Journal of Anxiety Disorders 28 (2014) 851–864

Contents lists available at ScienceDirect

Journal of Anxiety Disorders

# Interpretation bias modification for youth and their parents: A novel treatment for early adolescent social anxiety

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ARTICLE INFO

*Article history:*
Received 30 August 2014
Accepted 25 September 2014
Available online 5 October 2014

*Keywords:*
Cognitive bias modification
Youth social anxiety
Family-based treatment

ABSTRACT

Social anxiety is the most prevalent anxiety disorder of late adolescence, yet current treatments reach only a minority of youth with the disorder. Effective and easy-to-disseminate treatments are needed. This study pilot tested the efficacy of a novel, online cognitive bias modification for interpretation (CBM-I) intervention for socially anxious youth and their parents. The CBM-I intervention targeted cognitive biases associated with early adolescents' maladaptive beliefs regarding social situations, and with parents' intrusive behavior, both of which have been theoretically linked with the maintenance of social anxiety in youth. To investigate the efficacy of intervening with parents and/or children, clinically diagnosed early adolescents (ages 10–15; $N = 18$) and their mothers were randomly assigned to one of three conditions: the first targeted early adolescents' cognitive biases related to social anxiety (Child-only condition); the second targeted parents' biases associated with intrusive behavior (Parent-only condition); and the third targeted both youth and parents' biases in tandem (Combo condition). The use of a multiple baseline design allowed for the efficient assessment of causal links between the intervention and reduction in social anxiety symptoms in youth. Results provided converging evidence indicating modest support for the efficacy of CBM-I, with no reliable differences across conditions. Taken together, results suggest that online CBM-I with anxious youth and/or their parents holds promise as an effective and easily administered component of treatment for child social anxiety that deserves further evaluation in a larger trial.



## 1. Introduction

Social anxiety disorder is the most prevalent anxiety disorder of late adolescence and adulthood (Ollendick & Hirshfeld-Becker, 2002), affecting up to 15% of teenagers in the United States (Heimberg, Stein, Hiripi, & Kessler, 2000). Social anxiety typically runs a chronic course over the lifespan (Keller, 2003) and is linked to poor long-term outcomes, such as major depression (Hayward et al., 2000), academic underachievement, and substance abuse (DeWitt, McDonald, & Offord, 1999). Yet, a mere 25% of youth with social anxiety have access to any intervention (Essau, Conradt, & Petermann, 1999). Moreover, among the minority of socially anxious youth who do receive the current gold standard treatment, cognitive behavioral therapy (CBT), approximately 40% fail to demonstrate a clinically significant treatment response (Kendall, Settipani, & Cummings, 2012). Clearly, additional treatments are needed—both to reach underserved populations and to increase the efficacy of CBT.

### 1.1. Cognitive models of social anxiety

Cognitive models of social anxiety (Clark & Wells, 1995; Rapee & Heimberg, 1997; Schreiber, Hofling, Stangier, Bohn, & Steil, 2012) posit that, in social contexts, multiple cognitive biases are activated for socially anxious individuals. For example, their attention becomes especially self-focused, and they experience greater access to negative beliefs about themselves and others' evaluation of them. These cognitive processes may give rise to negatively biased interpretations of the many ambiguous cues that social situations present (Beard & Amir, 2008), which, in turn, amplify and/or maintain social anxiety symptoms. Empirical work corroborates the theorized connection between interpretation bias and anxiety symptoms in youth. For example, studies have shown that anxious youth tend to interpret ambiguous hypothetical stories as threatening (e.g., Bögels & Zigterman, 2000), and do so based on less

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http://dx.doi.org/10.1016/j.janxdis.2014.09.011
0887-6185/

information than non-anxious youth (e.g. Muris, Merckelbach, & Damsma, 2000).

The child anxiety literature also supports a role for family interactions in shaping interpretation bias. For example, two similar studies assessed clinically anxious youth's interpretation bias of ambiguous situations (Chorpita, Albano, & Barlow, 1996) and their hypothetical behavioral response (e.g., avoidance) to ambiguous situations (Barrett, Rapee, Dadds, & Ryan, 1996), both before and after discussions with family. Both studies found that anxious youth initially interpreted ambiguous scenarios more negatively than non-anxious youth, and, moreover, anxious youth's negative interpretations (Chorpita et al., 1996) and expected avoidant behaviors (Barrett et al., 1996) increased following discussions with their families. Further, Creswell and O'Connor (2006) found that the correlation between mothers' and children's threatening interpretations of ambiguous scenarios was partially mediated by mothers' expectations for the child's distress, suggesting that children's interpretation biases may have a "reciprocal relationship with mothers' expectations of children's anxious cognitions" (Field, Hadwin, & Lester, 2011). These findings indicate the possibility that modifying interpretation biases at both the parent and child level could lead to reduced anxiety symptoms in youth.

### 1.2. Cognitive bias modification for interpretation

Cognitive bias modification for threat interpretation (CBM-I) refers to computerized training in interpreting ambiguity in a benign way, so as to reduce threat-related interpretations and increase benign interpretations of ambiguous situations in participants' everyday life (Mathews & Mackintosh, 2000). The adult anxiety literature has shown that directly reducing negative cognitive biases through CBM-I can lead to reductions in anxiety symptoms, highlighting a causal role for cognitive biases in anxiety and, in turn, the clinical utility of CBM-I (MacLeod & Mathews, 2012; Steinman & Teachman, 2014). Thus, several child and adolescent studies have adapted the ambiguous scenario paradigm that has commonly been used in adult CBM-I studies. This paradigm presents emotionally ambiguous scenarios that are resolved when participants complete a word fragment at the end of the scenario that assigns a benign meaning to the situation (in the positive training condition). Results suggest that youth's interpretation biases can be altered through CBM-I (see Lau, 2013), though many questions remain. For example, across studies, changes in anxiety symptoms have rarely accompanied changes in interpretation bias, and effect sizes have been small. Nonetheless, findings from the burgeoning youth CBM-I literature, taken together with those from the more established adult literature, suggest that several methodological modifications, which are applied in this study, could increase the efficacy of youth CBM-I and its ability to alter anxiety symptoms.

For example, ecologically valid training materials have been associated with larger effect sizes. Whereas early youth CBM-I studies used scenarios related to a fictional "space odyssey" theme, subsequent work (Lester, Field, & Muris, 2011) used materials involving real-life scenarios congruent with participants' anxiety symptoms related to either animal or social fears. In addition to finding that children's threat bias decreased after positive training in both the animal and social conditions, a non-significant trend suggested that bias modification was stronger for children trained with content that was congruent with their developmentally normative fears. Thus, all CBM-I scenarios in the current study targeted beliefs theoretically and/or empirically linked to intrusive parenting or social anxiety.

Of note, one of the few studies that employed a high social anxiety (vs. unselected) sample was also one of the few youth CBM-I studies to show reductions in participants' trait social anxiety following training (Vassilopoulos, Banerjee, & Prantzalou, 2009). However, the only published youth CBM-I study that has employed a clinically diagnosed sample did not find reductions in emotional vulnerability following training (Fu, Du, Au, & Lau, 2013). The current study's inclusion of clinically diagnosed socially anxious youth aims to provide a clearer test of the clinical utility of CBM-I for children and maximize the likelihood of observing effects.

Finally, youth CBM-I studies have typically focused treatment on only the child or adolescent, which may neglect the need to address the family context in which youth anxiety develops. In the only published youth CBM-I study to include parents (Lau, Pettit, & Creswell, 2013), CBM-I scenarios were embedded in bedtime stories that parents read to their children over three nights. Children who received the intervention not only showed positive changes in interpretation bias, they also showed a significant reduction in social anxiety symptoms, relative to control participants. While the inclusion of parents marks an exciting new direction in youth CBM-I research, we note that Lau et al. included parents as administrators of treatment, as opposed to the recipients. Given the purported role of parents in child anxiety, it is possible that administering CBM-I to *both* parents and children could have additive benefits.

### 1.3. Role of parenting in child anxiety

Though the role of parenting in child anxiety has not been clearly specified, one aspect of parenting that may influence child anxiety is parental intrusiveness. McLeod, Wood, and Avny (2011) point to multiple mechanisms that may account for the positive relationship between parental intrusiveness and child anxiety. Parental intrusiveness may lower children's self-efficacy or sense of an internal locus of control, or it could block opportunities for exposure to feared stimuli, which has been strongly linked to fear reduction (Rachman, 1977). For example, some benign and developmentally appropriate situations, such as parties and class presentations, may make anxious youth fearful. In response to their child's distress, parents may enable their child's avoidance of these situations, thereby preventing the child from learning that he or she is capable of facing fears and managing anxiety.

