

# Social support as a predictor of treatment adherence and response in an open-access, self-help, internet-delivered cognitive behavior therapy program for child and adolescent anxiety



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## ABSTRACT

**Background:** Although self-help, internet-based cognitive behaviour therapy (ICBT) can produce significant reductions in anxiety for many young people, a sizable proportion show low program adherence and continue to show anxiety problems after treatment. It is important that we identify factors that predict those most likely to complete program sessions and benefit from self-help ICBT so that we can better match interventions to individual needs, and inform program design and development.

**Objective:** This study examined the role of social support in predicting treatment adherence and outcome among youth enrolled in an open-access, internet-delivered, CBT intervention targeting anxiety.

**Methods:** Participants were 3684 young people (aged 7 to 17 years) who reported elevated levels of anxiety symptoms when registering for the program. Treatment adherence was assessed as number of treatment sessions completed. Treatment response was evaluated as change in self-reported anxiety symptoms. Youth-reported social support (from friends, family and a special person) at pre-treatment was examined as a hypothesized predictor of adherence and outcome after controlling for baseline anxiety, gender, and age, with age being examined as a moderator.

**Results:** Linear regression analyses showed that participants with greater social support, from all sources, tended to show greater program adherence, although the proportion of explained variance was small. Age moderated the effect of family support upon adherence, such that greater family support was associated with greater number of sessions completed only for older youth. Greater family and total support were associated with greater reductions in anxiety, irrespective of participant age, but again the percent of variance explained was small. Younger participants were more likely to complete more sessions and to show greater reductions in anxiety. Those with higher pre-treatment anxiety tended to complete fewer sessions but demonstrated greater reductions in anxiety.

**Conclusions:** The findings highlight the need to consider ways to enhance treatment adherence and outcome of those engaging in self-help ICBT for youth anxiety problems, particularly when social support is low.

## 1. Introduction

Research into the impact of internet-delivered cognitive behavior therapy (ICBT) for youth anxiety with brief therapist assistance has indicated positive outcomes for the majority of participants (Ebert et al., 2015; Pennant et al., 2015; Stasiak et al., 2016). However, even brief therapist support comes with a cost and, to date, there are insufficient numbers of trained clinicians to fulfill the unmet need for treatment. Self-help versions of ICBT programs through open-access forums provide a means of offering treatment to much larger

populations of anxious youth. There is now a need for research to examine the efficacy of such self-help ICBT programs in order to determine for whom they are most effective.

In a recent study, March et al. (2018) reported on the outcome of 4425 anxious young people who enrolled in an open-access, ICBT intervention. Results showed that young people who completed at least three treatment sessions tended to show significant reductions in anxiety symptoms. For those participants who completed the majority of the program, 57% achieved recovery into the non-anxious range on the 8-item Children's Anxiety Scale (CAS-8: Spence et al., 2014), and 54%

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achieved statistically reliable reductions in anxiety symptoms (March et al., 2018). However, the study also indicated that only 30% of anxious youth who enrolled in the program with no therapist support completed three or more sessions, whereas previous studies in which ICBT was supplemented with therapist support have reported much higher levels of program adherence (March et al., 2009; Spence et al., 2011; Vigerland et al., 2016). Thus, it is important to identify factors that predict better rates of program adherence and outcomes from self-directed ICBT, so that informed decisions can be made around the referral of clients who are most likely to benefit from these programs. Such information may also inform the design and development of self-help ICBT programs in ways that enhance engagement and outcomes.

There has been minimal research examining predictors of adherence and treatment outcome in relation to ICBT with anxious youth, and that which does exist relates to treatment outcome rather than adherence, and to therapist-guided rather than self-help interventions. A recent study found that higher levels of baseline anxiety and depressive symptoms, female gender, and higher levels of computer comfortability were associated with better treatment response from therapist-guided ICBT for anxious youth (Stjerneklar et al., 2019). In contrast, Vigerland et al. (2017) found no impact of type of anxiety disorder, number of diagnoses, or symptom severity upon outcomes from therapist-guided ICBT. Turning to the clinic-based literature for potential guidance, there have been several studies examining predictors of clinic-based delivery of CBT for youth anxiety. However, reviews of the literature in this area have also failed to show a consistent pattern of results (Nilsen et al., 2016; Cook, 2014; Lundkvist-Houndoumadi et al., 2014; Walczak et al., 2018), and suggest that predictors of outcome for youth anxiety programs vary according to a range of factors, including the ways in which predictors and outcome are measured, the specific type of anxiety disorder, the content of treatment, the length of follow-up being examined, and the mode of treatment delivery.

Poor engagement with, and adherence to, treatment is a challenge for all forms of psychotherapy but is a particular issue for internet delivered therapies irrespective of age group or type of presenting problem (Mohr et al., 2011). Furthermore, self-help, internet-based therapeutic interventions typically achieve weaker clinical outcomes than those that are human-supported (Mohr et al., 2011). Thus, it is important that we examine predictors of ICBT outcomes when it is delivered in a self-help format specifically, as there are likely to be particular features that will make certain predictors important. Indeed, there has been a good deal of discussion regarding ways to promote effective engagement in online interventions (Yardley et al., 2016). Although many methods relate to those built-in to program design, Yardley et al. (2016) also note the importance of social context and social support (SS) in the client's environment which can both enhance and impair engagement with, and outcomes from, online programs. For example, even though self-help ICBT programs for young people typically provide child-friendly, engaging and interactive session materials (Spence et al., 2016), there is no therapist to provide support and encouragement, nor to help them to problem solve challenging situations. Therapy adherence for self-help ICBT requires a high level of commitment, time management, motivation, and self-direction on the part of the young person. We propose that support from parents, family, friends, and other special persons will be important factors in determining whether young people adhere to the program and, as a consequence, gain better therapeutic outcomes. The present study therefore focuses on the potential role of SS as a predictor of adherence to, and outcomes from, self-help ICBT with anxious youth in an open-access program.

