Internet-delivered Cognitive Behaviour Therapy with Minimal Therapist Support for Anxious Children and Adolescents: Predictors of Response

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Conflict of Interest: Authors SS, CD and SM 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.

Abstract

Background: In general, internet-delivered cognitive behaviour therapy (iCBT) produces significant reductions in child and adolescent anxiety, but a proportion of participants continue to show clinical levels of anxiety after treatment. It is important to identify demographic, clinical and family factors that predict who is most likely to benefit from iCBT in order to better tailor treatment to individual needs.

Methods: Participants were 175 young people (7-18 years) with an anxiety disorder, and at least one of their parents, who completed an iCBT intervention with minimal therapist support. Multilevel modelling (MLM) examined predictors of response to iCBT as measured by the slope for changes in the primary outcome measures of child- and parent-reported anxiety scores, from pre-treatment, to 12-weeks, 6-month and 12-month follow-ups, controlling for pre-treatment total clinician severity ratings of all anxiety diagnoses.

Results: Child age, gender, father age, parental education, parental mental health, parenting style, and family adaptability and cohesion did not significantly predict changes in anxiety in the multi-variate analyses. For child-reported anxiety, greater reductions were predicted by a separation anxiety disorder diagnosis (SEP) and elevated depression, with lower reductions predicted by poor couple relationship quality. For parent-reported child anxiety, greater reductions were predicted by higher pre-treatment total CSRs, SEP, and lower family income, with lower reductions for children of older mothers. Irrespective of these predictors of change, children in general showed reductions in anxiety to within the normal range.

Conclusions: Overall, children responded well to iCBT irrespective of the demographic, clinical and family factors examined here. Poor couple relationship quality and older mother age were risk factors for less positive response to iCBT in terms of reductions in anxiety symptoms although still to within the normal range.

Introduction

Despite the high prevalence of anxiety disorders among young people and the considerable adverse consequences that result, only a minority of anxious youth receive treatment from mental health professionals (Lawrence et al., 2015; Merikangas et al., 2010). Internet-delivered cognitive behavior therapy (iCBT) has been proposed as a way of increasing access to therapy (March et al., 2018).

Several randomized controlled trials have now demonstrated positive outcomes from iCBT (Pennant et al., 2015; Rooksby et al., 2015; Vigerland et al., 2016). However, as with face-to-face treatment (Warwick et al., 2017), a significant proportion of children continue to experience anxiety following this mode of therapy. Thus, it is important to understand which young people are most likely to respond to iCBT so that opportunities for positive treatment response are optimized by providing additional support or alternative forms of intervention for those at risk of poor outcome.

Although there is an emerging body of research examining predictors of outcome following treatment of youth anxiety, most studies focus on face-to-face therapy. A review by Nilsen et al. (2016) concluded that in the majority of studies, neither demographic factors (eg. gender, age, ethnicity) nor clinical factors (eg. type of diagnosis, severity, comorbidity) appear to predict outcome for face-to-face CBT for child anxiety. However, a systematic review by Lundkvist-Houndoumadi, Hougaard, and Thastum (2014) concluded that higher anxiety severity and non-anxiety comorbidity (such as depression and ADHD) predict higher end-state severity but not a lesser degree of improvement. Thus, the findings on demographic and clinical predictors of outcome are mixed and inconsistent, and vary according to whether treatment outcome is defined as response to treatment (reduction in severity) or remission/end-point severity.

The evidence regarding family environment factors as predictors of face-to-face CBT outcome is similarly inconclusive. The review by Lundkvist-Houndoumadi et al. (2014) concluded that there is some evidence of a negative influence of mother or father psychopathology upon treatment outcomes, but primarily in studies involving children rather than adolescents. In addition, although it has been proposed that a more supportive and less over-controlling parenting style facilitates better CBT outcomes for child anxiety, the results have been conflicting (Festen et al., 2013). Similarly, while a more cohesive, supportive family environment has been suggested to predict better outcomes for face-to-face CBT for child anxiety, the results have differed (Schleider et al., 2015; Victor et al., 2007). Discord in the relationship between the parents is another family factor proposed to influence child anxiety CBT outcomes (Rapee, 2012), but to date there is insufficient evidence to enable firm conclusions to be drawn.