Ollendick and Benoit's (2012) parent–child interactional model of social anxiety proposes that parents may inadvertently contribute to child social anxiety by modeling anxiety and communicating their own cognitive biases to their children, such as the overestimation of social threat and the belief that avoidance is a helpful response to perceived threat. These biases may lead to parenting practices, such as intrusive parenting, that shape and sustain child cognitive biases, which in turn maintain child social anxiety. According to this model, targeting parent cognitive biases that are thought to contribute to child anxiety (e.g., my child cannot tolerate anxiety; I will be a bad parent if I don't stop my child's anxiety) may interrupt the transmission of anxiety from parent to child at an early point in this process.

### 1.4. Internet delivery of CBM-I

Internet delivery of youth CBT has gained empirical support as being both feasible and efficacious (see Richardson, Stallard, & Velleman, 2010, for a review). Online youth CBM-I, on the other hand, has only been attempted once, to our knowledge (Sportel, de Hullu, de Jong, & Nauta, 2013). While the outcomes indicated only a trend for symptom reduction in the group who received CBM, it is notable that participants assigned to the Internet-based CBM condition completed more treatment sessions than those in the school-based group CBT condition, suggesting that Internet CBM is at least feasible and does not lead to unusually high attrition.

Though Sportel et al. (2013) intervened with a community sample, Internet delivery of CBM-I may be especially promising for

socially anxious youth. Many socially anxious youth wish to avoid social situations (including therapy), yet they appear to use the Internet at least as much as youth without social anxiety (e.g., Mazalin & Moore, 2004). CBM-I may also be preferable to CBT for these youth. Whereas online CBT typically requires 30–60 min per session (Richardson et al., 2010), CBM-I sessions are typically designed to be completed in 20 min or less. Moreover, CBT demands introspection and sharing of explicit insight into thoughts and feelings (which can be challenging for socially reticent youth); CBM-I provides participants with short scenarios to be resolved in a game-like format, without explicitly requiring introspection.

### 1.5. Rationale for age range

We designed the present intervention for socially anxious youth who were 10–15-years-old for several reasons. First, social anxiety most commonly emerges between early and mid-adolescence (e.g., ages 10–16; Beidel, 1998; Mesa, Nieves, & Beidel, 2011) and increases with age. By including the lower end of this age range, we hoped to improve outcomes for youth with early onset of symptoms, which has been empirically linked to chronicity (DeWitt et al., 1999). Second, this period of social anxiety's emergence maps on to both youth's growing capacity for independence, and the normative attenuation of parent involvement in aspects of their children's everyday functioning. Thus, parents' continuation of intrusive behaviors at this stage in particular may limit the development of their children's independence.

### 1.6. Current study

To build on the promising but mixed youth CBM-I literature, the current study included several methodological modifications: (1) creating externally valid, developmentally informed materials that engage our pre-adolescent participants; (2) intervening with a clinically diagnosed sample; (3) increasing the number of CBM-I sessions to eight, a number found to be effective in the adult literature (e.g., Beard & Amir, 2008) but rarely found in the youth literature; (4) administering treatment online, as opposed to in the lab; and perhaps most importantly, (5) administering treatment to *both* anxious children and their parents.

Answering calls for more idiographic research in clinical science (Barlow & Nock, 2009), a multiple baseline design examined whether the intervention is efficacious in reducing symptoms of social anxiety. Idiographic experiment designs, such as multiple baseline designs, are "ideally suited for use by psychological scientists," because they can efficiently and with few participants "provide strong evidence of causal relations between variables" (Barlow & Nock, 2009, p. 20). In multiple baseline designs, participants are repeatedly assessed on key variables until stable responding is established. Following this baseline period, the intervention is introduced. If changes in key variables occur only when the intervention is introduced, the change can be attributed to the intervention. For this reason, multiple baseline designs have been called a "critical link" to the judicious allocation of time and funds toward subsequent, larger randomized controlled trials (Moras, Telfer, & Barlow, 1993, p. 412). Given the current intervention has not been previously been tested, our multiple baseline design was ideal to gather useful information about its likely efficacy, which can be applied to a more traditional, larger-scale clinical trial.

To investigate whether it is most efficacious to intervene with parents and/or children, youth and their mothers were randomly assigned to one of three conditions: one targeted early adolescents' cognitive biases related to social anxiety (Child-only condition); the second targeted parents' biases associated with intrusive behavior (Parent-only condition); and the third targeted both youth and parents' biases in tandem (Combo condition). We hypothesized that youth in all conditions would adhere to the study protocol (as indicated by successful completion of the eight training sessions and the assessment battery), and that they would show reduced negative interpretation bias, increased positive interpretation bias, and significant improvements in social anxiety symptoms. Given research suggesting that both children's and parents' beliefs may maintain child social anxiety (see Negreiros & Miller, 2014), addressing both sets of maladaptive beliefs may exert additive effects on reducing child anxiety symptoms. Thus, we hypothesized that participants in the Combo condition would improve the most.

## 2. Methods

### 2.1. Participants

Participants were recruited from suburban and rural areas of the Southeastern United States through flyers, advertisements, and social networking. Potential parent participants completed a semi-structured diagnostic phone screen. If the phone screen suggested a probable child social anxiety disorder diagnosis, then child verbal consent was obtained via phone, and both the parent and child were invited to an intake assessment at the clinic. Study inclusion criteria were a diagnosis of child social anxiety disorder based on clinical interview with the parent; average or above child intelligence based on brief cognitive testing; and, if applicable, no changes to the child's other mental health treatment plans for at least six weeks prior to enrollment (and no plans to alter other treatments during the study; following Teachman, Marker, and Smith-Janik (2008)). Children carrying additional clinical diagnoses, as assessed by the intake interview, were still eligible. Study exclusion criteria were child current psychosis, active suicidality, IQ less than 85, bipolar disorder, and conduct disorder (following Alfano et al. (2009)), though no one who was screened met these criteria. Parent and child participants each received $10 for each of the five clinic visits, and an additional $25 for study completion.

See Fig. 1 for a consolidated standards of reporting trials (CONSORT) diagram detailing participant enrollment. The final sample included 18 mother–child dyads ($n = 5$ boys). Six participants were randomized to the Combo condition, seven participants were randomized to the Child-only condition, and five participants were randomized to the Parent-only condition. The mean child age was 13 ($SD = 1.64$, range 10–15). Seventeen (94.44%) of the mothers reported their child's race as white, and one mother (5.56%) reported her child's race as mixed/other. Fifty percent of children met criteria for additional anxiety or depression diagnoses based on the modules of the diagnostic interview that were administered. See Appendix for each individual participant's demographic characteristics, including comorbid diagnoses.

### 2.2. Intervention

Following Mathews and Mackintosh (2000), participants were instructed to read and imagine themselves in 50 scenarios per session that were ambiguous in meaning until a word fragment near the end of the scenario resolved the ambiguity in a positive way (e.g., in a way inconsistent with socially anxious beliefs). Participants typed in missing letter(s) (one letter in Sessions 1–3; two in Sessions 4–8) to complete the word fragment and then answered a comprehension question that reinforced the positive interpretation of the scenario. An example of a child scenario is, "While walking through the halls, you overhear your name in a crowd of people. Then, they all begin to laugh. Your friends must have been thinking about that fun_y joke you told them earlier." Participants typed the letter "n" to complete the word "funny," ascribing a positive interpretation to the preceding text. Next, child participants

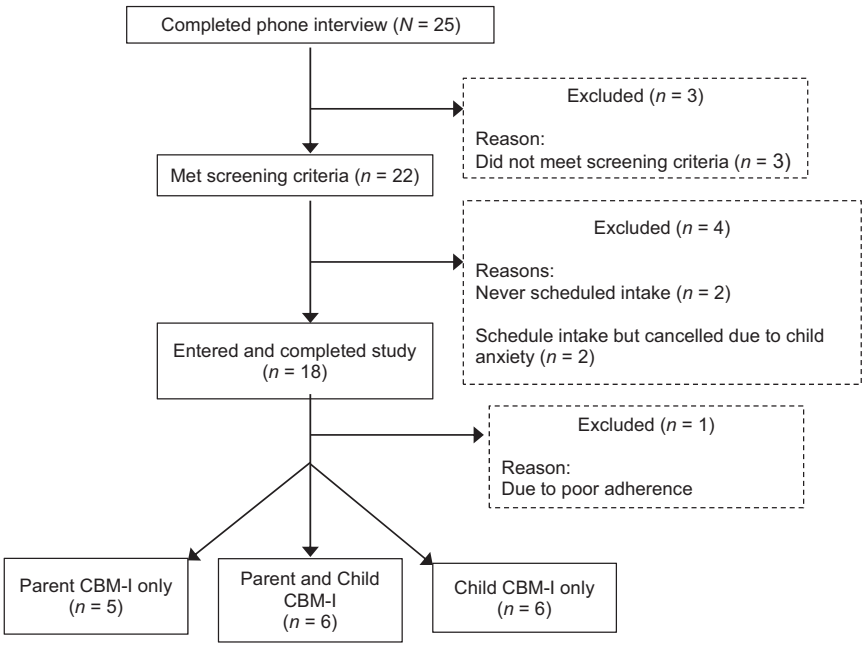


**Fig. 1.** Consolidated standard of reporting trials (CONSORT) diagram.

saw, "Do your classmates think your joke is funny?" and two boxes, labeled "yes" and "no," respectively. Participants clicked the appropriate "yes" box and then saw the next scenario. (Participants also received feedback for incorrect answers and could not proceed to the next scenario without indicating the correct answer.) An example of a parent scenario is, "Your son has a class presentation coming up. He asks you to ask his teacher if he can write a paper instead. You decline because your son is c_pable of doing this public speaking." Parents typed an "a" to complete the word "capable." A comprehension question then followed – "Is your son able to complete his class presentation?" – and parents clicked the "yes" box to indicate the correct answer. A male and female version of each scenario was created to match the child's gender.