In the adult literature relating to psychotherapy in general, there is a good deal of evidence to suggest that SS represents an important, non-specific factor that predicts positive outcomes from treatment (see metaanalysis reported by Roehrlé and Strouse, 2008). In terms of ICBT specifically, SS has been shown to predict better treatment adherence and outcome for both self-help and therapist-guided interventions in

the treatment of adult anxiety (Berntsen and Christensen, 2013; Al-Asadi et al., 2014). However, to date, researchers do not appear to have examined the role of SS as a predictor of adherence and outcome for ICBT among anxious youth. Stjerneklar et al. (2019) examined the time spent by parents each week helping their teen to complete the program (according to parent-report on a single question) as a predictor of outcome from therapist-guided ICBT for anxious adolescents, and found no significant effect. That study did not, however, examine the role of SS from different sources in the child's life and in different areas of support such as problem solving, sharing feelings, providing practical help, and being available when needed. The intervention also included therapist support, and it could be argued that the role of SS is likely to be more important in youth self-help interventions where there is no therapist contact.

The present study provides a more detailed assessment of sources of SS in the prediction of adherence and outcome in the context of a fully self-help ICBT intervention. Specifically, this study is the first to examine different elements of SS (from family, friends, and other special persons) as predictors of adherence and outcome following ICBT for youth anxiety. We hypothesized that the level of SS from family, friends and other special persons would be significant predictors of therapy adherence and outcome. We also proposed that SS, particularly from family, would play a significantly greater predictive role for younger children than for adolescents given that older youth typically show greater capacity for behavioral autonomy, independence, self-help action, and cognitive maturity (Wray-Lake et al., 2010). Furthermore, parents reduce their level of guidance and assistance as their child matures, and expect more autonomy and self-direction from them (Branje, 2018). Thus, we hypothesized that level of SS from family would be a significantly stronger predictor of program adherence and outcome for primary school-aged children rather than adolescents.

## 2. Methods

### 2.1. Participants

All participants enrolled in the BRAVE Self-Help open-access program between 1st July 2016 and 23rd March 2018. To be included in the study, participants were required to report elevated anxiety symptoms at pre-treatment above a predetermined criterion ( $\geq 84$ th percentile or T-score  $\geq 60$  on the Children's Anxiety Scale (CAS-8: Spence et al., 2014) in comparison to normative data; see below).

#### 2.1.1. Participants for examining predictors of adherence

Participants for the prediction of adherence involved the full sample of the study which involved 3684 anxious young people who were included irrespective of whether or not they completed any sessions (as variation in the number of sessions completed was the outcome variable). Participants were aged 7–17 years with a mean age of 12.22 years ( $SD = 2.97$ ) years. There were 2235 (60.7%) females, 1364 (37.0%) males, and 85 (2.3%) participants who identified as another gender category such as transgender or transexual (FtM or MtF), genderqueer, or androgynous. Only participants who enrolled in the teenage version of the program were given the option to select one of the "another gender" categories. Of the 3384 participants who provided geographic location of residence data that could be accurately coded into geographical categories, 2014 (54.7%) resided in Major Capital Cities (Sydney, Melbourne, Brisbane, Perth, Adelaide and Canberra), 1260 (34.2%) resided in Inner and Outer Regional Australia, and 110 (3.0%) resided in remote or very remote Australia. These categories were based on the Accessibility and Remoteness Index of Australia (Australian Bureau of Statistics, 2016). A useful map summarizing Australia's remoteness areas can be found at the following link:- <https://www.abs.gov.au/websitedbs/D3310114.nsf/home/remoteness+structure>

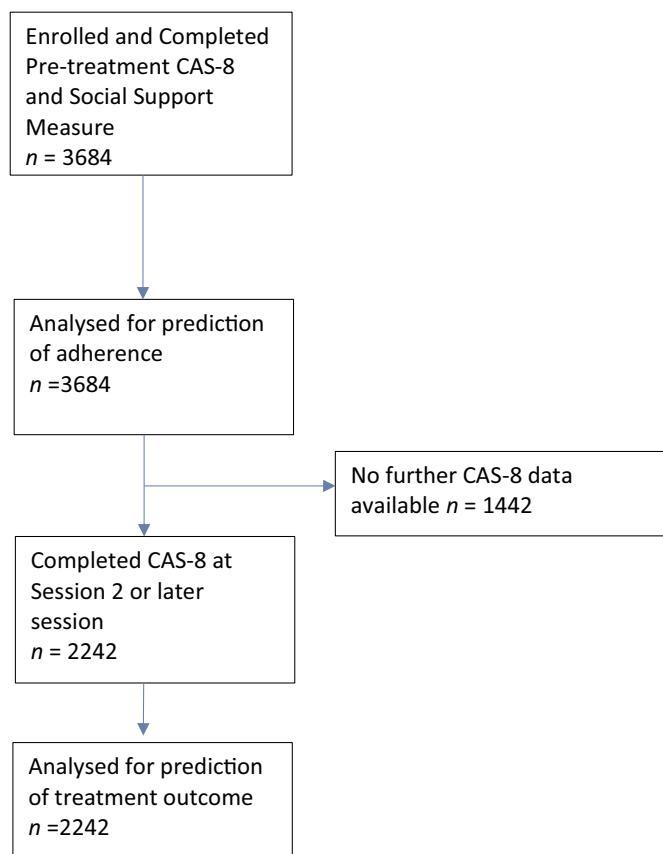


Fig. 1. Progression of participants through the study.