Despite the inconsistent pattern of results concerning predictors of outcome for clinic-based CBT, it is important that this line of research is extended to iCBT as we cannot automatically generalize findings from face-to-face CBT to iCBT for a number of reasons. First, although we are not aware of any studies with children that have compared predictors of outcome for face-to-face CBT versus iCBT, there is some evidence from the adult literature that predictors may differ. For example, Hedman et al (2012) found that, for socially phobic adults, some factors predicted treatment response for both iCBT and clinic CBT (eg. working fulltime, lower depressive symptoms, higher treatment adherence), whereas other factors (comorbid depression and anxiety) were associated with better treatment response for iCBT but not clinic CBT. Thus, we cannot assume that predictors identified for traditional CBT will automatically apply to iCBT. Second, we propose that there are characteristics specific to iCBT that will make family and parental factors more important in optimizing therapy outcomes. We suggest that the absence of direct contact with a therapist in iCBT means that outcomes

will be better if parents play a positive role in facilitating program compliance and engagement by providing a supportive and structured environment for their child. We propose that treatment response will be weaker for children from families with an unstructured and unsupportive environment, and with parent(s) who experience poor mental health, poor couple relationship quality, and parenting styles characterized by low support and high levels of over-control.

To date, there has been minimal research examining predictors of iCBT outcome for youth anxiety and the results have been conflicting. For example, Stjerneklar, Hougaard, and Thastum (2019), in a study involving 13-17 year-old anxious youth, found that higher levels of pre-treatment anxiety and depression, and female gender were associated with larger reductions in anxiety following iCBT. The degree of parental support in that study was not associated with treatment outcome which differs from Spence, March, and Donovan (2019) who found that greater family support predicted greater reductions in anxiety during an open-access self-help iCBT intervention for youth anxiety.

A study by Vigerland et al. (2017) with 8-12 year-old anxious children found no impact of the type of anxiety disorder, comorbid depressive symptoms, or number of diagnoses upon changes in anxiety symptom severity following iCBT once pre-treatment anxiety severity was controlled for. Vigerland et al. (2017) also found no effect of maternal or paternal anxiety or depression upon outcome. This finding contrasts with Morgan et al. (2018) who reported that poor parental mental health predicted higher levels of child anxiety at 24-week follow-up in children aged 3 to 6 years whose parents completed an iCBT program for child anxiety.

The current study examined the effect of pre-treatment variables relating to i) the demographic characteristics of the child and family, ii) clinical indicators of anxiety severity and comorbidity, and iii) family factors of parental mental health, couple

relationship quality, parenting styles, and family adaptability and cohesion in predicting response to iCBT for child anxiety. Treatment outcome was defined in terms of treatment response rather than remission and was assessed by the linear time slopes of two continuous measures of parent- and child-report of anxiety (ie. changes in anxiety) over four time points, namely pre-treatment, 12-weeks, 6-month follow-up (6-mth-fup) and 12-month follow-up (12-mth-fup).

In view of the conflicting findings regarding the predictive effects of demographic and clinical factors for both CBT and iCBT outcomes, no hypotheses were formulated regarding these variables and analyses were regarded as exploratory. With respect to family factors, we hypothesized that poor treatment response would be more likely for children living in an unstructured and unsupportive environment, with parent(s) who experienced poorer mental health, poor couple relationship quality, or demonstrated parenting styles characterized by low support and high levels of over-control. We also proposed that family factors would be more strongly associated with treatment outcome for children (12 years and below) than adolescents (13 years and above) given that adolescents typically show greater capacity for behavioral autonomy, independence, and cognitive maturity (Wray-Lake, Crouter, & McHale, 2010), and that parents tend to reduce guidance and assistance as their child matures (Branje, 2018).

Method

Participants

All participants met clinical diagnostic criteria for an anxiety disorder and included three sub-samples drawn from three sources, namely i) 30 children aged 7-12 years from the iCBT condition of a randomized controlled trial comparing iCBT with a wait list control (March, Spence, & Donovan, 2009), ii) 52 youth aged 13-18 years from the iCBT condition of a randomized controlled trial comparing iCBT with clinic-

delivered CBT and a waitlist condition (Spence et al., 2011), and iii) an additional 93 participants aged 7-18 years who applied to participate in the aforementioned RCTs after the experimental conditions were full, but who then completed either the child or teen iCBT program depending upon the age of the child, together with assessments at identical timepoints as those who participated in the RCTs. The additional participants had not previously participated in the RCT studies and are included in this study for the purpose of providing a greater sample size to examine predictors of outcome. The same assessment and treatment protocols were followed for the additional participants as for those in the two RCTs.

There were 175 participants (81 males; 94 females), aged 7-18 years (M = 12.00, SD = 2.50), and at least one parent. Throughout the manuscript all participants are referred to as "children", irrespective of age. All children presented with a primary diagnosis of separation anxiety disorder (SEP), social phobia (SOC), generalised anxiety disorder (GAD), or specific phobia (SpPh) as determined by the Anxiety Disorders Interview Schedule – Child and Parent versions (ADIS-C/P; Silverman & Albano, 1996).