Youth and parent training and assessment materials targeted beliefs that are empirically and theoretically linked to social anxiety (e.g., "Negative evaluation by others is highly likely;" "I'm unable to cope with negative social events, such as blushing or spilling") and to parent intrusive behavior (e.g., "My child cannot tolerate anxiety;" "It is my job to get rid of my child's anxiety"), respectively. Note, the full list of targeted beliefs is available from the first author, as well as details on the proportions of scenarios that targeted each belief, and copies of the training materials and associated comprehension questions.

Development of the training and assessment materials (e.g., CBM-I scenarios) involved modifying items from previous research (Benoit, 2013; Vassilopoulos et al., 2009), composing novel items, and iteratively revising them in response to feedback. Five graduate student raters and one post-baccalaureate rater each rated a subset of scenarios for validity (i.e., Does the scenario target the belief it intends to target?), valence (i.e., Is the scenario resolved in a benign way?), and clarity (i.e., Is what's happening in the scenario easily comprehensible?). If an item received <4 on a 5-point Likert scale used for each dimension (with higher numbers indicating greater validity, positive valence, or clarity), a revised version was submitted to another rater. This process was repeated until all CBM-I scenarios received ratings ≥4 in all categories.

In two 90-min focus groups (3 youth per group), and one 90-min meeting with an early adolescent and his mother, youth ($n = 7$ total) were asked for feedback on the training scenarios, the assessment materials, and the CBM-I web program (e.g., whether the language was age-appropriate, whether the scenarios were similar to those they might encounter, and what additional scenarios might be relevant to participants). Similarly, three parents of typically developing children in the age range of our sample were asked whether scenarios were relevant and age-appropriate for their children. Of note, the vast majority of focus group feedback about the scenarios was positive and resulted in few, minor changes (e.g., word substitutions). On the other hand, several additions to the intervention sessions were added in response to feedback. For example, relevant images accompanied approximately five scenarios per session. Progress bars at the top of the screen and reinforcing sounds between blocks (e.g., a crowd cheering) aimed to convey a sense of accomplishment.

### 2.3. Materials[1]

#### 2.3.1. Phone screening measure

*2.3.1.1. Probable social anxiety disorder diagnosis in children.* Parents were administered a semi-structured phone interview based on the social anxiety section of the structured clinical interview for DSM Disorders (SCID; First, Spitzer, Gibbon, & Williams, 1996) that included questions assessing DSM-IV criteria for social anxiety (which are consistent with DSM-5 criteria for social anxiety), as well as basic demographic information.

#### 2.3.2. Intake measures

*2.3.2.1. Social anxiety diagnosis in children.* Clinical psychology graduate students trained in semi-structured interviewing administered selected sections of the Anxiety Disorders Interview Schedule-Child/Parent versions (ADIS-C/P) in person at intake and at follow-up. Both parents and children were administered the social anxiety module of ADIS. Based on literature suggesting that children may identify more of their internalizing symptoms than

[1] The materials reported here are part of a larger study that examined changes following CBM-I. We focus here on the measures specific to social anxiety because these reflect our main questions, but other measures (e.g., Children's Depression Inventory) were also administered. A full list of measures is available from the first author.

their parents, and parents may report more of their children's externalizing symptoms than their children (Herjanic, Herjanic, Brown, & Wheatt, 1975; Rapee, Barrett, Dadds, & Evans, 1994), children were also administered specific phobia, panic, agoraphobia, generalized anxiety disorder (GAD), obsessive compulsive disorder (OCD), post-traumatic stress disorder (PTSD), dysthymia, and major depressive disorder modules of the ADIS, while parents were administered the separation anxiety disorder, school refusal, attention-deficit hyperactivity disorder (ADHD), and conduct disorder modules. However, given the reticence of many child participants during the intake interview, data from parents' interviews were used to determine social anxiety disorder diagnosis before and after the intervention (note, parent report has been used in prior studies; e.g., Alfano et al., 2009).

To assess inter-rater reliability for social anxiety diagnoses, an upper-level graduate student who was not involved with the current study coded a subset of video-recorded parent ADIS administrations. Specifically, 50% ($n = 9$) of the social anxiety modules of the parent intake interviews and 50% ($n = 9$) of the social anxiety modules of the parent follow-up interviews were double coded. Agreement between coders was 79%, indicating good reliability.

*2.3.2.2. Intellectual functioning.* Children's intellectual functioning was also assessed at intake to ensure that child participants could meet the verbal and conceptual demands of the intervention. The Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999) is a gold standard cognitive assessment for children that was administered to determine whether participants had at least average cognitive functioning (defined as full scale IQ greater than or equal to 85, following Alfano et al. (2009)).

*2.3.3. Primary outcome measure: Child social anxiety symptoms*

The Social Anxiety Scale for Adolescents-Revised (SAS-A; LaGreca & Lopez, 1998; average Cronbach's alpha across all time points = 0.95; range 0.94–0.97) was administered to children in the clinic at intake, and online during the baseline period, after the first, third, sixth, and eighth CBM-I session, and at follow-up, to assess change in anxiety symptoms. The SAS-A called on participants to rate the frequency with which they experience social anxiety symptoms on a Likert scale from 1 (not at all) to 5 (all of the time). While some of our participants in the lower end of our age range were younger than those in the norming groups for this measure, the language in the adolescent version seemed more appropriate for the majority of our participants. Versions of this self-report scale have been used in prior child CBM-I studies (Vassilopoulos et al., 2009), and it has also shown sensitivity to change in several clinical intervention trials (e.g., March, Entusah, Rynn, Albano, & Tourian, 2007). SAS-A Total scores were primarily used in analyses, though its three factors—fear of negative evaluation (FNE), social avoidance and distress in new situations (SAD-New), and general social avoidance and inhibition (SAD-Gen)—were also analyzed separately for exploratory purposes.

*2.3.4. Primary assessment of cognitive bias change: Interpretation bias*

Recognition ratings were created to assess whether training altered interpretations assigned to novel ambiguous scenarios (Mathews & Mackintosh, 2000). Parent and child versions were administered to participants during clinic based assessments at intake, after Sessions 3, 6, 8, and at follow-up. Recognition ratings consisted of three phases. First, similar to CBM-I, participants were instructed to read and imagine themselves in six ambiguous scenarios and complete a word fragment. In contrast to training, however, the emotional ambiguity in the scenarios was not resolved with the word fragment. Second, participants engaged in a 3-min distractor activity (i.e., working on a jigsaw puzzle, adapted from Steinman & Teachman, 2010). Finally, participants read both a positive and a negative interpretation of each original ambiguous scenario and rated each for its similarity in meaning to the original ambiguous scenario on a 4-point scale from very different to very similar.

In general, Cronbach's alpha for recognition ratings was acceptable for both positive and negative interpretations across all time points, though within the low range (average alpha = 0.61 for youth, and average alpha = 0.72 for parents). However, extremely low alphas in two cases (i.e., alpha = 0.22 for parent negative interpretation bias after Session 3, and alpha = 0.12 for child negative interpretation bias at follow-up) indicate this variable should be interpreted cautiously.

*2.3.5. Descriptive analyses of variables of interest*

Parent intrusive behaviors and child behavioral avoidance were assessed at intake and during clinic-based assessments after intervention Sessions 3, 6, 8, and at follow-up. Descriptive analyses probed the relationships between these variables and youth's social anxiety symptoms. Participant exit interviews assessed their subjective experience of participating in the intervention.