### 2.1.2. Participants for examining predictors of treatment outcome

These participants involved 2242 anxious children and adolescents from the full sample described above who had completed the CAS-8 on at least two time points. That is, they had completed the CAS-8 at pre-treatment and at the beginning of one or more treatment sessions between Sessions 2 and 10 (see Fig. 1). Using two time points enabled determination of change in self-reported anxiety scores on the CAS-8 from pre-treatment to the final measurement of the CAS-8 available for each individual, which varied according to the number of sessions completed.

### 2.2. Procedure for participation

Participants enrolled in the BRAVE Self-Help program through a website accessible only to Australian families, having been directed to the program through self-referral and internet searches, information from health or education professionals, parents and family members, and links hosted on several Australian mental health information sites. The program is open-access, and therefore young people do not require a referral to enrol and complete the sessions, there are no set criteria for participation, and users are not required to demonstrate symptomatic levels of anxiety.

Informed consent (and parental consent in the case of children aged < 16 years) was required prior to beginning the program during the Web-based registration process. Before they could commence the program, children were requested to ask a parent to read the online information page and to provide informed parental consent. This involved checkbox responses to a series of questions to which parents confirmed that they: were the parent or guardian of the child; understood the nature and content of the program; were assured of but recognised the legal limitations to confidentiality; had the contact details of the researchers and the Ethics Office for any ethical concerns, and;

agreed that their child could participate in the program. After these steps had been completed, children were able to progress to the online information sheet and were then invited to provide their own online informed consent to participate. Participation was voluntary, and young people were made aware that they could cease using the program at any time, without consequence. Ethical approval for the study was obtained from the human ethics committees of the University of Queensland (UQ), University of Southern Queensland, and Griffith University. Data were stored on secure servers hosted by UQ. Participants were not provided with any reimbursements for participation. The progression of participants from registration through the study is presented in Fig. 1.

### 2.3. Content of the intervention

The BRAVE Self-Help program has been described in detail previously (March et al., 2018), as has the therapist-assisted version (March et al., 2009; Spence et al., 2008). The program consists of 10 interactive, Web-based CBT sessions developed for the treatment of specific phobia, generalized anxiety disorder, separation anxiety disorder and social anxiety disorder. Sessions can be completed on a personal computer or tablet and are presented in a prescribed sequence, although participants are able to progress at their own pace. Each session takes around 45 mins to complete. Automatic email reminders are sent when participants have not completed the next session within one week. The program content includes the evidence-based CBT components of psycho-education, the detection of physiological signs of anxiety (B represents Body Signs), relaxation techniques (R represents Relax), cognitive strategies such as thought detection, cognitive restructuring and coping statements (A represents Activate Helpful Thoughts), graded exposure and problem solving skills (V represents Victory Over Your Fears) and self and parent reinforcement (E represents Enjoy! Reward Yourself). Material is presented in an age-appropriate, interactive and engaging way, with animated cartoons, quizzes, and games. The sessions also include corrective/reinforcement messages, personalized messages/pop-ups, and automated feedback and reinforcement. The self-help program includes tools to assist in the development of the exposure hierarchy, a virtual relaxation room, and a resource room in which young people can quickly access key material and information. Given the self-help nature of the intervention, the program incorporates regular checks on anxiety levels, with an automated system in which young people are provided with additional help-seeking information if their anxiety increases into, or remains within, the clinical range. Examples of screenshots from the program are shown in Fig. 2.

### 2.4. Measures

As this study relates to a large scale, national, open-access intervention, we were restricted in terms of the amount of information we could obtain about individuals in order to minimize burden of responding. Thus, the available data were limited to basic demographic information, and brief measures of anxiety and SS.

#### 2.4.1. Anxiety symptoms

Anxiety symptom severity was measured using the 8-item Children's Anxiety Scale (CAS-8) (Spence et al., 2014). The CAS-8 was adapted from the Spence Children's Anxiety Scale (Spence, 1998), and assesses symptoms on a four-point scale (0 = Never, 3 = Always). It has demonstrated good reliability and provides population-level gender-standardized norms for comparison (Spence et al., 2014). Scores of  $\geq 84$ th percentile (i.e. above a T-score of 60: CAS8 score  $\geq 10$  for males and  $\geq 12$  for females) are considered indicative of elevated anxiety, while scores  $\geq 94$ th percentile (i.e. above a T-score of 65: CAS8 score  $\geq 13$  for males and  $\geq 16$  for females) are considered representative of clinical levels of anxiety. Participants completed the

Child Program Examples	Teen Program Examples
<p>Age appropriate graphics, praise and encouragement</p> 	<p>Use of characters to present information</p> 
<p>Color, animation, cartoons and stories</p> 	<p>Downloadable content</p> 
<p>Interactive quizzes</p>	<p>Brave ladder tool for fear hierarchy</p>
	

Fig. 2. Examples of program content.

**Table 1**  
Sample characteristics of participants for prediction of adherence (N = 3684) and treatment outcome (N = 2242).

