Holmes, J., March, S., & Spence, S. (2009). Use of the Internet in the Treatment of Anxiety Disorders with Children and Adolescents. *Counselling, Psychotherapy, and Health*, 5(1), The Use of Technology in Mental Health Special Issue, 187-231.

Use of the Internet in the Treatment of Anxiety Disorders with Children and Adolescents

Jane Holmes, D.Psych

Sonja March, B Psych Hons
University of Queensland

Susan Spence, PhD
Griffith University

Contact:
Sonja March
School of Psychology
University of Queensland
Brisbane, QLD 4072, Australia.
s.march@psy.uq.edu.au

Holmes, J., March, S., & Spence, S. (2009). Use of the Internet in the Treatment of Anxiety Disorders with Children and Adolescents. *Counselling, Psychotherapy, and Health,* 5(1), The Use of Technology in Mental Health Special Issue, 187-231.

Abstract

This article describes the use of computer- and internet-based interventions as a potential alternative treatment approach for children with anxiety disorders. Given the paucity of research into computerised treatments for child anxiety, this article begins by reviewing the literature regarding the application of computers in adult anxiety disorders. It will also review the available literature relating to computerised interventions for childhood disorders generally and more specifically, for childhood anxiety. Further, it will describe the development of BRAVE – ONLINE, an internet-based, CBT intervention for child anxiety and discuss the program findings to date. Such internet-based interventions have the potential to greatly increase the dissemination of psychological interventions to children in need.

Holmes, J., March, S., & Spence, S. (2009). Use of the Internet in the Treatment of Anxiety Disorders with Children and Adolescents. *Counselling, Psychotherapy, and Health,* 5(1), The Use of Technology in Mental Health Special Issue, 187-231.

Anxiety disorders are among the most common psychosocial problems in childhood and are associated with a range of adverse consequences if left untreated (Costello et al., 1996; Essau, Conradt, & Petermann, 2000, 2002; Silverman, Pina, & Viswesvaran, 2008). Cognitive-behaviour therapy (CBT) has been extensively researched and demonstrated to be an effective treatment for the majority of children with anxiety disorders (Barrett, Dadds, & Rapee, 1996; Barrett, Duffy, Dadds, & Rapee, 2001; Kendall, 1994; Kendall & Southam Gerow, 1997; Kendall et al.,1996). Some studies have found slightly stronger effects if therapy includes training in parenting techniques, in addition to child-focused components (Barrett, Rapee, Dadds, & Ryan, 1996; Cobham, Dadds, & Spence, 1999), although not all studies have found parental involvement to provide additional benefits (Nauta, Scholing, Emmelkamp, & Minderaa, 2003; Spence, Donovan & Brechman Toussaint, 2000). In a recent review, Silverman et al. (2008) examined all available treatment studies and concluded that individual CBT and group CBT meet criteria as *probably efficacious* treatments for child anxiety, whilst other treatments including parent involvement were *possibly efficacious*.

Despite the development of effective therapy, the vast majority of anxious children do not receive treatment for their problems (Essau et al., 2000). There are various explanations for this. Failure to receive therapy may reflect lack of parental awareness of the problem and its consequences, lack of knowledge about effective treatments, and/or lack of availability of services and professionals who are trained in the delivery of CBT approaches. Another explanation for the failure to seek treatment is that many families have difficulty attending a clinic on a regular basis, particularly those

living in rural and remote areas. Furthermore, CBT is costly and current clinical services would be unable to meet demand if all cases were to request treatment.

These issues are not unique to child anxiety and other areas of health have attempted to increase access to treatment through the use of computer-based technology, as an alternative or adjunct to clinic-based therapy (Newman, 2004). Cognitive behaviour therapy, in particular, has been suggested to be well suited to computer-based administration because of its structured and systematic format (Anderson, Jacobs, & Rothbaum, 2004; Kenardy & Adams, 1993; Selmi, Klein, Greist, Sorrell, & Erdman, 1990).

Most of the research regarding the feasibility and efficacy of computer-delivered treatment of anxiety has been limited to adult populations. Thus, before examining the literature relating to computer-based treatment of anxiety in children, the following section discusses the outcome studies involving adults.

Computer and Internet-Based Treatment of Anxiety Disorders in Adults

Computer-aided treatment may involve various technological forms, such as internet sites, email, chat-rooms, palmtop computers, virtual reality, interactive voice response systems, desktop computer programs and CD-ROMs. The extent of therapist participation can also differ considerably with these technologies, ranging from stand-alone, self-help treatments with no therapist contact, to computer applications with some therapist involvement via telephone or email, or delivered as an adjunct to face-to-face therapy.