*2.3.5.1. Observed child behavioral avoidance and parent intrusive behaviors.* An intentionally anxiety provoking social stressor behavioral avoidance task (BAT) was modified from BATs frequently used in child anxiety research (e.g., Becker & Ginsburg, 2011) to provide an ecologically valid measurement of avoidance and distress. The BAT consisted of four phases: (1) presentation of instructions by the research assistant, including instructions for parents and children to meet for a 3-min planning session in a private room, (2) completion of parent and child self-report questionnaires predicting performance and distress (not discussed in the current study), (3) delivery of speech (if child participant agreed) immediately after the parent–child planning discussion and questionnaire completion, and (4) parent and child 1-min discussion in private room after the speech. Participants were made aware that each phase was videotaped. Parent intrusive behaviors (e.g., unsolicited help to child in planning the speech) were coded following Becker and Ginsburg (2011). The number of parent intrusive behaviors observed in the 3-min preparation period before the speech (phase 1) was combined with the number of intrusive behaviors observed in the 1-min discussion period after the speech (phase 4) to create a composite of parent intrusive behavior. The duration of the child's speech indexed child avoidance.

To establish inter-rater reliability among our coders, the three undergraduate research assistant coders underwent training and coded videos that showed mock BAT sessions. After independently coding a set of three mock videos, Krippendorf's alpha was modest (alpha = 0.65), so coders met with the first author to discuss discrepant ratings and then coded a second set of three mock videos. Following this second round of coding, Krippendorf's alpha indicated strong inter-rater reliability (alpha = 0.97).

*2.3.5.2. Child report and parent self-report of parent intrusive behavior.* The Parent Activities Questionnaire (PAQ; designed for this study with contributions from Wood, 2006) is a novel measure of parental intrusiveness that included eight core items measuring parental intrusiveness, as well as four distractor items. Two core items and several distractor items were borrowed (with permission) from Wood's (2006) Parent Child Interaction Questionnaire (PCIQ), and six new items were created for this study. The PAQ called on parents and children to rate the frequency of several parent behaviors on a Likert scale from 1 (this never occurred) to 5 (this almost always occurred), including behaviors indicating a parent's help with activities that youth would presumably be able to perform independently (e.g., "I helped my child decide what to wear so s/he would look nice for school."), invasions of space

(e.g., "My parent came into my room without knocking when the door was closed to talk to me."), and other behaviors that might be considered infantilizing (e.g., use of immature language). Mean Cronbach's alpha across all time points for youth was in the low to acceptable range (i.e., mean alpha = 0.65; range 0.61–0.72); however, the mean Cronbach's alpha across all time points for parents was much lower (i.e., mean alpha = 0.37; range −0.24–0.59). The surprising negative alpha value indicates very poor internal consistency, and suggests results for this variable must be interpreted cautiously.

*2.3.5.3. Participants' subjective experience of the intervention.* Exit interviews at follow-up probed participants' thoughts about various aspects of the intervention, including feasibility and acceptability. To flexibly guide interviews, the first author used a list of topics to be discussed but also facilitated an open-ended conversation.

### 2.4. Procedure

Parents who endorsed clinical levels of social anxiety in their child during phone screening were invited to the clinic with their child for the intake assessment, which included diagnostic interviewing, cognitive assessment, and administration of recognition ratings, the BAT, and PAQ (and other questionnaires not analyzed in the current study; a full list is available from the first author). Participants were also shown how to complete the intervention on the computer, and provided with a calendar showing target dates for completing baseline assessments at home. After the baseline assessment period, participants completed the eight sessions of CBM-I online from their personal computers, and returned to the clinic after Sessions 3, 6, 8, and at 1–2 month follow-up for additional assessments, including recognition ratings (different items each time), the BAT, and PAQ.

## 3. Results

### 3.1. Adherence

All participants completed the entire study protocol, indicating overall excellent adherence. Participants were told that measures and/or sessions should be completed every three days, but that this timeline could be somewhat flexible in order to accommodate family's busy schedules. The mean (SD) and modal number of days between measures was 4.5 (2.84) and 3, respectively, suggesting that most measures and/or sessions were completed every three days, with some variability[2]. In five cases, children's participation "paused" for 10 or more days between sessions. In casual conversations with study personnel, mothers cited competing family and school commitments as barriers to maintaining a consistent intervention schedule.

Notwithstanding overall strong adherence, Child Participant 6's data were excluded in advance of conducting the primary analyses due to probable indiscriminant responding. Item analysis of Participant 6's responses to sessions 6 and 8 revealed that he chose the identical response for every item on the SAS-A (i.e., 4 on the 5-point Likert scale). Moreover, his reaction times in responding to SAS-A questionnaire items at all time points were uniformly faster than the mean reaction times of the full sample, further evidence that he may not have been responding in a thoughtful way.

### 3.2. Data analytic plan

Using the SAS-A as the primary outcome measure, results from the following analyses were integrated to assess the intervention's efficacy within and across the three conditions: graphical, clinically significant change, and effect size analyses; multilevel modeling; and comparison of child diagnostic status at intake versus at follow-up. Effect size analyses of change in interpretation bias, and descriptive analyses of parent intrusive behavior, child avoidance, and participant exit interviews aimed to generate hypotheses for future research.

### 3.3. Change in social anxiety symptoms

#### 3.3.1. Graphical analyses

SAS-A Total scores were plotted to infer changes caused by the intervention. Marked reductions in SAS-A scores after – but not before – the intervention commenced suggest a causal link between the intervention and reductions in symptoms (Kazdin, 2003). In keeping with three as the generally acknowledged minimum number of baseline assessments (Kazdin), most participants received three baseline measures (though due to administrative error, four participants received one additional baseline measure). Notably, the range among the baseline scores for each individual participant was less than one standard deviation, based on the variance reported on the SAS-A from LaGreca and Lopez (1998), which suggests stable baseline responding.

The first author and three additional, independent raters (two graduate students and one post-baccalaureate research assistant) each independently analyzed de-identified versions of all graphs and assigned each to one of four categories: (1) substantial reduction in symptoms *because* of the intervention, as indicated by symptom levels that decreased substantially over the course of the intervention at a rate (i.e., slope) that was clearly greater than during the baseline period; (2) substantial reduction in symptoms not clearly linked to the intervention, as indicated by overall decreases in symptom levels, but with no clear difference between slopes in the baseline and intervention periods; (3) no substantial change in symptoms; and (4) worsening of symptoms, though no graphs indicated worsening.[3] While raters were encouraged to "eye" the graphs (following convention; e.g., Parsonson & Baer, 1978), they were told the normative standard deviation for SAS-A Total scores from LaGreca and Lopez (1998) as a benchmark for substantial reductions in symptoms. If at least three of the four raters agreed on a category assignment, the classification was considered valid. Raters met in person to discuss cases with lower inter-rater agreement and determined a final classification collaboratively. Participants whose graphs were assigned to the first three categories are henceforth referred to as "treatment responders,"

[2] Child Participant 1 had some difficulty following study protocol. First, twice during the baseline period, she completed two SAS-A assessments consecutively; on these two occasions, only the first score this participant provided was used in analyses. Second, one of Participant 1's SAS-A total scores was over three times as high as that of the session before or after it and thus designated as an outlier and excluded from analyses. Third, Participant 1 provided data from one additional intervention session that was averaged with the data from the following session to result in one composite score for both sessions. Finally, Participant 1 began but never finished several additional sessions. Unfortunately, a record of exactly what proportion of the sessions she completed is not available. For these reasons, Participant 1's data should be interpreted cautiously.

[3] Child Participant 6, who was excluded from analyses (see "Data preparation" section), showed mild worsening in symptoms over the course of the baseline period, intervention, and Follow-up. While this could be suggestive of iatrogenic effects, the slight increasing slope was actually steeper during the baseline period than the intervention period, suggesting any increase in symptoms was unlikely due to the intervention. Also, interestingly, during exit interviews, Child Participant 6's mother reported improvements in his social anxiety; Child Participant 6 himself reported no improvements, but he also denied that the intervention hurt him in any way.