Measure		Full sample		Treatment outcome sample	
		Mean or N	SD or %	Mean or N	SD or %
Treatment adherence	Mean number of sessions completed <sup>a</sup>	2.25	(2.51)	3.43	(2.57)
Anxiety	Pre-treatment CAS-8 <sup>b</sup> (full sample)	15.03	(3.34)	14.84	(3.26)
Control variables	Gender				
	Male	1364	(37.0)	855	(38.1)
	Female	2235	(60.7)	1341	(59.8)
	Other	85	(2.3)	46	(2.1)
	Age	12.22	(3.00)	11.90	(2.87)
Predictors	Social Support (MSPSS) <sup>c</sup>				
	Family	21.14	(5.95)	21.74	(5.68)
	Friends	17.82	(6.08)	18.18	(6.05)
	Sig. other	22.03	(5.22)	22.48	(5.02)
	Total score	60.99	(13.76)	62.40	(13.25)

Notes:

<sup>a</sup> Sessions completed out of 10.

<sup>b</sup> CAS-8: Children's Anxiety Scale (8 items); score range 0–24; high scores reflect higher anxiety.

<sup>c</sup> MSPSS: Multidimensional Scale of Perceived Social Support; subscale scores range from 4 to 28, total score from 12 to 84; high scores represent higher social support.

CAS-8 prior to beginning the program (baseline) and at the beginning of each session. The average internal consistency of the CAS-8 across the data collection points for the present study was 0.83.

#### 2.4.2. Demographics

Demographic data (age, gender, and residential postcode) were collected at the point of enrolment.

#### 2.4.3. Social support

Youth-reported SS was assessed during enrolment using the 12-item Multidimensional Scale of Perceived Social Support (MSPSS: Zimet et al., 1988). The scale includes three subscales assessing perceived SS within the child's life from family, friends, and a special person. Each subscale includes 4 items assessing SS in relation to problem solving, sharing feelings, providing practical help, and being available when needed. Participants are asked to indicate how they feel about each statement on a 7-point rating scale (1 = very strongly agree; 7 = very strongly disagree). Example items include “My family really tries to help me”, “I have a special person who is a real source of comfort to me” and “I can talk about my problems with my friends”. Although initially developed for adults, the scale has been shown to have strong psychometric properties with adolescents (Bruwer et al., 2008; Canty-Mitchell and Zimet, 2000). Given the age range in the present study, the wording was modified slightly to ensure that all items were within the reading age of participants. Exploratory factor analysis of the data from the present study supported the original 3-factor structure, explaining 77.89% of the variance in scores, and with all items loading > 0.70 on their predicted factor. Internal consistency in the present study was 0.91 for total SS, and 0.92, 0.91, and 0.88 for family, friends and a special person subscales respectively.

### 2.5. Predictor analyses

#### 2.5.1. Prediction of treatment adherence

Analyses examining the prediction of treatment adherence were conducted first. Adherence was operationalized as the number of program sessions completed (possible range of 0–10). Predictors of adherence were examined with linear regression models using IBM® SPSS® statistics, v.24.0. Analyses were conducted separately for each form of SS and total SS. Each analysis controlled for baseline anxiety scores, age and gender at Step 1. The SS predictor variable was entered at Step 2. The potential moderating effects of age were examined by entering the interaction term between age and SS at Step 3. Where a significant interaction effect was found it was examined graphically

using the SPSS PROCESS Macro v 3.3 (Hayes, 2018).

#### 2.5.2. Prediction of treatment outcome

The change in anxiety symptoms over time was examined first using repeated measures ANOVA to determine the degree of change, followed by examination of predictors of outcome using the process outlined above. Treatment outcome was operationalized as change in self-reported anxiety symptoms (CAS-8) from pre-treatment to the final measurement of CAS-8 available for each individual, which varied according to the number of sessions completed. The use of change scores for examining prediction of treatment outcome has been used in previous research investigating predictors of outcome following ICBT (Hedman et al., 2013). In addition to controlling for age, gender and baseline anxiety, the first step of the linear regression analyses controlled for number of sessions completed. Steps 2 and 3 followed the method outlined above for prediction of adherence.

### 2.6. Missing data

For the prediction of adherence, there was minimal missing data as a) all registrants were included irrespective of whether they commenced and adhered to the program, b) there were very few measures and surveys were very short, and c) the data were collected online as part of registration and had to be completed before the participant was able to proceed. Missing data points were replaced with the series mean for that item if the scale was missing < 25% of data points for a subscale. Less than 0.1% of data points were replaced.

For the prediction of treatment outcome, individuals were only included if they had completed a second anxiety assessment. Missing data for those who failed to complete a second anxiety assessment were not replaced. No imputations of missing data were made for missing individuals. For predictor variables, there were minimal missing data.

## 3. Results

A summary of participant characteristics in terms treatment adherence, pre-treatment anxiety, demographic factors, and social support is provided in Table 1.

### 3.1. Session completion and predictors of adherence

This analysis included all 3684 participants who enrolled in the program and completed the assessments, irrespective of whether they commenced the program, or the amount of subsequent engagement.