Exclusion criteria were i) a secondary diagnosis of obsessive-compulsive disorder, oppositional defiant disorder, posttraumatic stress disorder, panic disorder, conduct disorder, dysthymia or major depressive disorder at a clinician severity rating $\geq$ the primary anxiety disorder, ii) an intellectual handicap, learning disability, or pervasive developmental disorder, iii) current self-harming behaviour or iv) ongoing treatment for anxiety elsewhere. Families were required to have access to a computer and the Internet at home. Once a family had enrolled in the program, they were included in the study irrespective of the number of sessions or assessments they completed.

The mean number of child anxiety diagnoses was 2.88 (*SD* = 1.41) and mean CSR = 5.94 (*SD* = 0.78). The majority was born in Australia (87.9%), spoke English at home (96.4%), and lived with both biological parents (78.9%). Family income data indicated that, compared to the Australian Bureau of Statistics national census data (ABS; 2009), participants on average came from middle- to high-income families, and parents were relatively well-educated, with 43.1% of fathers and 48.6% of mothers having a university degree. Table 1 summarizes the demographic, clinical and family characteristics that were examined as potential predictors of treatment response.

Insert Table 1 about here

Given evidence of the significant role of fathers in child anxiety treatment (Bögels & Phares, 2008), both paternal and maternal predictor factors were examined. Questionnaire responses were received from 110 fathers, and 172 mothers. Although both parents were invited to complete the parent sessions of the program, for 84.6% of children only their mother participated, for 14.1% both parents participated, and for 1.3 % of children, only their fathers participated.

As participants came from different sources, we checked for differences in pre-treatment demographic, clinical and family variables between those from the randomized controlled trials (the RCT subsamples) versus the additional participants recruited specifically for the prediction of outcome (the predictor sub-samples). The child RCT subsample was compared with the child predictor subsample (age 7-12 years), and the teen-RCT sub-sample (age 13–18 years). There were no significant differences between the teen-RCT versus teen-predictor or between the child-RCT versus child-predictor sub-samples for any of the pre-treatment variables (Supplementary Table 1 available online).

The same method, in terms of recruitment, measures, assessment and treatment protocols, was followed for all sub-samples in the study.

Measures

Diagnostic Status for Participant Selection

The ADIS-C/P structured clinical interview (Silverman & Albano, 1996) was conducted prior to treatment to determine whether children met the inclusion criteria for an anxiety disorder and to identify the presence of specific subtypes of anxiety disorder. Interviewers were independent of the study and blind to treatment condition. Clinician judgement regarding diagnosis and clinician severity rating (CSR: 0=absent, 4-8 representing clinical levels of severity) reflected responses from both child and parent. A random subset of 15% of interviews were voice-recorded and rated by independent, trained interviewers. Inter-rater reliability was Kappa = 0.94 for the primary diagnosis and Spearman's correlation = .93 for the CSR.

Primary Outcome Measures

The primary outcome measures were parent and child versions of the Spence Children's Anxiety Scale (SCAS-C and SCAS-P; Nauta et al., 2004; Spence, 1998). The SCAS-C and SCAS-P assess the frequency of 38 anxiety symptoms, rated on a 4-point Likert scale ranging from 0 ("never") to 3 ("always"). Total scores range from 0-114, with higher scores indicating greater anxiety symptom severity. The SCAS-C also includes six additional positively worded six filler items. High internal consistency has been shown for the total score for both child (Spence, 1998; Spence, Barrett, & Turner, 2003) and parent versions (Nauta et al., 2004). Internal reliabilities for the total scores in the present study were .91 (SCAS-C) and .88 (SCAS-P). Parent report in the present study was completed by the child's mother.

Predictors of Outcome

Demographic Characteristics – of child gender, child, mother and father age, level of mother and father education assessed as having completed a university degree

or not, and family income coded as being below A$60,000 per annum or at/above A$60,000.

Clinical Factors – were examined in terms of pre-treatment anxiety severity, type of anxiety disorder, and comorbid depressive symptoms.

Pre-treatment anxiety severity was assessed as the summed total of CSRs for all anxiety disorder diagnoses on the ADIS-C/P (Pre-Total-CSRs) as outlined by Stjerneklar et al. (2019). Pre-Total-CSRs was used to control for pre-treatment anxiety severity in examination of predictive effects of all other variables in the MLM analyses.

Type of anxiety disorder (SEP, SOC, GAD, or SpPh), was determined as the presence or absence of a diagnosis of the specific anxiety disorder at pre-treatment whether it be the primary or "non-primary" diagnosis.

Depressive symptoms were assessed with the Center for Epidemiological Studies Depression Scale (CES-D), which consists of 20 items, rated on a 4-point scale regarding frequency of depressive symptoms in the past week (Radloff, 1977). Summed scores range from 0 to 60, with higher scores indicating more depressive symptomatology. The scale has strong reliability and construct validity (Garrison et al., 1989; Radloff, 1977). Internal consistency in the present study was high (Cronbach alpha = .90).