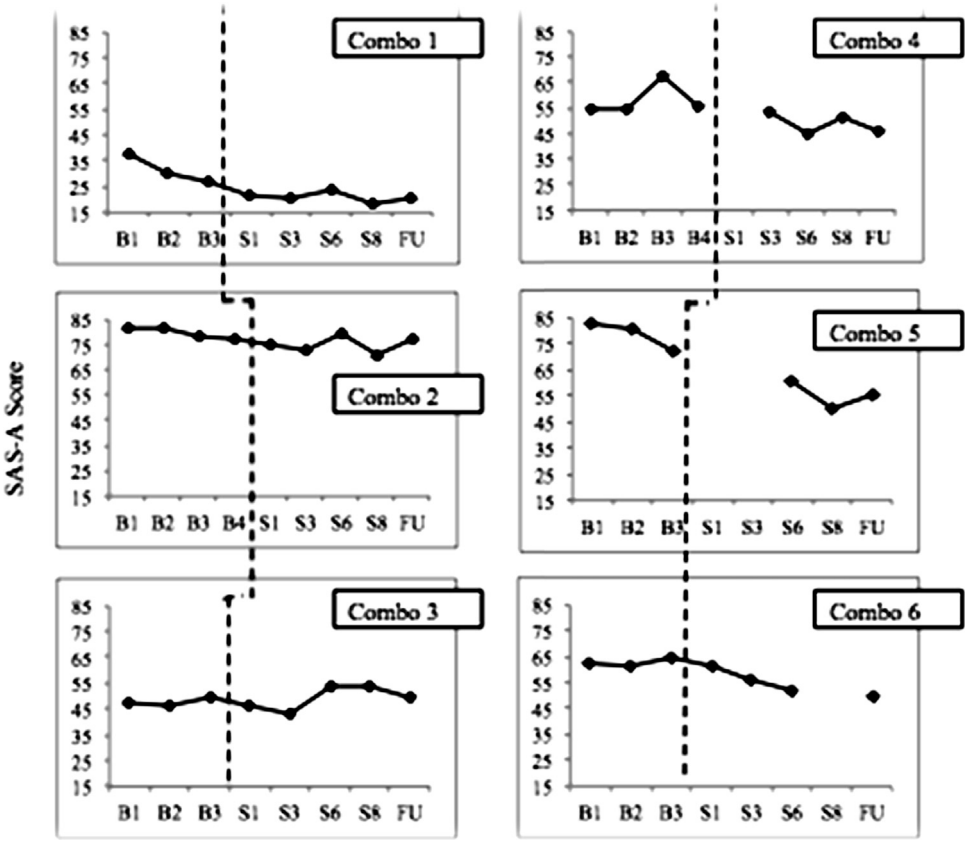


**Fig. 2.** Graphs of SAS-A total scores over baseline and treatment phase for participants in Combo condition. In this and subsequent graphs, the dotted vertical line marks the end of the baseline period and the beginning of the intervention period. On the *X*-axis, B1 = the first baseline score, B2 = the second baseline score, etc., and S1 = the score after intervention Session 1; S3 = the score after the intervention Session 3, etc., and FU = the score at clinic-based follow-up session. The *Y*-axis indicates SAS-A total scores.

"improvers," and "non-changers," respectively. See Figs. 2–4 for each individual's graph.

*3.3.1.1. Combo group.* Out of the six participants in the Combo condition, Participants 5 and 6 were considered treatment responders after Session 8, and Participants 4, 5, and 6 were considered treatment responders at follow-up. The remaining participants in the Combo group were assessed to be non-changers. In sum, approximately half of the participants from the Combo group experienced substantial reductions in anxiety due to the intervention.

*3.3.1.2. Child-only group.* Out of six participants in the Child-only group, Participant 4 was the only treatment responder. Participant 1 was considered an improver after Session 8 and at follow-up, as was Participant 3 at follow-up only. All other participants were non-changers. Thus, half of the participants in the Child-only group improved over the course of the intervention, but only one participant's improvement can be causally linked to the intervention.

*3.3.1.3. Parent-only group.* Out of five participants in the Parent-only group, two (Participants 2 and 3) showed substantial reductions in symptoms, but they were not assessed as causally linked to the intervention.

*3.3.2. Clinically significant change indices*

According to Jacobson and Truax (1991), two criteria must be satisfied to determine clinically significant change: (1) the reliable change index (RCI) exceeds the cut-off established for significance (i.e., 1.96, when alpha is set at $p < 0.05$), indicating an individual's pre- and post-treatment functioning are significantly different, and (2) post-treatment scores are less than 1 standard deviation higher than the normative mean, indicating that symptoms are in the typical, healthy range. A thorough review of published norms determined that SAS-A test-retest reliabilities reported in Garcia-Lopez, Olivares, Hidalgo, Beidel, and Turner (2001), and means and standard deviations reported in Inderbitzen-Nolan and Walters (2000) were most appropriate for use in the current analyses.

Across all conditions, 35% of participants showed clinically significant change. This proportion is somewhat lower than that of participants who showed substantial improvement according to graphical analyses (i.e., 47%), but still suggests that the intervention was efficacious for about a third of participants. Again, the proportion of participants showing clinically significant change was similar across conditions.

*3.3.3. Social anxiety diagnosis*

According to ADIS interviews with parents, all but two children in the Child-only condition and one child in the Parent-only condition ($n = 3$) still met criteria for social anxiety disorder at follow-up. While this finding suggests that parents saw little improvement in their child's social anxiety, 12 (~70%) of parents' "interference ratings" (i.e., the extent to which social anxiety impaired their child's functioning) declined, suggesting over two thirds of parents saw improvements in their child's functioning following the intervention (mean reduction in parent ratings = 0.74; mean reduction in child ratings = 2.12 on a 0–8 scale).

*3.3.4. Multilevel models*

Multilevel modeling complements visual inspection and clinically significant change analyses by quantitatively modeling group-level longitudinal data within a regression framework. The two levels of the model specified were sessions (Level 1) and

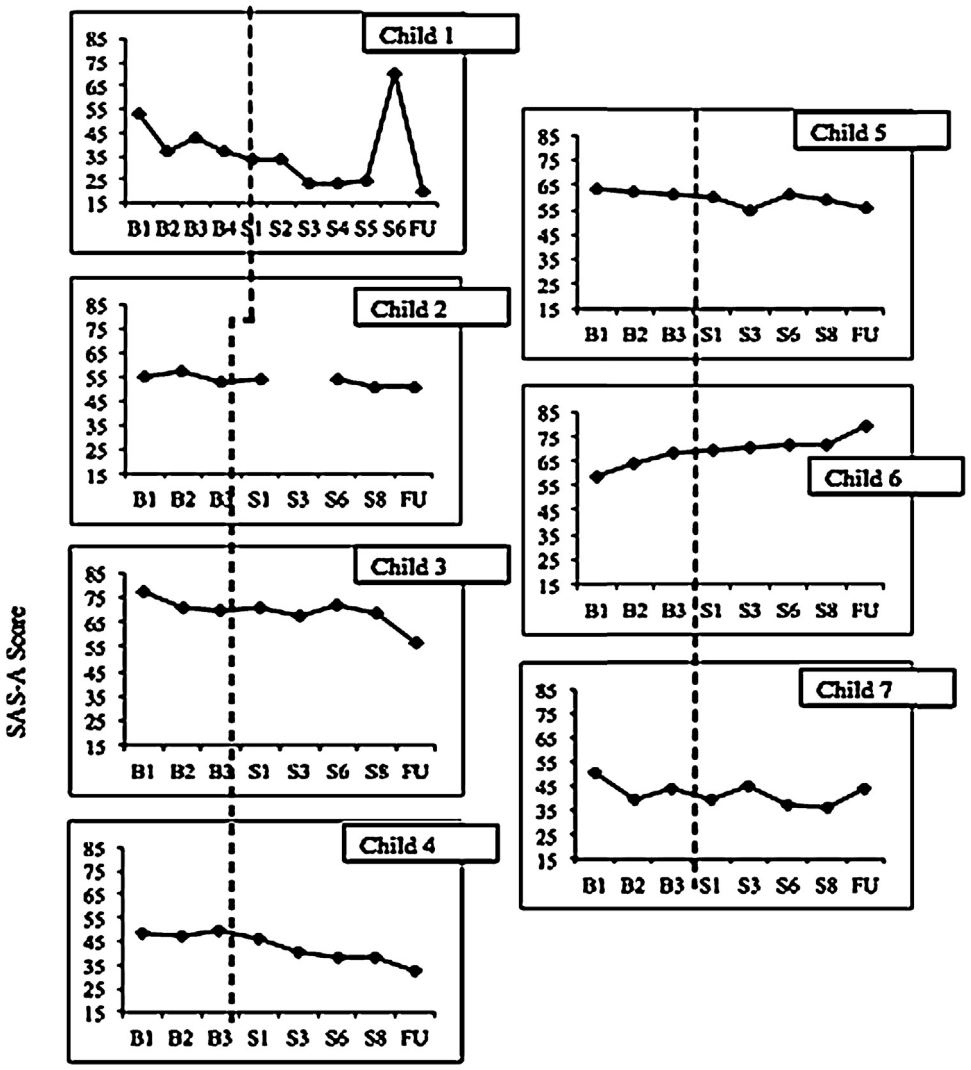


**Fig. 3.** Graphs of SAS-A total scores over baseline and treatment phase for participants in Child-only condition.

participants (Level 2). Initial analyses used piecewise linear growth modeling, with session time points entered into both a random slopes model and a random intercept model as continuous across time. Results either indicated convergence problems or suggested that effects were non-linear. Therefore, a random intercepts model was specified wherein session time point was entered as a categorical (as opposed to continuous) variable to investigate non-linear effects of the intervention. Evidence that the intervention had a unique effect (i.e., changes in scores above and beyond any changes that occurred during the baseline assessment phase) would be indicated by the following results: no significant differences in mean SAS-A scores across baseline time points, and significantly lower mean SAS-A scores across intervention session and follow-up time points than across baseline time points. An interaction term tested whether this pattern was the same or different across each of the three intervention groups.