Impact of Computer-Based Application of Specific Components of CBT

The level of complexity of the interventions delivered using computer-based approaches have differed considerably, with some being limited to specific elements of CBT, such as systematic desensitisation, in-vivo exposure or vicarious exposure, whereas others have involved more comprehensive programs that contain multiple CBT components.

Systematic Desensitisation. Buglione, Devito, and Mulloy (1990) compared computer-instructed, systematic desensitisation to group therapy in 36 university students with test anxiety. Both treatments were equally effective in reducing test anxiety. Computer-administered, systematic desensitisation for treating test anxiety has also been shown to be effective in two case studies (Biglan, Villwock, & Wick, 1979; Wilson, Omeltschenko, & Yager, 1991). Chandler and colleagues (Chandler, Burck, Sampson, & Wray, 1988; Chandler, Burck, & Sampson, 1986) similarly found computer-delivered, systematic desensitization to significantly reduce anxiety scores in the treatment of specific phobias.

Invivo Exposure. Several computer programs have been developed to provide clients with step-by-step instruction for in-vivo exposure. Ghosh, Marks, and Carr (1988) developed and tested a self-instructed computer program for in-vivo exposure in a sample of 40 agoraphobic patients. They examined the effectiveness of this computer program, in comparison to self-instructed exposure by a therapist, or self-help workbook and found no difference in effectiveness among the three formats. Greist et al. (2002) developed a computer-driven interactive voice response system (IVR) for exposure in the treatment of obsessive-compulsive disorder. This program (BT steps) allowed patients to progress

through a computer-driven, self-paced workbook accessed via the telephone. The authors compared BT steps to clinician guided self-exposure and self-relaxation in a large sample of 218 patients with obsessive-compulsive disorder. Results indicated that clinician-guided exposure was significantly more effective than computer-guided exposure and that both treatments were superior to relaxation. However, computer-guided patients who completed at least one self-exposure homework session improved as much as clinician-instructed patients. This finding suggests that poor patient compliance with computer-based treatment may explain the weaker results for computer-guided exposure. Patients also reported greater satisfaction with clinician-guided exposure therapy, compared to computer-guided therapy and self-relaxation.

Vicarious Exposure. Several studies have examined computerised application of vicarious, rather than invivo, exposure in the treatment of anxiety disorders. These programs are based on the principles of observational learning and require participants to act as therapists, by guiding an on-screen figure through different anxiety provoking scenarios, which are related to their own specific anxiety problem. Smith, Kirkby, Montgomery, and Marks (1997) compared three different versions of computer-aided vicarious exposure in a sample of 45 individuals with spider phobia. The computer conditions included vicarious exposure with computer feedback, vicarious exposure without feedback and a control group that received irrelevant exposure with feedback. At post-treatment and 12-month follow-up, participants in all three conditions showed a reduction on outcome measures, including those in the control group. The authors concluded that the general reduction in phobic symptoms was due to either a non-specific therapeutic factor, or to a natural reduction in symptoms over time.

In a more recent study, the same research group (Gilroy, Kirkby, Daniels, Menzies, & Montgomery, 2000) examined the efficacy of computer-aided vicarious exposure, standard in-vivo exposure and progressive muscle relaxation for the treatment of spider phobia (n=45). They found that computer-aided and live exposure were equally effective in reducing phobic symptoms at post-treatment and 3-month follow up, and that both treatments were superior to relaxation. However, participants who received live exposure showed a trend towards higher ratings of treatment satisfaction, compared to computer and relaxation conditions. At 33-month follow-up, computer-aided and live exposure maintained treatment gains, but these differences were no longer statistically significant from the relaxation control (Gilroy, Kirkby, Daniels, Menzies, & Montgomery, 2003).

Clark, Kirkby, Daniels, and Marks (1998) also investigated the efficacy of a computer vicarious exposure program in a pilot study of 13 participants with obsessive-compulsive disorder. Participants completed three, 45-minute computer sessions of vicarious exposure and response prevention. Results indicated that scores on two of the three outcome measures were modestly reduced from pre- to post-treatment. In another study, Harcourt, Kirkby, Daniels, and Montgomery (1998) (1998) found computer-aided vicarious exposure led to a reduction in symptom scores in a sample of 18 adults with agoraphobia. However, neither of these studies included a comparison group or follow-up data.