Family Factors – were examined in terms of parental mental wellbeing (mental health and couple relationship quality), family functioning, and parenting style.

Parent Mental Health was measured using the Depression, Anxiety and Stress Scale – Short Form (DASS-21; Lovibond & Lovibond, 1995). The total score of the 21 items, each rated 0 to 3, was used with values ranging from 0 (low) to 63 (high). Internal consistency was .89 (mothers) and .91 (fathers).

Couple Relationship Quality was assessed using the Quality of Marriage Index (QMI; Norton, 1983) and was completed only by parents who reported being currently

in a relationship. To avoid exclusion of parents who were not married, items with specific references to "marriage" were reworded to reflect 'relationship'. Total scores range from 6 to 45, with higher scores representing more positive relationship quality. Analyses used the mean score of both parents (where available), or for the father or mother separately if only one parent responded. Internal consistency was .95 (mothers) and .96 (fathers).

Family Functioning was evaluated with the Family Adaptability and Cohesion Evaluation Scale – Version III (FACES; Olson, Portner, & Lavee, 1985). Adaptability refers to the ability of a family to adjust constructively in response to environmental challenges, while cohesion refers to the emotional attachment, bonding and connectedness between family members (Olson 1991). In addition to child-report, parent-report was based on the mean score computed from both parent scores (where available), or for mother or father alone if only one parent responded. Internal consistency for cohesion was .82 (mothers), .79 (fathers) and .80 (child) and for adaptability .72 (mothers), .72 (fathers) and .69 (child).

Parenting Style was assessed with parent and child versions of the Parent Support-Control Questionnaire (PSCQ: Lilley, 2003). The Parental Support sub-scale includes 13 items reflecting emotional warmth, responsiveness, and acceptance, whereas the Parental Control sub-scale includes 13 items reflecting overprotection, regulation of activities, and intrusiveness. Both subscale scores range from 13 – 78, with higher scores indicating greater parental support or control. Internal consistency for Support was .88 (mothers), .89 (fathers) and .91 (child) and for Control .86 (mothers), .80 (fathers) and .81 (child).

Procedure

Participants were referred by mental health professionals, GPs, school guidance officers, and parents. If initial telephone screening criteria were met (conducted with

the parents), families were invited to complete an online questionnaire battery. The ADIS-C/P interview was conducted by telephone with the child and one of their parents separately. Eligible families who had provided informed consent were invited to commence the intervention.

Online Treatment

The program (BRAVE-ONLINE) has been described in detail elsewhere (Spence et al., 2008). It consists of 10, weekly sessions for young people and 5 or 6 sessions for parents of children and adolescents respectively. The program incorporates CBT anxiety management strategies including psychoeducation, relaxation training, cognitive restructuring, graded exposure, problem solving, and self-reinforcement. Parent sessions teach strategies to enable parents to support and reward their child for implementing anxiety management skills.

Children and parents received brief, weekly email feedback and support from the therapist following each session, automated emails to inform them when their next session was available or overdue, and a 30-minute phone call following the exposure session to assist with hierarchy construction and implementation. All therapists were psychologists who were trained for two days with BRAVE-ONLINE materials and received weekly supervision from an experienced clinical psychologist. There was no face-to-face contact between therapist and participants.

Statistical Analyses

The study employed a mixed-effect, longitudinal, multi-level model (MLM) approach using IBM® SPSS® statistics, v.26.0 to identify variables that influenced the slopes for change in SCAS-C and SCAS-P over four measurement occasions (pre-treatment, 12-weeks, 6- and 12-mth-fup). This approach has the advantage that all participants are included at all time points with missing data points being estimated algorithmically, thus making them intent-to-treat analyses. The data were structured at

two levels, with time at Level 1 nested within individuals at Level 2. Analyses to identify the best fitting and robust base model indicated a better fit using Maximum Likelihood (ML) estimation, with both the intercept and slope specified as random with an unstructured covariance matrix for the random intercept and slope and an identity covariance matrix for the repeated measure of time. As the inclusion of a quadratic term for time did not improve model fit for either outcome measure, all analyses were conducted for the prediction of linear changes in SCAS-C and SCAS-P. All predictor analyses controlled for pre-treatment anxiety severity using the total clinician severity rating (Pre-Total-CSRs) values for all pre-treatment anxiety diagnoses identified from the ADIS-C/P diagnostic interviews. Pre-treatment anxiety was therefore controlled for using a measure that differed from the SCAS-C and SCAS-P so that the same variables were not being taken as both the predictor and outcome, consistent with Stjerneklar et al. (2019).