**Table 2**  
Results from linear regression analyses – predictors of adherence.

	Dependent variable: adherence – number of sessions completed						
	Co-eff	SE	[95% CI]	Beta	t	p	R Sq Ch
Step 1.							
Pre-treatment variables							
Anxiety	−0.03	0.01	[−0.06, −0.01]	−0.05	−2.70	0.000	
Gender	−0.09	0.09	[−0.25, 0.08]	−0.02	−1.02	0.309	
Age	−0.14	0.01	[−0.17, −0.11]	−0.17	−9.67	0.000	0.036
Step 2 <sup>a</sup>							
Family SS <sup>c</sup>	0.02	0.01	[0.00, 0.03]	0.04	2.49	0.016	0.002
Step 3 <sup>b</sup>							
FamilySSxAge	0.01	0.00	[0.00, 0.01]	0.19	2.30	0.021	0.001
Step 2 <sup>a</sup>							
Friend SS	0.03	0.01	[0.02, 0.04]	0.07	4.56	0.000	0.005
Step 3 <sup>b</sup>							
FriendSSxAge	−0.00	0.00	[−0.01, 0.00]	−0.07	−0.84	0.399	0.000
Step 2 <sup>a</sup>							
Special person SS	0.02	0.01	[0.00, 0.04]	0.04	2.57	0.010	0.002
Step 3 <sup>b</sup>							
SpecialPSS xAge	0.01	0.00	[−0.00, 0.01]	0.15	1.62	0.105	0.001
Step 2 <sup>a</sup>							
Total SS	0.01	0.00	[0.01, 0.02]	0.07	4.14	0.000	0.004
Step 3 <sup>b</sup>							
TotalSSxAge	0.00	0.00	[−0.01, 0.00]	0.10	1.08	0.278	0.000

#### Notes

<sup>a</sup> Each social support variable entered at Step 2 in separate analyses after controlling for baseline anxiety, age, and gender.

<sup>b</sup> Results from Step 3 reported only for the interaction term.

<sup>c</sup> SS = social support.

The total number of sessions completed for the sample was as follows: 0 ( $N = 851$ , 23.1%), 1 ( $N = 1106$ , 30.0%), 2 ( $N = 569$ , 15.4%), 3 ( $N = 420$ , 11.4%), 4 ( $N = 198$ , 5.4%), 5 ( $N = 134$ , 3.6%), 6 ( $N = 88$ , 2.4%), 7 ( $N = 85$ , 2.3%), 8 ( $N = 49$ , 1.3%), 9 ( $N = 37$ , 1.0%), and 10 ( $N = 147$ , 4.0%).

Results for each of the four linear regression analyses predicting adherence are provided in Table 2. As is evident from Table 2, baseline anxiety ( $B = -0.03$ ,  $SE = 0.01$ ,  $p = .000$ ) and age ( $B = -0.14$ ,  $SE = 0.01$ ,  $p = .000$ ) were found to significantly negatively predict adherence at Step 1 for all analyses. Participants with lower baseline anxiety tended to complete more sessions, as did younger participants. Gender at Step 1 was not a significant predictor. Family SS ( $B = 0.02$ ,  $SE = 0.01$ ,  $p = .016$ ), Friends SS ( $B = 0.03$ ,  $SE = 0.01$ ,  $p = .000$ ), Special Person SS ( $B = 0.02$ ,  $SE = 0.01$ ,  $p = .010$ ), and Total SS ( $B = 0.01$ ,  $SE = 0.00$ ,  $p = .000$ ) all significantly and positively predicted adherence at Step 2. Those with higher SS were more likely to complete more sessions, although the percentage of variance in adherence was small for all forms of SS, explaining < 1% of variance.

The hypothesis that SS would be a stronger predictor of adherence for younger children than for adolescents was examined through interaction effects between age and SS entered at Step 3 in each of the linear regression analyses (see Table 2). The interaction between age and level of SS did not significantly predict number of sessions completed for SS from friends, a special person or total score. However, the interaction between age and family SS was significant ( $B = 0.01$ ,  $SE = 0.00$ ,  $p = .000$ ), indicating that age moderated the predictive effect of family SS upon adherence. The nature of this significant effect was examined further using the PROCESS macro outlined above, and the result is illustrated in Fig. 3 for the mean age of 12.22 years  $\pm 1$  SD. The results show that, for younger children, level of SS did not significantly influence the number of sessions completed. However, for the older age group, there was an increase in the number of sessions completed as the level of family SS increased.

### 3.2. Change in anxiety over time and predictors of treatment outcome

This analysis was conducted for all participants for whom two CAS-

8 data points were available as described above ( $N = 2242$ ). There was a significant reduction in CAS-8 scores from pre-treatment to the final assessment point, with a reduction from  $M = 14.84$  ( $SD = 3.26$ ) to  $M = 12.83$  ( $SD = 5.07$ ),  $F(1, 2241) = 475.32$ ,  $p < .001$ , partial eta squared = 0.175, effect size  $d = 0.50$  (moderate effect size).

As shown in Table 3, Step 1 of the linear regression analyses revealed that baseline anxiety ( $B = 0.24$ ,  $SE = 0.03$ ,  $p = .000$ ), age ( $B = -0.09$ ,  $SE = 0.31$ ,  $p = .004$ ) and number of sessions completed ( $B = 0.52$ ,  $SE = 0.03$ ,  $p = .000$ ) were significantly associated with changes in CAS-8 anxiety scores. Greater reductions in anxiety were associated with higher baseline anxiety levels, younger age of child, and greater number of sessions completed. To clarify the nature of the significant effect of number of sessions completed upon changes in CAS-8, subsidiary analyses were conducted to examine the size of anxiety change for three categories of session completion (namely 1–3; 4–6; and 7 or more sessions completed). Greater reductions in CAS-8 anxiety were associated with the completion of more sessions (1–3 sessions [ $M$  change = 1.24,  $SD = 3.52$ ,  $d = 0.37$ ], 4–6 sessions [ $M$  change = 2.65,  $SD = 4.89$ ,  $d = 0.58$ ], or 7 or more sessions [ $M$  change = 4.80,  $SD = 5.72$ ,  $d = 0.93$ ]).