Promising results for computer-aided vicarious exposure have also been found in the treatment of flight phobia. Bornas, Tortella-Feliu, Llabres, and Fullana (2001) developed and tested a computer program that involved graded exposure to a sequence of

photographs and audio cues for different stages of a plane flight. They compared computer-assisted exposure, computer-assisted exposure with therapist-instructed arousal reduction and a wait list control. Results at post-treatment and six-month follow-up showed that both exposure treatments were equally effective in reducing fear ratings and superior to the control group.

Impact of Comprehensive Computer-based CBT Programs

In addition to exposure programs, a number of comprehensive computerised interventions have been developed. These computer programs involve differing levels of therapist participation and vary from individualised interventions tailored to treat specific anxiety disorders, to generic CBT programs that can be applied to several different anxiety disorders.

Palmtop computers. Palmtop computers demonstrate great potential as an adjunct to CBT for anxiety disorders, as they can be used to deliver and record therapy-related information and prompt individuals in anxiety reduction techniques, when faced with real-life anxiety-provoking situations. Researchers have developed palmtop computer programs for a number of specific anxiety disorders. These include obsessive-compulsive disorder, social phobia, generalised anxiety disorder, panic disorder and acrophobia. Overall, these studies have shown that palmtop computers can be used successfully as an adjunctive treatment for anxiety disorders.

Baer, Minichiello, Jenike, and Holland (1988) reported a case study with a patient with obsessive-compulsive disorder who used the computer to prompt compliance with response prevention exercises. Specifically, the patient referred to the computer each

time they had an urge to perform a ritual. The computer then instructed the patient to resist the urge for three minutes and provided a reminder that no negative consequences would result from resisting the urge. Results indicated that the patient showed marked improvement in the reduction of rituals and in compliance to response prevention exercises. However the ritualistic behaviour returned to baseline levels once the computer was removed, which suggests the patient may have used the computer as a safety signal.

Subsequently, a computer program for generalised anxiety disorder (GAD) was developed and tested in a pilot study based on three subjects (Newman, Consoli & Taylor, 1999). In an attempt to reduce the cost of therapy, these researchers evaluated the effectiveness of six sessions of group CBT with adjunctive computer assistance. The computer was used over a 12-week period and included instruction in relaxation, cognitive restructuring and imaginal exposure. The three subjects reported significant reductions in anxiety over the 12-week period and none met criteria for GAD at post-treatment, or 6-month follow-up. These results suggest that the palmtop computer did not serve as a safety signal, as treatment gains were maintained after the computer was removed at the end of treatment. However these findings should be viewed with caution, given the small sample size and lack of comparison group.

Another palmtop computer program was developed for social phobia and was tested in a randomised controlled trial of 54 patients (Gruber, Moran, Roth, & Taylor, 2001). These researchers compared 12-session group CBT, 8-session group CBT with palmtop computer assistance and a wait-list control. The palmtop computer was used to assist with homework exposure assignments. Results showed that 12-session group therapy initially had stronger effects than computer-assisted therapy at post-treatment,

however by 6-month follow-up, both treatments were equally effective in reducing social phobic symptoms. A recent case study has also documented reductions in social phobic symptoms following the use of a palmtop computer combined with group therapy (Przeworski & Newman, 2004).

The utility of palmtop computers has also been examined in the treatment of panic disorder. In a sample of 18 panic patients, Newman, Kenardy, Herman, and Taylor (1997) compared 4 sessions of CBT with adjunctive palmtop computer assistance, to 12 sessions of standard CBT. Computer therapy and standard therapy showed equal rates of satisfaction, credibility and dropouts. Following treatment, participants in the computer-assisted therapy showed significantly less clinical improvement than those in standard therapy (33% versus 54% respectively). However, this difference was no longer significant at 6-month follow-up, with 46% of patients in standard CBT and 35% of patients in computer-assisted CBT reporting clinically significant change. This finding suggests that computer-assisted therapies continue to produce improvements following treatment, catching up with the effects of clinic-based treatment. However caution should be taken when interpreting these findings, as this study failed to include a comparison condition involving brief therapy without computer assistance. Thus, it is unclear whether the palmtop computer provides any additional benefit beyond abbreviated CBT.

The methodological limitations of earlier studies have recently been addressed in a multi-centre treatment study comparing several CBT delivery modes in 186 patients with panic disorder (Kenardy, Dow et al., 2003). Participants were randomly allocated to one of four conditions; 12 sessions of CBT, 6 sessions of CBT, 6 sessions of CBT with

palmtop computer assistance, or a wait-list control. At post-treatment, results demonstrated that 12-session CBT and 6-session CBT with adjunctive computer assistance were equally effective in reducing panic symptoms and superior to 6-session CBT and the wait list. At 6-month follow-up however, there were no significant differences among the three treatment groups. These findings indicate that palmtop computers can reduce the amount of therapist contact and still produce similar levels of improvement to standard clinic therapy. Furthermore, computer-assisted treatment improves treatment outcome beyond abbreviated therapy on its own, at least in the short-term. Treatment satisfaction and credibility ratings were similar for the three treatment conditions.