Treatment outcome was assessed as the degree of change in anxiety scores (the slope) over the four occasions separately for the SCAS-C and SCAS-P. A variable was concluded to be a significant predictor of treatment outcome if there was a significant interaction between the predictor variable and the time slope for the SCAS-C or SCAS-P, after controlling for Pre-Total-CSRs. If this condition was met, the predictor variable explained a significant proportion of the between-individual variation in changes in anxiety on SCAS-C or SCAS-P over the four occasions.

Candidate predictors were analysed as continuous variables except for gender, parental education, income, and presence/absence of specific diagnoses. Continuous predictors were centred around the mean, and dichotomous variables coded 0 or 1. Estimates of skewness and kurtosis for all variables were within acceptable limits. No issues were identified regarding multicollinearity, with all variance inflation (VIF)

values below 3.5. Multivariate normality of variables was confirmed for all models using Q-Q plots.

To identify the predictors of the slope for change in anxiety, a stepped approach was used (Fournier et al., 2009). For each domain of potential predictors (demographic, clinical and family), univariate MLM analyses were conducted for each variable, controlling for Pre-Total-CSRs. Where variables were identified as significant predictors ($p<.05$) in the univariate analyses for a domain, a multivariate model was examined in which all significant univariate predictors from that domain were entered simultaneously. Finally, the variables from each domain that still reached significance ($p<.05$) were entered together in a multivariate analysis, and those that remained significant ($p<.05$) were retained in the final model. This approach was conducted first for SCAS-C and then separately for SCAS-P.

To interpret and clarify the significant slopes, post-hoc MLM linear contrasts were conducted to determine differences in slopes for different levels of the predictor variables, using a categorical approach taking ranges 1SD above/average/1SD below the estimated marginal mean for continuous variables, or presence/absence for the dichotomous predictors. These effects are illustrated graphically in supplementary material.

Missing data.

There were minimal missing data at pre-treatment as the data were collected online as part of registration and had to be completed before the participant could proceed. Missing data for pre-treatment questionnaire items were replaced with the series mean for that item if the scale was missing less than 25% of data points. Less than 0.1% of pre-treatment data points were replaced in this way. In terms of drop-out, at the 12-week assessment point, 6 families were unavailable, as were 15 at 6-mth-fup

and 16 at 12-mth-fup. Missing data for these families was handled through the MLM analyses which uses an intent-to-treat approach as described above.

Results

Determining the base model for SCAS-C.

SCAS-C: The null model (random intercept) for SCAS-C scores showed an intraclass correlation co-efficient (ICC) of 0.34, suggesting that 34.4% of total variability in SCAS-C lay between-individuals and 65.6% within-individuals. The random intercept and slopes model indicated a significant improvement in fit over the random intercept-only model, with a significant time effect, suggesting a linear reduction in SCAS-C averaging 7.2 points over each assessment period from a pre-treatment mean score of 38.01 (Supplementary Table 2). The random error of the linear slope for SCAS-C scores suggested significant variance in change in SCAS-C remaining to be explained by between-individual factors.

Estimated marginal means indicated a reduction in SCAS-C from $\overline{X}$ = 40.12 (*SE* = 1.29) at pre-treatment, to 28.56 (*SE* = 1.29) at 12-weeks, 21.56 (*SE* = 1.12) at 6-mth-fup, and 18.51 (*SE* = 1.06) at 12-mth-fup. There were no significant differences between the four subsamples in changes in SCAS-C over the four occasions (Supplementary Table 3). Thus, all subsequent analyses were conducted with the combined samples.

Univariate MLM Analyses of Predictors of Change in SCAS-C: Controlling for Pre-treatment Anxiety (Pre-Total-CSRs).

The interaction effects for the univariate MLM analyses between the potential predictors and the slope for change in SCAS-C from pre-treatment, 12-weeks, 6- and 12-mth-fups (henceforth referred to as "change in SCAS-C") are shown in Table 2.

The univariate interaction between Pre-Total-CSRs and change in SCAS-C was not significant (Table 2), suggesting that the slope for reductions in SCAS-C did not differ significantly according to different levels of Pre-Total-CSRs. However, Pre-Total-CSRs was significantly associated with the intercept for SCAS-C (ie. the mean SCAS-C score at pre-treatment), thus Pre-Total-CSRs was included as a control for pre-treatment levels of anxiety in all subsequent analyses relating to prediction of change in SCAS-C.

INSERT Table 2 about here

Child and family demographic factors. The candidate predictors of child age and gender, family income, and parent age and education were examined as individual predictors of change in SCAS-C in univariate MLM models. The findings suggest that younger maternal age and lower maternal education were significantly associated with greater reduction in SCAS-C (Table 2).

Clinical factors. Of the potential pre-treatment clinical predictors, the univariate MLMs showed that presence of SEP and higher CES-D depression scores significantly predicted a greater reduction in SCAS-C.