Using the SPSS MIXED command, the following random intercept model was tested:

Level 1: $Y_{\text{SAS-A}} = \mu + \alpha_i + \beta_j + \alpha\beta_{ij} + \varepsilon_{ij}$ where $\varepsilon_{ij} \sim n\,(0, \sigma^2)$

Level 2: $\mu = \gamma_0 + \mu_{0i}$ where $\mu_{0i} \sim n\,(0, \tau^2)$

Results showed a significant main effect of session, $F$ (8, 99.18) = 3.92, $p < 0.001$, indicating that mean SAS-A scores across all baseline and intervention sessions were not equal. Planned contrast comparisons between all baseline and all intervention sessions showed that baseline SAS-A scores were significantly greater than SAS-A scores following intervention sessions, as expected, $F$ (1, 138) = 13.15, $p < 0.001$. Also as hypothesized, *post hoc* pairwise comparisons using fishers least significant difference (LSD) test showed (1) no differences among baseline scores, indicating that participants' social anxiety symptoms were stable during this period, and (2) significantly lower mean SAS-A scores across most session and follow-up time points than across baseline time points, highlighting a positive effect of the intervention. In contrast, results showed no effect of CBM-I condition, $F$ (2, 14.73) = 0.07, $p = 0.93$, again indicating that which condition participants were assigned to did not significantly affect results. Finally, results showed no condition by session interaction, $F$ (16, 99.18) = 0.42, $p = 0.98$, indicating that changes across session scores did not differ across conditions. Notably, Session 1 scores were significantly lower than only one baseline score; however, scores following Session 3 were lower than *all* baseline scores, suggesting that the intervention's effects strengthened with that additional "dose" of the intervention. These gains were generally maintained from Session 3 forward (with one minor exception at Session 6), and the absence of differences between Sessions 3, 6, 8, and follow-up assessments suggest that most of the gains had been made by Session 3. (Full results are available from the first author.)

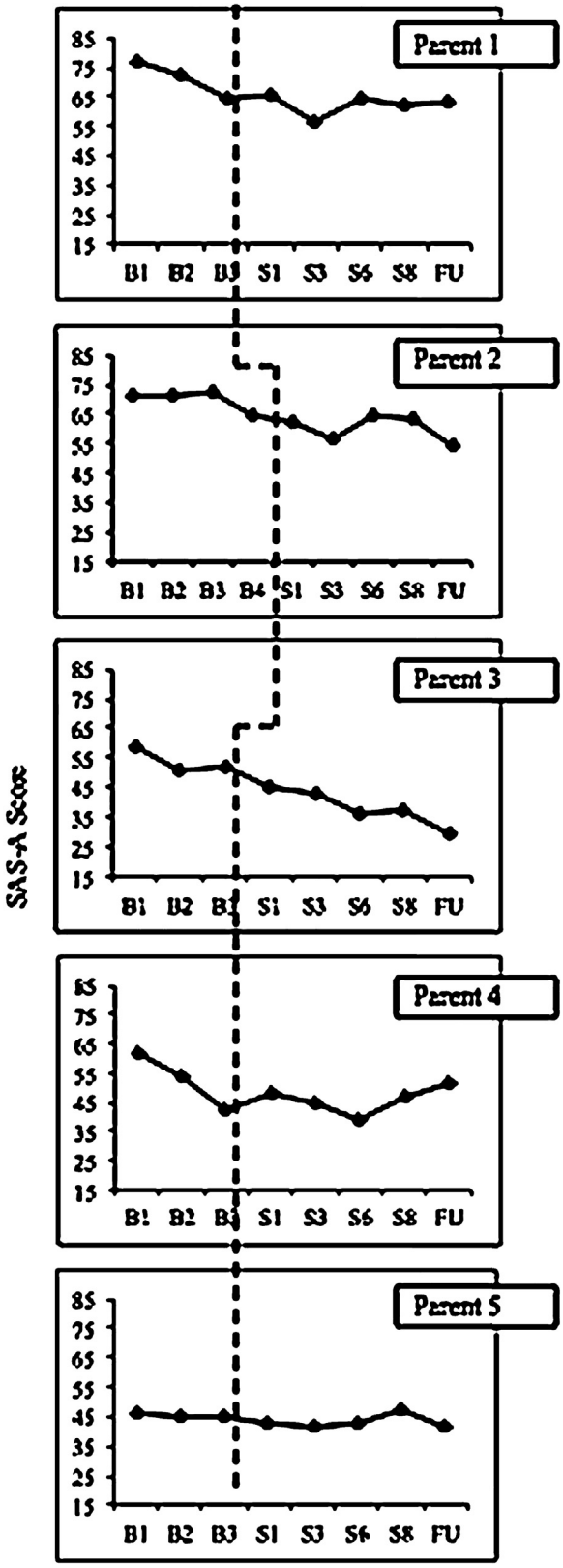


**Fig. 4.** Graphs of SAS-A total scores over baseline and treatment phase for participants in Parent-only condition. In sum, 47% of the sample showed improvement after Session 8 and/or at follow-up, and in half those cases, the intervention appeared to play a causal role. The number of participants who improved was similar across conditions, but most treatment responders were in the Combo condition, and none were in the Parent-only condition.

**Table 1**
Cohen's *d* effect sizes for child social anxiety by condition.

| Group | SAS-A Total | FNE | SAD-New | SAD-Gen |
|---|---|---|---|---|
| **Combo** | | | | |
| Post-8 | 0.87 | 0.58 | 1.28 | 0.45 |
| Follow-up | 1.12 | 0.75 | 2.37 | 0.38 |
| **Child-only** | | | | |
| Post-8 | 1.23 | 1.10 | 1.27 | 0.71 |
| Follow-up | 1.30 | 1.09 | 1.06 | 1.05 |
| **Parent-only** | | | | |
| Post-8 | 1.35 | 1.74 | 0.88 | 0.35 |
| Follow-up | 1.59 | 3.40 | 0.39 | 1.34 |
| **Full sample** | | | | |
| Post-8 | 1.14 | 1.00 | 1.12 | 0.44 |
| Follow-up | 1.38 | 1.21 | 0.97 | 0.80 |

*Notes.* "Post-8" effect size calculations were based on participants' intake score and score following Session 8; "Follow-up" effect size calculations were based on participants intake score and score at follow-up. SAS-A Total = total score of the Social Anxiety Scale for Adolescents; FNE = Fear of Negative Evaluation subscale of the SAS-A; SAD-New = Social Avoidance and Distress in New Situations subscale of the SAS-A; and SAD-Gen = General Social Avoidance and Inhibition subscale of the SAS-A.

In sum, results suggest that, as expected, participants' social anxiety did not change during the baseline period, but did decline during the earlier part of the intervention. On average, these early gains were maintained throughout the rest of the sessions and through the follow-up assessment. Participants' condition did not affect this pattern.

#### 3.3.5. Cohen's d effect sizes

Cohen's *d* effect sizes for SAS-A Total scores and SAS-A subscales were calculated for each group and the total sample. See Table 1. Though our small, pilot sample warrants cautious interpretation of results, Cohen's *d* analyses suggest mostly large effect sizes for all subscales, with no pronounced differences across conditions. Specifically, the effect sizes for SAS-A Total scores for all conditions were 1.14 and 1.38, after Session 8 and at follow-up, respectively. Taken together with the analyses described above, these results provide additional evidence supporting the efficacy of the intervention for at least a subset of participants, with no reliable differences among conditions.

### 3.4. Change in Interpretation bias

Effect sizes for parent and child measures of positive and negative interpretation bias were calculated in the same manner as for SAS-A scores. As seen in Table 2, mostly negative effect sizes for both youth and parent positive interpretation bias (indicating an *increase* in positive ratings), and mostly positive effect sizes for both youth and parent negative interpretation bias (indicating a *decrease* in negative ratings), indicate that the direction of effects was as expected. Though, again, our small sample warrants cautious interpretation of results, these analyses indicate mostly small effect sizes, but a very wide range, from extremely small (0.002) to very large (−1.61). In general, larger effect sizes were seen for change in parent than child interpretation bias, with no substantial differences in effect sizes between positive and negative bias, and no substantial differences among conditions.