Desktop computer and CD-ROM programs. Therapy involving desktop computer programs has also been shown to produce positive effects in the treatment of anxiety disorders, as an adjunct to therapist contact. Shaw, Marks, and Toole (1999) initially evaluated Fear Fighter; a nine-module computer exposure program, as a self-help program within a sample of 15 patients with mixed anxiety who received no access to therapist contact. Results indicated that only 40% of participants showed moderate to marked improvement. In response to these limited results, the authors suggested that the effectiveness of computer-based programs could be improved if patients had some contact with a therapist. Subsequently, the impact of the Fear Fighter program, combined with brief therapist contact, was examined. Eighty-five individuals with mixed anxiety disorders, including agoraphobia, social phobia, generalised anxiety disorder and specific phobias participated in the study (Kenwright, Liness, & Marks, 2001). They compared the therapist-assisted computer program (Fear Fighter) to therapist-guided self-exposure.

Participants in the Fear Fighter condition completed computer sessions at the clinic and spent the first 10 minutes of computer sessions with a therapist, the next 40 minutes working at the computer, and a final 10 minutes with the therapist to discuss further work and problem solving. Post-treatment data indicated that the two groups reported similar reductions in symptom scores, despite patients in the Fear Fighter group spending 86% less time with the therapist, compared to therapist-guided exposure patients. However, the computerised therapy condition had a substantial attrition rate (41%). Another limitation of this study was that patients were not randomised to conditions. Instead, patients in the computer condition were self-referred and as such were less severe than the clinic group on several outcome measures at pre-treatment.

The same research team addressed this limitation in a recent randomised control trial of 93 outpatients with phobia or panic disorder (Marks, Kenwright, McDonough, Whittaker, & Mataix-Cols, 2004). They compared the efficacy of the Fear Fighter program to therapist-guided self-exposure and a relaxation placebo. Like the previous study, participants allocated to the Fear Fighter program received 20 minutes of therapist contact at each computer session. Results showed that both exposure treatments produced significant improvements on outcome measures at post-treatment and one-month follow-up, whereas the relaxation placebo produced minimal change. These results replicated earlier findings, indicating that computer-based exposure programs with minimal therapist contact can be as effective as therapist-guided self-exposure for individuals with anxiety disorders. Furthermore, treatment helpfulness and satisfaction ratings were similar for both treatments, although more dropouts were found in the computer condition (43%), compared to the therapist-guided condition (24%).

White, Jones, and McGarry (2000) investigated the effectiveness of a CD-ROM program for the treatment of anxiety, in a sample of 26 patients with chronic and severe anxiety from low socio-economic backgrounds. The CD-ROM comprised three sessions that covered psychoeducation, relaxation, cognitive restructuring and relapse prevention. Results indicated that 20% of patients in the computer treatment showed clinically significant change at post treatment and 50% at 6-month follow-up. Although these results look promising, it is difficult to determine whether improvements were due to therapy, non-specific effects, or natural recovery, as the study did not include a control group.

Online therapy. One of the more recent applications of computer technology has been to make use of the internet for communication between patients and therapists, and/or for the delivery of intervention information, instructions and materials. Only one study appears to have examined the use of chat-based online therapy for anxiety, most likely due to the privacy and ethical concerns associated with this technique. In a single case study, Rassau and Arco (2003) examined the effects of 6 sessions of online chat-based CBT for test anxiety. The participant reported a reduction in test anxiety and an increase in positive study behaviours, including note taking, hours of study and number of pages read. However, this finding is limited by a single case design and lack of follow-up data.

Email is another mode of internet delivery that has been used to increase communication between patients and therapists. In a randomised controlled study, Lange, van de Ven, Schrieken, and Emmelkamp (2001) examined the effectiveness of an email-assisted treatment for post-traumatic stress and pathological grief in a sample of 25

university students who had experienced a traumatic event. The intervention involved 10 sessions of self-directed writing tasks with therapist feedback provided via three email contacts. Those participants randomly allocated to the email-assisted intervention showed significantly greater improvements in trauma-related symptoms and general psychopathology at post-treatment and 6-week follow-up, compared to a wait-list control. The same research group has recently replicated these findings using a larger community sample of 101 participants (Lange, Rietdijk et al., 2003). Although these findings are encouraging, it is uncertain whether they can be generalised to a clinical sample of patients with post-traumatic stress disorder.