Family factors. Table 2 indicates that poor couple relationship quality and low child report of parental control predicted a greater reduction in SCAS-C.

Multivariate Analysis of Predictors of Change in SCAS-C Over the Four Assessment Occasions

The significant univariate predictors of change in SCAS-C from each demographic, clinical, and family domain, were entered simultaneously for that domain. The variables remaining statistically significant for each domain were maternal age and education (demographic); SEP and CES-D (clinical); and QMI and child report of parental control (family). These variables were then entered into a multivariate model across all domains simultaneously (Supplementary Table 4). SEP,

CES-D, and QMI continued to significantly predict changes in SCAS-C over time. Finally, these three variables were entered simultaneously in a further multivariate model, and all remained statistically significantly predictors of change in SCAS-C and formed the final model (Table 3).

INSERT Table 3 about here

Post-hoc MLM contrasts of the linear slopes confirmed significant reductions in SCAS-C for children with and without SEP, although the decline was greater for those with SEP (Supplementary Table 5). Figure 1 shows that children with SEP responded particularly well to ICBT even after controlling for Pre-Total-CSRs.

For pre-treatment CES-D, post-hoc contrasts of the linear slopes showed significant reductions in SCAS-C for all levels of CES-D, but the reduction was greater for those with higher pre-treatment CES-D compared to those with average range or low CES-D scores (Supplementary Table 5). Figure 1 shows that, compared to children with average pre-treatment CES-D scores, those with high CES-D scores also showed higher pre-treatment SCAS-C scores (even after controlling for Pre-Total-CSRs), but no significant difference in SCAS-C at 12-mth-fup.

For QMI, post-hoc MLM contrasts showed significant reductions in anxiety over the four occasions irrespective of QMI level. However, the slope for change in SCAS-C was significantly smaller (less reduction) for children whose parents reported lower pre-treatment QMI scores (indicative of poorer couple relationship quality) compared to those who reported high QMI scores, although they did not differ from those with average scores (Supplementary Table 5 and Figure 1).

Interaction Effects for Age and Gender in Prediction of SCAS-C Over Time

There were no significant interactions between age or gender with any of the demographic, clinical or family factors in the prediction of change in SCAS-C, controlling for Pre-Total-CSRs.

Determining the base model for SCAS-P.

SCAS-P: The null model (random intercept) for SCAS-P indicated an ICC of 0.275 suggesting that 27.5% of total variability in scores lay between-individuals (Supplementary Table 6). The model for random intercept and time slope for SCAS-P indicated a significant improvement in fit (Supplementary Table 6), with a significant effect for time, suggesting a linear reduction in SCAS-P averaging 5.6 points over each assessment period. The random error associated with the linear slope suggested significant variance in change in SCAS-P remaining to be explained by between-individual predictors.

Estimated marginal means indicated a reduction in SCAS-P from $\overline{X}$ = 32.59 (*SE* = 1.02) at pre-treatment, to 23.73 (*SE* = 0.85) at 12-weeks, 18.07 (*SE* = 0.70) at 6-mth-fup and 15.96 (*SE* = 0.75) at 12-mth-fup.

There were no significant differences between the four subsamples in changes in SCAS-P over the four occasions (Supplementary Table 3). Thus, all subsequent analyses were conducted with the combined samples.

Univariate Analyses of Predictors of Change in SCAS-P Over the Four Assessment Occasions: Controlling for Pre-treatment Anxiety (Pre-Total-CSRs).

The interaction effects for the univariate MLM analyses for prediction of changes in mother report of their child's anxiety (SCAS-P) over time are shown in Table 2.

The univariate interaction between Pre-Total-CSRs and change in SCAS-P was significant (Table 2), suggesting that the greater reduction in SCAS-P was associated with higher Pre-Total-CSRs. All subsequent analyses relating to potential predictors of changes in SCAS-P controlled for Pre-Total-CSRs.

Child and family demographic factors. The univariate results suggested that children with younger mothers or younger fathers, those with fathers without a university education, and those from families with lower incomes tended to show larger decreases in SCAS-P, whereas there were no significant effects for child age, gender, or maternal education (Table 2).

Clinical factors. Of the potential clinical predictors, over and above Pre-Total-CSRs, the univariate MLMs showed that the presence of SEP was the only clinical variable that significantly predicted change in SCAS-P, suggesting that children with SEP tended to show greater reductions in SCAS-P than those without this diagnosis.

Family factors. None of the parent wellbeing, family functioning or parenting style variables significantly predicted change in SCAS-P, although the interaction between couple relationship and the time slope approached significance (p=.06).