### 3.5. Descriptive examination of change in child avoidance and parent intrusive behavior

To investigate the extent to which changes in child avoidance and parent intrusive behavior were correlated with changes in child social anxiety symptoms over the course of the intervention, separate regression equations were run for each participant for each

**Table 2**
Cohen's *d* effect sizes for interpretation bias by condition.

| | Youth Pos. Interp. Bias | | Youth Neg. Interp. Bias | | Parent Pos. Interp. Bias | | Parent Neg. Interp. Bias | |
|---|---|---|---|---|---|---|---|---|
| | Post-8 | Follow-up | Post-8 | Follow-up | Post-8 | Follow-up | Post-8 | Follow-up |
| Combo | −0.60 | −0.33 | 0.55 | 0.31 | −1.12 | −1.61 | 0.88 | 0.67 |
| Child-only | −0.26 | 0.43 | 0.50 | 0.34 | −0.13 | 0.21 | 0.43 | 0.98 |
| Parent-only | 0.13 | −0.31 | −0.12 | 0.22 | −0.94 | −0.31 | 0.85 | 0.49 |
| Full sample | −0.23 | 0.00 | 0.47 | 0.35 | −0.15 | 0.30 | 0.16 | 0.88 |

*Notes.* "Post-8" effect size calculations were based on participants' intake score and score following Session 8; "Follow-up" effect size calculations were based on participants intake score and score at follow-up. Pos. Interp. Bias = positive interpretation bias; Neg. Interp. Bias = negative interpretation bias. Positive effect sizes indicate the expected direction of change for negative interpretation bias; negative effect sizes indicate the expected direction of change for positive interpretation bias.

**Table 3**
Correlations among changes in symptoms, child avoidance, and parent intrusive behavior.

| Measure | 2. | 3. | 4. |
|---|---|---|---|
| 1. Change in self-reported child social anxiety symptoms | 0.09 | −0.38 | −0.26 |
| 2. Change in observed child behavioral avoidance | | −0.02 | 0.01 |
| 3. Change in parent-reported parent intrusive behaviors | | | 0.15 |
| 4. Change in child-reported parent intrusive behaviors | | | |

*Note.* All $p > 0.05$.

of these variables of interest. Specifically, social anxiety symptoms, child avoidance, and child- and parent-reported parent intrusive behavior were each regressed on time point to yield each participant's rate of change (i.e., slope coefficient) on these variables over the course of the intervention. Next, Pearson correlations between the slope of participants' social anxiety symptoms with the slopes for avoidance and intrusive behavior were examined to estimate the extent to which the change processes were related. As seen in Table 3, the effect sizes also tended to be small, suggesting weak relationships among the change processes. This raises interesting questions about what variables do account for the observed changes in child social anxiety symptoms, especially in light of the unexpected small to moderate effects for decreasing symptoms tied to increasing parent intrusive behaviors.

### 3.6. Participant exit interviews

Participants' interview responses were assessed for common themes.

#### 3.6.1. Self-perceptions of change often conflicted with other measures

In almost all cases, non-changers and their parents reported improvements in child social anxiety; one non-changer even ranked her progress as an "8" on a scale of 1–10. Strikingly, treatment responders and their parents sometimes reported even less improvement than non-changers.

#### 3.6.2. Materials normalized social anxiety

Several youth stated that repeated exposure to scenarios involving socially anxious youth made them realize that most of their peers probably could identify with the scenarios as well. Many participants reported that coming to appreciate social anxiety as a more shared experience helped reduce their symptoms.

#### 3.6.3. Assessment sessions were perceived as a helpful part of the intervention

Assessment sessions appeared to have served a therapeutic function as well. Consistent with theories of exposure, many participants found giving speeches and interacting with research assistants to be therapeutic. Some parents suggested that positive experience with study personnel might have disconfirmed their child's negative beliefs about new social experiences.

#### 3.6.4. Parents' awareness of their responses to their child's anxiety

Several parents stated that the intervention "opened their eyes" to ways they may have been enabling their children's anxiety and/or "opened a dialogue" with their child about family practices that may be contributing to anxiety. At the same time, some parents reported that even with raised awareness, they did not necessarily change their parenting behaviors dramatically. Of note, parents in the Child-only group who did not receive the intervention mentioned their raised awareness, suggesting that even assessments of parent intrusive behaviors may have spurred thought and discussion.

#### 3.6.5. Online format was feasible and acceptable

In addition to participants' strong adherence to the study protocol, several other indicators from exit interviews suggest high feasibility and acceptability. All but one participant said that they preferred to complete the intervention at home, versus at the clinic. The majority of participants said the length and frequency of each session was acceptable. All participants indicated instructions were clear and easy to follow. Most parent participants found the program's interface acceptable and denied that its simplicity hindered their engagement. Most children found the interface clear and easy to use as well, but reported that a more elaborate interface would have facilitated their engagement. Many children had suggestions for improvement, such as adding more pictures and sounds, and making it look more similar to contemporary videogames and web pages.

## 4. Discussion

The primary goals of this pilot study were to evaluate the feasibility and preliminary efficacy of CBM-I for socially anxious youth and their parents. To test whether including parents in treatment would improve outcomes in youth, participants were randomized to three conditions that included children only, parents only, or both in treatment (i.e., the Combo condition). It was hypothesized that all youth would show reductions in negative interpretation bias, increases in positive interpretation bias, and decreases in social anxiety symptoms, and that effects would be greatest for those in the Combo condition.

Findings partially supported hypotheses. Convergent results across several analyses suggest that approximately half of the youth in our small sample experienced substantial symptom improvement over the course of the CBM-I intervention. In at least half these cases, the intervention appears to have caused these gains, while in the other half, the causal agent is more difficult to discern, largely because gains had already begun to emerge during the baseline period. Effect size analyses (which warrant cautious interpretation

due to our small sample) indicated large effects for symptom reductions in youth, and changes in both youth and parent interpretation biases in the expected directions, albeit of a smaller magnitude than has been reported in a recent meta-analysis of adult CBM-I (Menne-Lothmann et al., 2014). Unexpectedly, descriptive analyses of parent intrusive behavior and child avoidance showed little evidence that they were related to observed symptom reduction. Across analyses, results suggested no reliable differences across conditions, or between Session 8 and follow-up, suggesting maintenance of gains. Full completion of the study by all participants indicated strong adherence.

### 4.1. Evaluating efficacy

Results of graphical and clinically significant change analyses could be interpreted as conferring only modest support for the efficacy of CBM-I, with 24% of participants showing change clearly linked to CBM-I via graphical analysis, and 35% showing clinically significant change. However, graphical analysis is a particularly stringent method, given that changes have to be so large as to be obvious to the eye, a relatively insensitive "instrument" (Parsonson & Baer, 1978). Similarly, in providing a dichotomous measure of improvement, clinically significant change analyses, as well as diagnostic classification based on parent ADIS interview, are also quite stringent. Of note, many anxious youth remain symptomatic even following well-established clinic-based treatments (Seligman & Ollendick, 2011), highlighting the importance of continuous measures that capture incremental change.

Cohen's *d* effect size analysis, on the other hand, suggested larger effects than would be inferred from graphical and clinically significant change analyses. In fact, the effect sizes for the whole sample, 1.14 after Session 8 and 1.38 at follow-up, are larger than effect sizes estimated by meta-analyses of child CBT treatment studies (cf. 0.94 as reported in Ishikawa, Okajima, Matsuoka, and Sakano (2007)). We note though that the effect sizes in the meta-analyses typically compared treatment to wait-listed control groups, which, taken together with our small sample, challenges direct comparison to the current study's effect sizes. Nonetheless, mixed modeling provided corroborating evidence that a substantial proportion of our sample improved over the course of the intervention. Evidence that the intervention likely *caused* these improvements comes from the convergence of: graphical analyses, mixed modeling, epidemiological data suggesting that social anxiety is unlikely to remit spontaneously (Ollendick & Hirshfeld-Becker, 2002), the findings of stability in our baseline assessments, and our participants report of no changes in concurrent treatments during or 6 weeks prior to the study.

Notably, the proportion of our participants who showed substantial reductions in symptoms was not especially different from the rates typically observed for the current gold standard treatment for child anxiety, CBT. Specifically, approximately 50% of our sample showed significant symptom reduction, compared to an expected 60% for CBT (Kendall et al., 2012). Yet, 100% of our sample completed the study protocol, whereas, by some estimates, 20% of children do not complete a course of CBT (March, Spence, & Donovan, 2009). Of course, higher efficacy and strong adherence for both interventions would be ideal; yet when considering the expense and therapist access required for CBT, the promise of a lower cost and more accessible alternative compels future research.

These results compare favorably with prior youth CBM-I research, which has often shown interpretation bias change—but rarely shown symptom change (see Lau, 2013, for a review). The current findings of symptom change for a substantial proportion of participants, with effect sizes that can tentatively be interpreted as large, suggest that the methodological modifications we applied to existing CBM-I paradigms may have improved outcomes.

