had the opportunity to decide on the proposed drug therapy and between an innovative (TacCBT) and a more traditional method of CBT treatment delivery. Such attention to the users’ preference was a strength factor of our study, according to our recovery-oriented unit principles, which is widespread in our country (Giusti et al., 2019).

Regarding social and personal functioning, as measured by the WHODAS domains, at baseline, all participants in the early stage of anxiety disorder reported low impairment in interpersonal and social relationships and everyday life activities. These results can also be attributed to the social functioning measure used in the present study, the WHODAS 2.0, which is not a mental health-specific instrument; nor is it tailored to identify specific dysfunctions in those with anxiety disorders, despite its general sensitivity to the impact of mental disorders and to changes over the time course of a mental disorder such an anxiety disorder (Sjonnese et al., 2016).

At the end of the study, both CBT groups showed a significant improvement in the domains of “Participation” in social life and interpersonal relationships, which was better than that in the TAU group, reporting very low scores of impairment upon entry in the study.

In relation to cognitive flexibility, we hypothesized that the choice and acceptance to undergo a computerized treatment program would be influenced by a good level of cognitive flexibility, defined as open-minded proneness. Our result suggests that cognitive flexibility cannot be considered a conditioning factor for the choice of treatment delivery (traditional CBT vs TacCBT). In fact, our hypothesis was disconfirmed because at the entry of the study, the users choosing the TacCBT did not show better cognitive flexibility compared to the subjects in other groups, in which all participants reported limited cognitive flexibility.

At the entry in the study, participants showed sufficient cognitive

Table 3
Means and standard deviations of clinical, functioning and cognitive measures of three GROUPS pre (T0) and post-treatment (T1).

	CBT Group (n = 25)		TacCBT Group (n = 13)		TAU Group (n = 12)		F-value (df = 2.47)	η^2 p (estimated effect size group for time interaction)
	Mean (SD)		Mean (SD)		Mean (SD)			
	T0	T1	T0	T1	T0	T1		
Clinical variables								
SAS total score	49.40 (12.04)	39.52 (6.38)	47.08 (11.82)	38.85 (6.27)	49.75 (17.15)	45 (14.64)	Time 16.213** Group 0.705 Interaction 0.663	0.027
STAI_Y1 total score	57.96 (13.34)	48 (9.26)	46 (11.64)	36.54 (8.98)	48.25 (11.72)	44.92 (11.43)	Time 23.956** Group 6.161 Interaction 1.771	0.070
STAI_Y2 total score	56.60 (10.32)	50.96 (10.20)	52.69 (12.61)	37.38 (12.79)	48.08 (12.68)	45.08 (13.08)	Time 24.52** Group 3.894* Interaction 4.804*	0.170
Functioning variables								
WHODAS_Getting along	1.24 (0.99)	0.81 (0.75)	1.97 (0.81)	1.70 (0.80)	0.51 (0.17)	0.51 (0.17)	Time 10.958* Group 11.00** Interaction 3.265*	0.122
WHODAS_Life activities	1.44 (1.33)	0.95 (0.97)	2.23 (0.96)	1.58 (0.69)	0.47 (0.19)	0.44 (0.18)	Time 10.518** Group 9.094** Interaction 2.086	0.082
WHODAS_Participation	1.59 (1.29)	0.93 (1.10)	2.37 (0.82)	1.91 (0.83)	0.62 (0.22)	0.62 (0.22)	Time 24.242** Group 8.485** Interaction 6.835**	0.225
Cognitive variables								
BCIS_Self reflectiveness	14.06 (4.75)	13.92 (4.15)	11.31 (3.19)	11.08 (2.59)	13 (4.71)	12.67 (4.39)	Time 0.240 Group 4.470** Interaction 0.032	0.001
BCIS_Self certainty	9.48 (2.84)	7.28 (2.93)	7.92 (2.62)	5.92 (2.06)	9.92 (2.57)	10.08 (2.35)	Time 5.380* Group 8.840** Interaction 1.606	0.064

Abbreviations: **BCIS**, Beck Cognitive Insight Scale; **sCBT**, standard cognitive-behavioral intervention; **TacCBT**, computerized cognitive-behavioral intervention; **SAS**, Self-rating Anxiety Scale; **STAI**, State and Trait Anxiety Inventory (STAI-Y1 and STAI-Y2); **WHODAS**, World Health Organization Disability Assessment Schedule 2.

* p < .05.

** p < .01.

flexibility, as assessed by the BCIS index cut-off of 4. These data seem to confirm that anxious subjects may show difficulties in the flexibility of re-evaluating one's cognitive processes with a tendency for reasoning biases that contribute to the persistence of anxiogenic beliefs (Giusti et al., 2018; Vroling et al., 2016). Main cognitive bias in anxious subjects led them to overestimate the likelihood of adverse events happening to themselves (Bar-Haim et al., 2007); it also led to a lower performance accuracy due to the decreased allocation of attentional resources and insufficient data collection (Giusti et al., 2018). Both the CBT interventions were enriched by the modules on "Jumping to conclusions" and "BADE"; additionally, both the experimental groups showed improvement in the self-certainty domain compared to the control group. These domains were more responsive to interventions focused on cognitive content (such as psychoeducation or the cognitive-behavioral therapy). Conversely, self-reflectiveness may be more suitable for therapies based on the process of thinking, such as cognitive remediation or mindfulness therapies (Gonzalez-Blanch et al., 2014).

In our opinion, if the TacCBT program is as effective as standard person-to-person CBT, it is important to be aware of the advantages of TacCBT for both the users and mental health professionals. Users can access treatment based on their needs and without any delay, as enrollment in a group can take time, given that at least 3–4 people must be recruited. This therapy can optimize the therapists' time as they can follow several users simultaneously, even if they are in different stages of treatment. Moreover, we estimated that young adult individuals could be more attracted to computer-aided, as well as internet-delivered therapies. Contrary to our belief, Mewton et al. suggested that it might be possible to generalize this intervention across all age groups (Mewton et al., 2013).

Our study presents three main limitations. First, the study design was a "real-world" controlled, pilot study; however, the users' choice between the two experimental conditions cannot be defined as a randomization. Participants chose the intervention that they believed best suited them; practically, this is a strength of the study. Theoretically/statistically, we acknowledge that this is also the biggest weakness of our study because we lack the prospective registration on a clinical trials registry. The participant-selected treatment modalities met their motivation and facilitated a good adherence to the interventions. Moreover, personalized and tailored therapeutic approaches should be investigated to facilitate the new paradigm of "precision psychiatry" (Fernandes et al., 2017). Second, the generalization of our findings is limited by the sample size. The third limitation concerns the lack of a longer follow-up period, foreseen at one-year, in order to assess the maintenance of the results.

5. Conclusions

Our preliminary findings encourage the future application of our "prototype" TacCBT program, with clinically verified feasibility in the treatment of anxiety in young adults who are unwilling or unable to follow the person-to-person CBT therapy; additionally, it optimizes their access to care and ensures the same outcomes. Further studies are needed to verify the benefits of the intervention over time.

Declaration of competing interest

The authors report no conflict of interest.

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