Multivariate Analysis of Predictors of Change in SCAS-P

The significant univariate demographic predictors, namely maternal age, paternal age and education, and family income, were entered into a multivariate model simultaneously. Maternal age and family income remained significant predictors of change in SCAS-P. These demographic variables were then entered into a multivariate analysis with SEP. Maternal age, family income and SEP at pre-treatment each continued to significantly predict changes in SCAS-P scores and were included in the final model for prediction of the slope for change in SCAS-P (Table 4).

Post-hoc MLM contrasts were conducted to clarify the results. For SEP, the contrasts showed that, while the linear slope was significant for those with and without SEP, it was significantly greater for those with SEP (Supplementary Table 7). Figure 2 shows that, even after controlling for Pre-Total-CSRs, children with SEP reported higher levels of SCAS-C but responded well to ICBT, such that by 12-mth-fup, SCAS-C levels were equivalent to those without SEP.

Insert Figure 2 about here

Post-hoc MLM contrasts showed that while the linear slope was significant for those with younger or older mothers, the linear slope was significantly greater (more reduction) for children of younger mothers (Supplementary Table 7). Figure 2 shows that, at 12-mth-fup, SCAS-P scores were lower for children of younger compared to older mothers, $t(170) = 2.82$, $p=.005$.

Post-hoc contrasts showed that, while the linear slope showed a significant decrease in SCAS-P for children in both income categories, the reduction was significantly greater for children of lower compared to higher income families (Supplementary Table 7). Although lower income families showed significantly higher SCAS-P scores at pre-treatment, even after controlling for Pre-Total-CSRs, $t(169) = -2.46$, $p=.015$, by 12-mth-fup there was no significant difference in SCAS-P scores by level of family income (see also Figure 2).

Insert Table 4 about here

Interaction Effects for Age and Gender in Prediction of SCAS-P Over Time

There were no significant interactions between age or gender with any of the demographic, clinical or family factors in the prediction of change in SCAS-P, after controlling for Pre-Total-CSRs.

Compliance.

Although not a focus of the study, we examined whether treatment outcomes were associated with level of program compliance. The mean percent of sessions completed by children was 74.3% by the 12-week assessment point, and 81.3% by 6-mth-fup. In terms of parent compliance, the mean percent of sessions completed was 86.0% at 12-weeks and 89.2% by 6-mth-fup. There were no significant associations between number of sessions completed by children or parents at the 12-week or 6-mth-fup assessment points and changes in anxiety on SCAS-C or SCAS-P.

Discussion

The results from multilevel modelling analyses demonstrated that although there were strong and significant reductions in anxiety symptoms following iCBT on both parent and child report, there was sufficient variation in the slopes for level of change in anxiety to warrant examination of predictors of outcome.

In terms of demographic characteristics, there was no evidence that child gender or age predicted change in anxiety symptoms, consistent with Stjerneklar et al. (2019). The only demographic variables that remained significant predictors of change in anxiety in the multivariate models, after controlling for pre-treatment anxiety severity, was family income and mother's age (for SCAS-P), with anxiety reductions being greater for children with younger mothers and from families with lower incomes. We can only speculate as to why response to iCBT might be slightly better for children of younger mothers. Possibly, older mothers are less technologically proficient and thus less able to facilitate their child's participation in the program. Also, older mothers are perhaps likely to be more involved in the workforce and/or to have more children to care for and thus have less time to dedicate to their child's therapy. These issues could be explored in future research.

For clinical variables, pre-treatment SEP predicted a strong response to iCBT for both SCAS-P and SCAS-C. Children with SEP responded particularly well to iCBT despite having a slightly higher initial level of anxiety symptoms compared to those without SEP. Contrary to some findings from clinic-based CBT for child anxiety (Hudson et al., 2015), but consistent with those from iCBT for child anxiety (Stjerneklar et al., 2019; Vigerland et al., 2017), the results did not find social phobia to predict iCBT treatment response. This was also the case for GAD and SpPh, suggesting that, in general, children with all four types of anxiety disorder respond well to iCBT.

High pre-treatment depression symptoms also predicted greater reductions in SCAS-C (but not SCAS-P), although scores at 12-mth-fup were equivalent to those of children with average depression scores. This result for SCAS-C mirrors that of Stjerneklar et al. (2019), but differs from Vigerland et al. (2017) who found no association between pre-treatment depression and changes in anxiety in response to iCBT for youth anxiety.

Contrary to predictions, there was no evidence that parent wellbeing, family environment or parenting style were associated with reductions in anxiety symptoms following iCBT for child anxiety, irrespective of informant. In multivariate analyses, the only family variable to significantly predict changes in anxiety was quality of the couple relationship. The level of reduction in anxiety symptoms on SCAS-C was lower for children of parents who reported poor relationship quality compared to those with parents who reported high relationship quality. However, irrespective of level of parent relationship quality, mean SCAS-C scores at 12-mth-fup had reduced to below the normative cut-off for "elevated" SCAS-C scores (https://www.scaswebsite.com/)[1]. Thus, although there is some support for the hypothesis that poor couple relationship quality reduces the effect of iCBT, children in these families still showed positive reductions in anxiety, albeit not as strong as children from families with good couple relationship quality.