Internet sites have also been used to provide a vehicle through which to deliver therapy information, guidance, and materials. Kenardy, McCafferty, and Rosa (2003) randomly allocated 74 university students with elevated anxiety to a 6-week CBT internet treatment or a wait list control condition. The internet program consisted of psychoeducation about anxiety, instructions for relaxation training, interoceptive exposure, cognitive restructuring and relapse prevention. Following treatment, participants in the internet condition demonstrated significantly greater reductions on three of the five outcome measures, including anxiety related cognitions and depressive symptoms. Drop-outs were found to have significantly greater levels of anxiety and depression, than those participants who completed the program. The beneficial effects of the intervention were maintained at 6-month follow-up (Kenardy, McCafferty, & Rosa, 2006). It should be noted, however, that the sample in the Kenardy, McCafferty, et al. (2003) study were of relatively low anxiety severity and it is important to determine whether similar benefits emerge with more severe cases.

In a randomised control study, Klein and Richards (2001) examined the efficacy of a two-module internet-based information program compared to a wait list control condition, within a sample of 22 participants with panic disorder. The internet modules contained information about the nature, effects and causes of panic, useful and non-useful ways of managing panic, and brief suggestions on how to overcome thinking errors. The internet condition also involved limited therapist assistance, in that participants were telephoned to check whether they were using the program. Following treatment, participants in the internet condition reported significantly greater reductions in panic frequency, anticipatory fear of panic, general anxiety, body vigilance and increases in self-efficacy for managing panic, compared to controls. However it was unclear whether these effects were sustained in the long-term, as no follow-up assessment was conducted.

Richards and Alvarenga (2002) replicated these results using an extended, more detailed internet-based information program consisting of five modules. Nine participants with panic disorder worked through the program over a 5- to 8-week period and were re-assessed three months after completing the program. This study involved limited therapist assistance in that participants were telephoned to check whether they were experiencing any difficulties in using the internet program. Program use was associated with significant reductions in panic frequency and distress during panic attacks. Although this study evaluated treatment effects over a longer period, it was limited by a small sample size and lack of a control group.

These limitations were recently addressed in a larger controlled trial of 55 participants with panic disorder (Klein, Richards, & Austin, 2006). Participants were randomly allocated to one of three conditions; a 6-week CBT internet program with

therapist guidance via email, a self-help written manual with therapist guidance via the telephone, or an information only control condition with telephone contact. Both active treatments were associated with improvements on panic-related outcome measures, in comparison to the information only control condition. Reductions in panic symptoms were maintained for both treatments, with the internet-based treatment being superior to the written self-help manual at 3-month follow-up, in terms of physical health and reduced visits to the GP. These findings suggest that internet-based CBT with limited therapist guidance may be more effective than other self-help treatment methods for panic disorder. Klein et al. (2006) also explored the quality of the therapeutic alliance in the two treatment conditions. Overall, participants in both the internet condition and the written self-help manual condition rated a high level of therapeutic alliance, with no significant difference between the treatments. Interestingly, ratings of the therapeutic relationship were found to be unrelated to treatment outcome, which suggests that a good therapeutic relationship may not be necessary for treatment success in internet-based therapy.

Recently, Carlbring et al. (2005) reported the results of a trial that compared internet self-help plus minimal therapist contact by email, with traditional clinic-based CBT, in the treatment of panic disorder. Minimal differences in outcome were found at post-intervention and 1-year follow-up, with both treatments producing significant, lasting reductions in anxiety. Similar positive findings, with strong effect sizes have been found for internet treatment of social phobia, involving minimal email contact (Andersson, Bergstrom, Carlbring, & Lindefors, 2005; Carlbring, Furmark, SteczkÃ, Ekselius, & Andersson, 2006). Andersson et al. (2005) suggested that it was preferable to

conduct exposure in vivo, and therefore added two group exposure sessions to the internet program. However, Carlbring et al. (2006) found equivalent effects when the full program was delivered over the internet, including instructions for the conduct of exposure tasks.