In particular, our study corroborates existing evidence that supports the administration of multiple sessions of ecologically valid CBM-I to a clinically diagnosed sample, though many questions remain. Better effects with more severely symptomatic samples mirrors a trend seen in the adult literature (Hallion & Ruscio, 2011) that may suggest that more severely symptomatic samples have more "room" to change (Reuland, Steinman, & Teachman, 2014). Of note though, the only published youth CBM-I study to include a clinical sample showed null results for symptom change (Fu et al., 2013); however, the sample in Fu et al. consisted of individuals with either generalized anxiety disorder or social anxiety disorder, and the CBM-I intervention included one session with materials targeting both. With only half of the CBM-I scenarios relevant to the content of their anxiety, participants may have received too small a "dose" of CBM-I to be effective.

### 4.2. Administering treatment to both children and their parents

A central hypothesis of the current study was that intervening with both children and their parents (i.e., the Combo condition) would result in greater gains than intervening with either alone. Though graphical analysis hints at some support for this hypothesis, by all other measures, it was not supported. One interpretation of this null finding is that parenting beliefs and associated behaviors exert a relatively weak influence on child anxiety, in line with meta-analytic findings (McLeod, Wood, & Weisz, 2007). This may be particularly true for social anxiety, for which the locus of worry is often outside the family (Sarver, Beidel, & Spitalnick, 2014). With the exception of extreme cases, even intrusive parents' opportunities to behave intrusively diminish as children reach early adolescence, given school separates even socially anxious children from their parents for most of the day. Finally, the specific scenarios that youth highlighted in exit interviews as particularly personally relevant typically involved peers, rather than parents.

On the other hand, the null effects of treatment condition suggest that intervening with parents alone may be *as efficacious as* intervening with only children or with parent–child dyads. Given anxious children often refuse therapy (Bouchard, Mendlowitz, Coles, & Franklin, 2004), the possibility of intervening exclusively with parents represents a much-needed new avenue for treatment. Granted, children in all conditions participated in clinic-based assessments that may have had therapeutic benefits; yet, for youth in the Parent-only condition, this level of involvement was minimal compared to the demands of other treatments, such as CBT. This possibility that parents can play a decisive role in their child's anxiety reduction compels future investigations of parent-only (or parent-mostly) interventions for child anxiety.

### 4.3. Limitations and conclusion

The current findings need to be interpreted in light of the study's limitations. One concern is that clinic-based assessment sessions may have contributed to symptom reduction. For example, unintended measurement reactivity (e.g., following from the repeated social anxiety assessments and speeches, which may have served as exposure opportunities) and therapeutic alliance-like effects from the repeated experimenter-participant interactions may have enhanced effects, over and above the effects of CBM-I. Another limitation is that our definition of parent intrusive behavior conflated *parenting style* with *parent behaviors* in that CBM-I scenarios aimed to change beliefs (part of the definition of parenting style) connected with parenting behaviors, blurring the boundaries between the constructs somewhat. Some researchers suggest that combining these constructs may lead to mixed findings (Negreiros & Miller, 2014). In addition, parents exhibited fewer than anticipated intrusive behaviors during the speech task, limiting the range on this

measure. Other measurement concerns tie to the low reliability of some of the measures (e.g., the Parent Activities Questionnaire and some of the recognition ratings). Finally, while we chose the multiple baselines design carefully, and feel it was the right first test given the novelty of this intervention, it does have clear limitations. Of course, use of a larger, more diverse sample and a control group in future work will greatly inform the evaluation of this CBM-I approach.

Despite these limitations, the current study's finding that, based on graphical analyses, almost half of our sample improved over the course of the intervention suggests that CBM-I holds promise as a treatment for child social anxiety. Clearly, larger randomized controlled trials are needed before CBM-I should be administered as a frontline treatment, but these results suggest further testing is warranted given the somewhat limited efficacy and accessibility of current gold standard treatments, such as CBT. While establishing CBM-I as an effective stand-alone, online treatment could have enormous public health benefits, it will also be valuable to test CBM-I as part of modular treatment plans (e.g., Chorpita, 2006) that aim to combine several empirically supported treatments in a way that is tailored to the case conceptualization of the client. In this way, CBM-I may be examined as part of a larger "toolkit" for child anxiety. Given the limited efficacy, accessibility, and refusal rates associated with current treatments for youth social anxiety, the addition of a novel, easy-to-disseminate treatment like CBM could be a potentially important step to effectively addressing this prevalent problem.

## Acknowledgements

We are grateful to Daniel Martin and Karen Grace Martin for their statistical consultation on this project, as well as Kristy Benoit and Stephanos Vassilopoulos for sharing materials from their studies to help with the development of our training program. We would also like to thank the Teachman Program for Anxiety, Cognition, and Treatment (PACT) laboratory for their feedback on this project. This research was supported in part by an NIH grant no. R01AG033033 to Bethany Teachman. Note: Teachman has a significant financial interest in Project Implicit, Inc., which provided services in support of this project under contract with the University of Virginia.

## Appendix A. Appendix

Child participant demographics and descriptive statistics by condition.

| ID | Age | Sex | Race/ ethnicity | IQ | Comorbid diagnoses (for modules assessed) | Other therapies during study? | Parent 1 (participant) highest level of education | Parent 2 highest level of education | Does child split time between households? | Income |
|---|---|---|---|---|---|---|---|---|---|---|
| Combo Group | | | | | | | | | | |
| 1 | 10 | F | White | 114 | None | No | Advanced grad. or prof. degree | Advanced grad. or prof. degree | No | 60,000–80,000 |
| 2 | 14 | F | White | 96 | Phobia, GAD, Sep ax | No | Some college or post-high school | College graduate | No | 100,000–120,000 |
| 3 | 13 | F | White | 93 | Phobia, GAD | Meds for ADHD | Advanced grad. or prof. degree | Advanced grad. or prof. degree | No | Prefer not to answer |
| 4 | 13 | F | White | 99 | None | No | Advanced grad. or prof. degree | Advanced grad. or prof. degree | No | 100,000–120,000 |
| 5 | 15 | F | White | 100 | GAD, Dysth, MDD | No | Some college or post-high school | Some college or post-high school | Yes | 60,000–80,000 |
| 6 | 14 | F | White | 104 | None | No | Advanced grad. or prof. degree | Advanced grad. or prof. degree | No | 120,000–140,000 |
| *M (SD)* | 13.17 (1.72) | | 101.00 (7.38) | | | | | | | |
| Child-only group | | | | | | | | | | |
| 1 | 14 | F | White | 107 | GAD | No | Some college or post high school | – | No | 0–20,000 |
| 2 | 14 | M | White | 97 | None | Meds for anxiety/depression | Advanced grad. or prof. degree | Advanced grad. or prof. degree | No | Greater than 200,000 |
| 3 | 15 | M | White | 100 | GAD | No | Advanced grad. or prof. degree | High school graduate or GED | No | 60,000–80,000 |
| 4 | 13 | F | White | 124 | None | No | College graduate | Advanced graduate or professional degree | No | 60,000–80,000 |
| 5 | 15 | F | White | 127 | None | No | Advanced grad. or prof. degree | – | No | 100,000–120,000 |
| 6 | 12 | M | White | 111 | None | Meds for ADHD | Advanced grad. or prof. degree | College graduate | No | 120,000–140,000 |
| 7 | 12 | M | Mixed/ other | 99 | None | Meds for anxiety, depression,bipolar | Advanced grad. or prof. degree | Advanced grad. or prof. degree | No | Greater than 200,000 |
| Mean (SD) | 13.57 (1.27) | | 109.28 (12.12) | | | | | | | |
| Parent-only group | | | | | | | | | | |
| 1 | 10 | F | White | 110 | Phobia | No | College graduate | Advanced grad. or prof. degree | No | 40,000–60,000 |
| 2 | 12 | F | White | 103 | GAD | No | Some college or post-high school | College graduate | No | 60,000–80,000 |
| 3 | 11 | M | White | 101 | Phobia | No | Advanced grad. or prof. degree | Advanced grad. or prof. degree | No | 100,000–120,000 |
| 4 | 15 | F | White | 103 | Phobia | No | High school graduate or GED | Some college or post-high school | No | 40,000–60,000 |
| 5 | 12 | F | White | 100 | None | No | Advanced grad. or prof. degree | Advanced grad. or prof. degree | No | Greater than 200,000 |

Appendix A. (*Continued*)

| ID | Age | Sex | Race/ ethnicity | IQ | Comorbid diagnoses (for modules assessed) | Other therapies during study? | Parent 1 (participant) highest level of education | Parent 2 highest level of education | Does child split time between households? | Income |
|---|---|---|---|---|---|---|---|---|---|---|
| Mean (SD) | 12.00 (1.87) | | 103.40 (3.91) | | | | | | | |
| Total mean (SD) | 13.00 (1.64) | | 104.89 (9.24) | | | | | | | |

*Notes.* Sep Ax = separation anxiety; Phobia = specific phobia (e.g., heights, insects); GAD = generalized anxiety disorder; Dysth = dysthymia; MDD = major depressive disorder.

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