We can only speculate as to why couple relationship quality influences treatment outcome for iCBT for child anxiety. There is some evidence that parents who exhibit higher levels of responsive, caring and supportive behaviour in their couple relationships also tend to use these skills in their parenting practices (Millings et al.,

[1] Cut-off points for the clinical (94%ile) and elevated (84%ile) range on the SCAS-C and SCAS-P vary according to child age and gender. A score below 33 is below the elevated cut-off for all age groups and both genders on the SCAS-C. A score below 24 is below the elevated cut-off for all age groups and both genders on the SCAS-P.

2013). Thus, it is possible that parents with skills to form high quality couple relationships also tend to be those who encourage and support their child to succeed in the iCBT program. The measure of parental support included in the present study did not examine the specific parenting behaviours related to program and task completion. This would be a valuable area for future research. Another possible explanation for the finding is that children may be anxious about their parents' relationship difficulties and this could impede therapy outcomes.

The lack of association between parental mental health and changes in anxiety is consistent with the finding of Vigerland et al. (2017) for iCBT with 8-12 year old anxious children. However, it contrasts with Morgan et al. (2018) who reported that higher parent psychological distress predicted higher levels of anxiety among 3-6 year-olds at 24-week follow-up. It is feasible that poor parental mental health has a stronger impact upon outcomes from iCBT for much younger children and where the program is completed by the parent alone. In the present study, the sample was not only older (7 – 18 years), but children and parents completed modules separately.

Strengths and Limitations of the Study

Strengths of the study include a relatively high retention rate, data from multiple informants including fathers as well as mothers, a 12-mth-fup period, and a clinical sample with anxiety severity consistent with other clinic-based studies (eg. Chu, Skriner, & Zandberg, 2013). In terms of limitations, the sample tended to include middle- to high-income families and parents who were relatively well-educated. Greater socio-economic diversity of participants would be desirable in future research.

It is likely that the degree of generalizability of the findings to other iCBT programs for child anxiety will depend on the degree of similarity to that used in the present study. The content and delivery of iCBT for child anxiety tends to differ across programs in relation to various factors such as number of sessions, level of therapist

support, involvement of parents, and particular CBT components included, not to mention variation in participant characteristics such as age of child and demographic features. The findings of the present study may therefore not be generalizable to other iCBT programs for which the content and delivery parameters are vastly different. This issue also relates to differences across studies in the method used to assess treatment outcome, length of follow-up, and type of statistical analysis. In the present study, treatment outcome was assessed in terms of the slope for change in anxiety symptoms reported by the parent and child over four occasions from pre-treatment to 12-mth-fup using multilevel modelling, rather than prediction of an endpoint such as diagnostic status. Our approach is consistent with Stjerneklar et al. (2019) who also used the SCAS-C. It differs, however, from Vigerland et al. (2017), who used CSR change scores between pre-treatment and three-month follow-up, controlling for pre-treatment CSR scores, in multiple regression analyses.

Future Directions

Identifying factors that interfere with or promote successful treatment outcome may enable us to adapt and enhance interventions in order to increase the proportion of young people who benefit from them. Despite identifying very few predictors of treatment response for therapist-assisted iCBT in the present study, this line of research remains important for interventions such as self-help iCBT for which there are typically higher rates of drop-out and lower effect sizes from treatment (March et al., 2018). For self-help iCBT, it is likely that the proposed predictor variables in the present study will play a more important role in predicting outcome than was found here.

Conclusions

The current study is the first to conduct an in-depth examination of family factors as predictors of response to iCBT for child anxiety disorders. In general,

participants showed strong and equivalent reductions in anxiety following iCBT irrespective of severity and comorbidity of anxiety disorders, child age or gender, parental mental health, family environment in terms of adaptability and cohesion, or parenting style. Elevated depression, presence of a separation anxiety diagnosis, higher Pre-Total-CSRs, and family income were associated with greater anxiety reduction for child or mother reported anxiety. However, by 12-mth-fup, anxiety scores had reduced to within the normal range for these children. Only poor couple relationship quality and older age of mother were associated with lower reductions in anxiety symptoms, and even for children from these families, anxiety scores at 12-mth-fup had decreased to within the normal range.

From a practical point of view, the findings suggest that iCBT, with brief, indirect therapist support, offers an effective treatment option for clinically anxious young people irrespective of the demographic, clinical and family factors examined in the present study. However, where parents are experiencing poor couple relationship quality, then additional assistance to address this issue may be advantageous in improving iCBT outcome for child anxiety.

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