Researchers have also compared the effectiveness of different computer-based treatments for anxiety. For example, Carlbring, Ekselius, and Andersson (2003) randomly allocated 22 participants with panic disorder to either CBT or applied relaxation, with both treatments delivered on the internet. The results indicated no differences between the two conditions at post-treatment, although participants in the applied relaxation condition showed a trend towards greater reductions in panic and anxiety symptoms. This trend was somewhat unexpected, given that applied relaxation has been shown to be less effective than cognitive therapy for panic disorder in standard clinic therapy. However, it should be noted that on average only 56% of the CBT internet program was completed by participants. The authors suggested that the use of standardised emails, rather than individually tailored emails, may have contributed to poor compliance to the CBT program. This indicates that compliance may be an important variable to consider when examining the effectiveness of stand-alone computerised treatments. Carlbring et al. (2003) concluded that although internet-based treatments appear to be effective, some active therapist involvement may be required for increasing compliance.

Richards, Klein, and Austin (2006) examined the benefits of adding an internet-delivered stress-management module to their standard CBT internet program in the treatment of panic disorder. Contrary to expectations, the addition of the stress-

management component did not add significantly to outcome at 3-month follow-up, although effects for the stress-management-CBT condition were superior to CBT alone immediately after treatment. Patients in both internet therapy conditions showed significantly greater reductions in panic disorder symptoms compared to an information-only approach.

Virtual reality. Virtual reality is another technology that has been used as an adjunct to therapy for anxiety. Virtual reality is used as an exposure tool, which allows individuals to become active participants within a computer-generated, three-dimensional environment. Individuals wear a head-mounted display, which provides visual and auditory cues in the simulated environment and allows this world to change with head and body motions (Anderson et al., 2004). Virtual reality offers several advantages over traditional therapy. For instance, it can be used for exposure to situations that are difficult to arrange and control, and the level of threat can be regulated (Rothbaum et al., 1995a). However one of the major disadvantages of virtual reality is that current equipment is prohibitively expensive and thus beyond the budget of most therapists (Anderson et al., 2004). As such, only a brief summary of research on this treatment approach is provided here. For a more extensive review of virtual reality exposure therapy for anxiety disorders, please refer to Krijn, Emmelkamp, Olafsson, and Biemond (2004).

Case studies have shown that virtual reality when delivered as part of a comprehensive anxiety treatment program (e.g. breathing retraining, cognitive restructuring) can be successfully used in the treatment of several anxiety disorders, including fear of public speaking (e.g. Anderson, Rothbaum, & Hodges, 2003), spider

phobia (e.g. Carlin, Hoffman, & Weghorst, 1997), claustrophobia (e.g. Botella, Banos, Villa, Perpina, & Garcia-Palacios, 2000), acrophobia (e.g. Choi, Jang, Ku, Shin, & Kim, 2001), fear of flying (e.g. Klein, 2000), post-traumatic stress (e.g. Rothbaum et al., 1999), and fear of driving (e.g. Wald & Taylor, 2000). Although these results suggest that virtual reality is a promising tool for exposure, case research has been limited by small samples and the lack of appropriate controls.

Controlled research has demonstrated that virtual reality, in conjunction with anxiety management strategies, is more effective than no treatment for panic disorder (North, North, & Coble, 1996), acrophobia (Rothbaum et al., 1995b), spider phobia (Garcia-Lopez et al., 2002), fear of flying (Maltby, Kirsch, Mayers, & Allen, 2002), and fear of public speaking (Harris, Kemmerling, & North, 2002). Fewer studies have compared virtual reality to standard in-vivo exposure therapy. The available research evidence suggests that virtual reality is as effective as in-vivo exposure in treating panic disorder (Vincelli et al., 2003), fear of flying (Muhlberger, Wiedemann, & Pauli, 2003; Rothbaum, Hodges, Smith, Lee, & Price, 2000) and acrophobia (Emmelkamp, Bruynzeel, Drost, & Van Der Mast, 2001; Emmelkamp et al., 2002), however remains inconclusive for other anxiety disorders. More randomised controlled trials in which virtual reality is compared with standard invivo exposure are required.

Summary of Research with Adult Populations

Overall, the research literature with anxious adults suggests that computer and internet-based approaches can be used successfully to deliver CBT in the treatment of anxiety disorders in adults, with a minimal level of therapist support. Randomised

controlled studies have demonstrated that such approaches are more effective than no treatment, and produce outcomes that, in the long-term, are equivalent to clinic-based treatment (Andersson et al., 2005; Kenardy, Dow et al., 2003; Kenwright et al., 2001; Marks et al., 2004). Positive outcomes have been found for computer- and internet-based treatment of panic disorder (Kenardy, Dow et al., 2003; Klein & Richards, 2001), social phobia (Gruber et al., 2001), generalised anxiety disorder (Newman et al., 1999), specific phobias (Gilroy et al., 2000), obsessive-compulsive disorder (Greist et al., 2002), post-traumatic stress (Lange, Rietdijk et al., 2003) and test anxiety (Buglione et al., 1990). Furthermore, most studies have reported levels of client satisfaction, credibility and dropout that are equivalent to clinic-delivered treatment, with the exception of one study that found dropouts to be higher in the computer treatment (Marks et al., 2004).