When SS was examined at Step 2, family SS ( $B = 0.04$ ,  $SE = 0.02$ ,  $p = .028$ ) and total SS ( $B = 0.01$ ,  $SE = 0.01$ ,  $p = .036$ ), but not friend or special person SS, significantly predicted changes in anxiety. Greater levels of family and total SS predicted greater reductions in anxiety (see Table 3 and Fig. 4). Although these effects were statistically significant, the amount of variance in anxiety change explained by these effects was small and < less than 1%.

As is evident from Table 3, the interaction between age and level of SS did not significantly predict changes in anxiety symptoms for any SS categories or total SS. Fig. 4 shows that greater total SS was associated with greater reduction in anxiety symptoms irrespective of age group.

## 4. Discussion

Consistent with prior research involving self-help ICBT, program adherence was poor for many in this study, and only a small proportion (4.0%) completed all 10 sessions. Indeed, around 23.1% signed up for

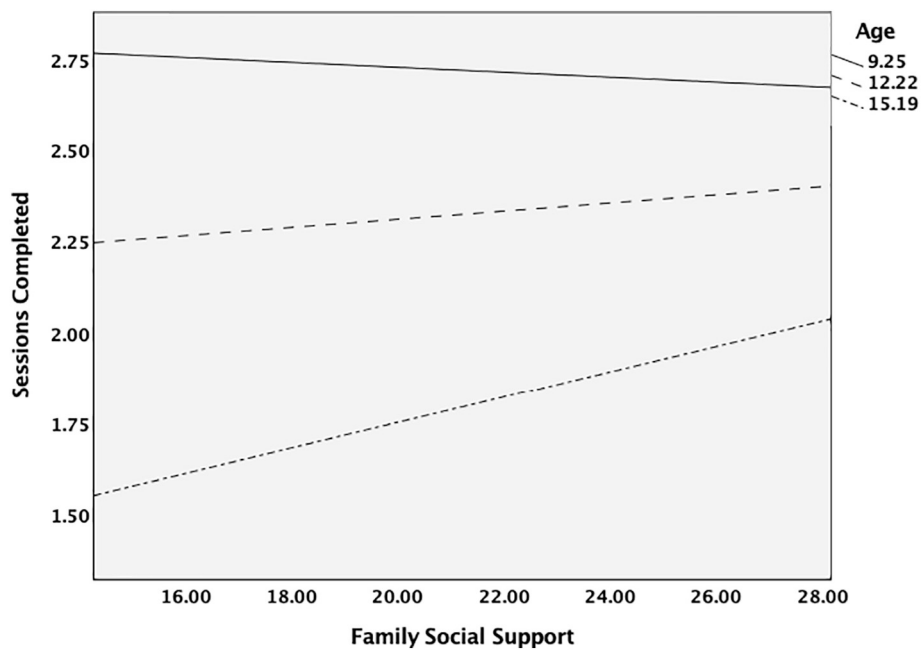


Fig. 3. Moderating effect of age (showing values for mean age ± 1 SD) on the association between family social support and number of sessions completed.

the program and did not complete a single session. Thus, it is clearly important to identify the characteristics of young people who are most likely to engage with self-help ICBT programs, and to identify ways to modify program design and content in ways that increase the chance of greater program adherence and better outcomes.

4.1. Predictor analyses

4.1.1. Social support as a predictor of adherence and changes in anxiety

The primary aim of the present study was to examine the role of SS

as a predictor of adherence and treatment outcome following self-help ICBT for youth anxiety. Consistent with our hypotheses, higher levels of SS from family, friends, a special person, and total support significantly predicted higher levels of program adherence, although the proportion of variance explained was small. For the prediction of treatment outcome, the findings were more varied, with only family and total SS significantly predicting level of change in anxiety symptoms (and only a small proportion of variance was explained). It is unclear why SS from peers and a special person should be associated with adherence but not changes in anxiety. Future studies, with more detailed assessment of

Table 3 Results from linear regression analyses – predictors of change in anxiety.

	Dependent variable: treatment outcome – change in anxiety <sup>c</sup>						
	Co-eff	SE	[95% CI]	Beta	t	p	R Sq Ch
Step 1.							
Pre-treatment variables							
Anxiety	0.24	0.03	[0.19, 0.30]	0.18	8.74	0.000	
Gender	-0.25	0.18	[-0.60, 0.11]	-0.03	-1.35	0.176	
Age	-0.09	0.31	[-0.15, -0.03]	-0.06	-2.89	0.004	
Sessions completed	0.52	0.03	[0.45, 0.59]	0.30	14.77	0.000	0.119
Step 2 <sup>a</sup>							
Family SS <sup>d</sup>	0.04	0.02	[0.00, 0.07]	0.05	2.20	0.028	0.002
Step 3 <sup>b</sup>							
FamilySS x age	-0.00	0.01	[-0.01, 0.01]	-0.03	-0.29	0.774	0.000
Step 2 <sup>a</sup>							
Friend SS	0.02	0.01	[-0.01, 0.05]	0.02	1.21	0.228	0.001
Step 3 <sup>b</sup>							
FriendSS x age	0.00	0.00	[-0.01, 0.01]	0.00	0.02	0.983	0.000
Step 2 <sup>a</sup>							
Special person SS	0.03	0.02	[-0.01, 0.06]	0.03	1.56	0.119	0.001
Step 3 <sup>b</sup>							
SpecialPSS x age	-0.01	0.01	[-0.02, 0.00]	-0.18	-1.64	0.102	0.001
Step 2 <sup>a</sup>							
Total SS	0.01	0.01	[0.00, 0.03]	0.04	2.10	0.036	0.002
Step 3 <sup>b</sup>							
TotalSS x age	-0.00	0.00	[-0.01, 0.00]	-0.07	-0.64	0.525	0.000

Notes:  
<sup>a</sup> Each social support variable entered at Step 2 in separate analyses after controlling for baseline anxiety, age, gender and number of sessions completed.  
<sup>b</sup> Results from Step 3 reported only for the interaction term.  
<sup>c</sup> Change in anxiety represents baseline minus final anxiety score (anxiety decrease).  
<sup>d</sup> SS = social support.