Although the results look promising, research has been hampered by methodological limitations such as small sample sizes (Chandler et al., 1988; Chandler et al., 1986; Clark et al., 1998; Klein & Richards, 2001; Lange et al., 2001; Newman et al., 1997; Shaw et al., 1999), non-clinical samples (Kenardy, McCafferty et al., 2003; Lange, van de Ven, & Schrieken, 2003), lack of control groups (Baer et al., 1988; Biglan et al., 1979; Chandler et al., 1988; Chandler et al., 1986; Clark et al., 1998; Harcourt et al., 1998; Newman et al., 1999; Przeworski & Newman, 2004; Rassau & Arco, 2003; Shaw et al., 1999; White et al., 2000; Wilson et al., 1991), and lack of adequate follow-up assessment (Buglione et al., 1990; Clark et al., 1998; Harcourt et al., 1998; Kenardy, McCafferty et al., 2003; Kenwright et al., 2001; Klein & Richards, 2001; Lange et al., 2001; Marks et al., 2004; Przeworski & Newman, 2004; Rassau & Arco, 2003; Shaw et

al., 1999; Wilson et al., 1991). Furthermore, most studies have evaluated treatment outcome on the basis of self-report questionnaires rather than diagnostic status.

Given these limitations, caution should be taken when interpreting this research and it would be premature to conclude that computer-based interventions offer a reliable method of attaining effective outcomes in the treatment of adult anxiety disorders. It should also be noted that not all studies have reported computer and internet-based interventions for anxiety to be effective (Greist et al., 2002; Smith et al., 1997). There is some evidence to suggest that computer therapy programs have a greater impact when used in conjunction with therapist contact, rather than as a stand-alone approach. For instance, some studies have found higher compliance rates and lower dropout rates for adjunctive computer therapies than sole computer therapies (Agras, Taylor, Feldman, Losch, & Burnett, 1990).

The benefits and promise of computer- and internet-based CBT interventions for anxiety disorders has also been supported in recent meta-analytic reviews conducted by Kaltenhaler et al. (2006), Przeworski, and Newman (2006) and Griffiths and Christensen (2006). Importantly, each of these reviews highlight the need for further methodologically rigorous research to establish the conditions under which computer- and internet-based therapy can be effective. The need for further program development and empirical investigation has also been emphasised in the guidelines for delivering computerized CBT for anxiety disorders, produced by the National Institute for Clinical Excellence (NICE, 2006). It seems that despite the surge in research investigating the efficacy of computerised interventions for anxiety disorders, more methodologically

sound attempts are required, before firm conclusions regarding the reliability of such interventions can be drawn.

Computer and Internet-Based Therapy with Children

Given the generally positive outcomes for computer-based and computer-assisted treatments of anxiety in adults, together with the high level of accessibility and acceptability of internet-delivered information to children and adolescents, there is a strong case to be made for the development and evaluation of internet-delivery of CBT for child anxiety disorders. However, research into computer-based treatment of child anxiety is still in its infancy. This is surprising, given that children and adolescents are generally highly skilled and experienced in the use of computer technologies (Calam, Cox, Glasgow, Jimmieson, & Larsen, 2000) and the internet is now considered an important method for reaching teenagers (Griffiths & Christensen, 2006; Nicholas, Oliver, Lee, & O'Brien, 2004). A large-scale survey in Australia revealed that in 2003, 95% of children and adolescents (aged 5 to 14 years) used a computer and 64% regularly used the internet (Australian Bureau of Statistics, 2004).

The limited literature evaluating computer and internet-based interventions in the treatment of childhood problems suggests that such approaches offer promise and are worthy of further investigation. Kornfield (1996) found a 13-module computer program based on rational emotive therapy, produced significantly reduced irrational thinking and improved self-esteem, compared to a relaxation placebo, in a sample of 61 adolescents with low self-esteem. More recently, Ritterband et al. (2003) investigated the efficacy of

an internet intervention for paediatric encopresis. Twenty-four children with encopresis were randomly assigned to either a three-week child-focused internet intervention or no intervention group. The intervention contained three core modules (60-90 minutes to in duration) that comprised psychoeducation and behavioural management techniques. Children in the internet intervention showed significantly greater improvements on outcome measures (i.e. fewer fecal accidents, increased defecation in the toilet and increased unprompted trips to the toilet), than those in the no intervention group. In a follow-up study, Ritterband and colleagues (2006) further investigated their online intervention for childhood encopresis by exploring the added benefits of the presence of audio, graphics (instead of only text) and interactivity (e.g. clickable buttons). They demonstrated that the presence of each of these three components led to positive changes in children's learning of material, motivation and readiness for change (Ritterband et al., 2006).