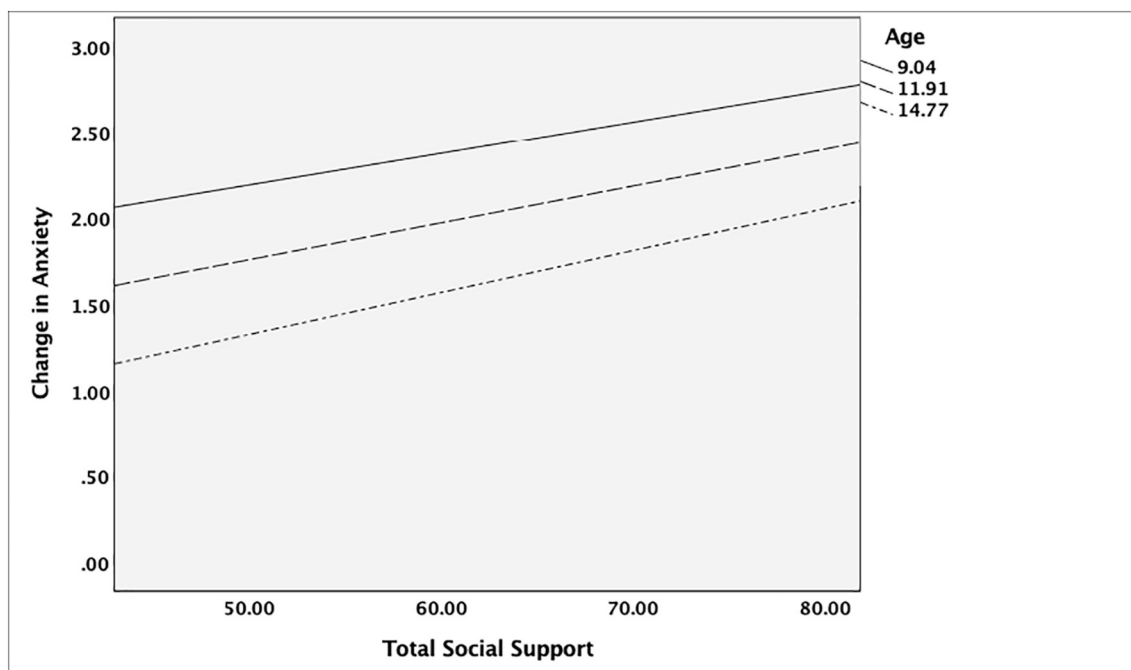


Fig. 4. Association between change in anxiety and total social support by age (showing values for mean age  $\pm$  1 SD).

different aspects of SS, may be able to clarify some of these differential relationships.

We had also predicted that SS from family would be particularly important in promoting program adherence for younger children, and less so for adolescents. However, contrary to our predictions, the results indicated that the association between family support and program adherence was evident for older but not younger participants. For teenagers, those with higher family support tended to complete more sessions than those with low levels of family support. For younger children, level of family support was not found to influence session completion. It is possible that, for younger children, parents and children tended to complete sessions together, or parents in general made an effort to encourage their child to complete the sessions, irrespective of the usual levels of family support provided to the child. In contrast, it could be speculated that parents of adolescents typically had less involvement with the program, and that only those who provided particularly high levels support encouraged and supported their teen to engage with program sessions.

Also contrary to our hypotheses, we did not find age of child to influence the impact of SS upon treatment outcome. Irrespective of the age of participants, those with high levels of family support tended to show greater reductions in anxiety symptoms over time. It should be noted however, that although statistically significant, the proportion of variance explained was extremely small, suggesting that other factors are important in determining treatment response. This point is expanded upon below.

It should also be noted that the measure of SS used in this study related to the assessment of SS available to the young person in general, rather than support specific to their participation in ICBT. It would be valuable for future research to examine the kinds of support from family, friends and other important persons that relate specifically to participation in self-help ICBT. For example, in the absence of support from a therapist, it seems sensible to suggest that family members could play an important role in encouraging the practice of new skills, answering questions, and providing praise and positive feedback for efforts to assist young people in the acquisition and application of anxiety management skills taught during the program. This suggestion remains only speculative however, and needs to be tested in empirical trials. Indeed, evidence from clinic-delivered CBT has produced conflicting

findings with respect to the value of parental involvement in therapy (Walczak et al., 2017; Breinholst et al., 2011). Manassis et al. (2014) suggested that this variation in findings may reflect the different ways in which parents can be involved in treatment, and highlighted the need for research to identify specific parental behaviours that enhance treatment outcomes.

Parents are not the only sources of support when young people participate in self-help ICBT, and it may be feasible in the future development of programs such as BRAVE Self-Help to build in elements that promote adherence and better outcomes. For example, feedback from young people suggests that they would value a reward system linked to their participation and task completion, as well as the use of SMS messaging to prompt skills practice. Another potential way of increasing SS to facilitate engagement and task completion, could be the establishment of small groups of anxious youth, facilitated by teachers, nurses, or counsellors within the school context. Given that therapeutic program content is embedded within the program, the support agent would not be required to have extensive training in CBT. Indeed, in the adult area, Titov et al. (2010) found that technicians could administer ICBT as successfully as trained clinicians. Such adaptations should be considered in future developments of ICBT, within a co-design approach involving young consumers and their families.

Given that SS, while statistically significant, explained only a small proportion of the variance in adherence and anxiety symptom change, there are clearly other important factors that determine treatment outcomes. Future research should therefore strive to identify other characteristics of young people and their families that predict those most likely to complete treatment and benefit from the interventions, so that we can better match individuals to treatments and inform the design of interventions to optimize outcomes. It would also be valuable, given that the majority of youth completed only 1–2 sessions, to identify those components of the program that have not only a strong impact on anxiety but are also likely to retain young people in treatment. It may be feasible to include such content in the early sessions of the program, so that the majority of participants receive these treatment components. Theoretically, placing the most impactful sessions early should increase the chance that young people will remain engaged with the program and achieve better reductions in anxiety. Future research should also examine the potential benefits of a shorter program



(e.g. 4 sessions) that may be sufficient for many young people. Those requiring further intervention could then be offered further sessions or a therapist-supported program in a stepped-care approach.

#### 4.1.2. Age, gender and baseline anxiety as predictors of adherence and changes in anxiety

The results of the present study also provide valuable information relating to the impact of age, gender, and baseline anxiety (the control variables) upon adherence and anxiety reduction. The findings revealed that younger participants and those with lower self-reported pre-treatment anxiety symptoms were more likely to complete more sessions. Younger participants, those with higher anxiety symptoms, and those who completed more sessions tended to show greater reductions in anxiety. The association between session completion and anxiety reduction revealed a moderate effect size ( $d = 0.58$ ) for those who completed 4–6 sessions and a large effect size ( $d = 0.93$ ) for those who completed 7 or more sessions.

The finding that higher baseline anxiety predicted greater reduction in anxiety is consistent with the results of [Stjerneklar et al. \(2019\)](#) and [Vigerland et al. \(2017\)](#) following therapist assisted ICBT. It is unclear whether this effect represents a greater tendency for regression to the mean for those with higher baseline anxiety, or whether those with higher anxiety benefit more from the program than their less anxious counterparts.

#### 4.2. Strengths and limitations of the study

The main strengths of the study are its large sample size that provided strong power to examine predictors of adherence and treatment outcome, and application of the program within a naturalistic, real-world context. These strengths, however, also relate to the weaknesses of the investigation. Given the open-access nature of the program in an uncontrolled environment, it was not surprising to find a high rate of drop-out at the early stages, consistent with much of the literature relating to fully self-help ICBT interventions, even with adults ([Karyotaki et al., 2015](#)). Thus, for the majority of participants, data were not available to determine anxiety levels at points in time equating to what would normally be a post-treatment assessment or longer-term follow-up. To evaluate treatment outcome, the study had to rely on changes from pre-treatment to the last point at which the participant completed the anxiety questionnaire, which varied according to the number of sessions completed. Although not ideal, this study provided an account of treatment participation in a real-world context, the ultimate application of prior work in a more tightly controlled research environment.

The lack of a comparison group against which to determine whether changes in anxiety were due to the intervention or merely spontaneous recovery, regression to the mean, or non-specific effects, was also a limitation of the study design. The findings do not enable us to determine whether the predictors of outcome are specific to the treatment delivery. The lack of a clinical diagnostic interview or parent measure of anxiety was a further issue that restricts conclusions that can be drawn regarding clinical change. The use of a clinical diagnostic instrument would have been prohibitively expensive, and the aim was to provide free program access to those seeking assistance. It would also have gone against the goal for providing a self-help, real world application for a large-scale community population.

Finally, in terms of limitations, we note that the present study restricted the assessment of adherence to the number of sessions completed, based on participants having completed all elements within an online session. This approach to adherence assessment does not take into account the quality of the responses produced, level of attention paid to the content, degree of learning acquired, or level of practice of the skills being taught. It also fails to take into account factors such as number of times the participant accessed the site and total amount of time spent on the site. In future research, a more detailed analysis of predictors of adherence could be produced by broadening the ways in

which adherence is measured.

## 5. Conclusion

Although many young people showed significant and meaningful reductions in anxiety following participation in the ICBT program, treatment adherence was a clear problem for many participants. Despite the fact that young people who completed 4 or more of the 10 sessions tended to show significant reductions in anxiety symptoms, with a medium to large effect size, the majority of those who enrolled in the program completed only 1–2 sessions. This finding emphasizes the importance of understanding the characteristics of young people who adhere to the program and obtain better outcomes. Adherence was found to be greater for younger children and those with lower baseline anxiety and higher levels of SS. Reductions in anxiety were greater for younger children and those with higher baseline anxiety, greater adherence, and greater family and total SS. Although SS was a statistically significant predictor of both adherence and reductions in anxiety, the percent of variance explained was small, suggesting that further research is needed to identify other factors that have a stronger predictive influence. The paper discusses potential methods that could be used to enhance treatment adherence and thus outcomes for anxious young people completing self-help ICBT interventions.

## Declaration of competing interest

The authors declare that although the intellectual property for BRAVE-ONLINE is owned by UniQuest/the University of Queensland, they may potentially benefit from royalties related to the program.

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