Computer and Internet Delivery of CBT for Child Anxiety

Few studies have investigated the benefits of computer-delivered therapy for children with anxiety disorders. In a case study by Nelissen, Muris and Merckelbach (1995), two children diagnosed with spider phobia received an individual, one-hour computer-delivered exposure session, which involved the presentation of three different images of spiders that varied in size and movement. Following the computerised exposure session, children received one session of invivo exposure therapy. Treatment outcome was evaluated on self-report and behavioural measures of spider fear at three time points; before treatment, after computerised exposure, and after invivo exposure. For both children, phobic symptom scores remained high following the computerised

exposure session and only significantly reduced after invivo exposure. The researchers concluded that the computerised exposure treatment did not elicit significant fear to disconfirm children's anxiety beliefs, or for habituation to occur.

Promising findings for the effectiveness of computerised treatments for anxiety has been reported by an Australian study of spider phobic children (Dewis et al., 2001). Twenty-eight children and adolescents were randomly allocated to one of three conditions; invivo exposure, computer-aided exposure or a wait-list control. Both exposure interventions consisted of three, 45-minute sessions. The computer exposure required participants to guide a screen character with spider phobia into different scenarios depicting a picture spider, a plastic spider, a dead spider and a live spider. Clinically significant reductions in self-reported and observer-rated fear were found for children who completed computer-aided exposure, compared to those in the wait-list control, although this difference was not statistically significant. Therapist-aided invivo exposure was found to be superior to both the computer-aided exposure and wait-list control. These results suggest that computer exposure produces lower levels of anxiety arousal and habituation, compared to invivo exposure.

The efficacy of computerised interventions has been investigated for other child anxiety disorders. A single case report investigated the efficacy of an internet-based, CBT program for the treatment of anxiety symptoms in a 7-year-old boy with selective mutism (Fung, Manassis, Kenny, & Fiksenbaum, 2002). The treatment consisted of a 14-week therapist-guided internet intervention based on the Coping Cat workbook (Kendall, 1990). Treatment also involved weekly parent sessions, which covered psychoeducation and training in child management, however it was unclear whether this component was

presented on the internet, or by the therapist. Significant reductions were found on child, parent and teacher-rated anxiety measures at the end of treatment. However the generalisability of these results is limited as they are based on one subject with selective mutism and the study did not include a control group or follow-up data.

A team of researchers from Macquarie University have recently developed a self-help, cognitive-behavioural CD-ROM program for treating anxiety in adolescents aged between 14 and 18 years (Cunningham, Rapee, & Lyneham, 2007; M. Cunningham, R. M. Rapee, & H. Lyneham, 2006b). The *Cool Teens CD-ROM* consists of 8 modules that take 30-60 minutes to complete over an 8 to 12 week period. This program uses a combination of media formats such as text, audio, illustrations, cartoons, and live video. As part of the development process, Cunningham, Rapee and Lyneham (2006a) conducted a prototype evaluation of one module with 21 adolescents, nine of which had previously attended the Cool Teens group therapy program. They found that users rated the majority of multimedia components positively, with a particular preference for live video. The participants who previously attended group therapy also noted several advantages of the CD-ROM program, such as convenience, privacy and reduced embarrassment related to not speaking in front of others. These findings suggest that computer-based programs may be an acceptable form of treatment to adolescents with anxiety disorders. A clinical study evaluating the efficacy and user acceptability of the *Cool Teens CD* is currently underway.

Another CD-ROM program that has recently been developed for anxious children aged 7 to 13 years is *Camp Cope-A-Lot* (*CCAL*; Kendal & Khanna, 2008); a 12 session cognitive behavioural program based on the Coping Cat treatment. *CCAL* utilises

interactive videos, illustrations, animation, interactive media, as well as built-in homework and rewards systems to create an interactive learning environment for children to master strategies in anxiety management. The first 6 sessions allow children to navigate the program independently at their own pace, whilst the remaining 6 sessions involve a therapist ("coach") to monitor progress and assist with exposure tasks. The efficacy of *CCAL* as a treatment program for child anxiety has not yet been established, although pilot data is promising.

Development, Efficacy and Feasibility of the BRAVE Internet Program. In addition to these CD-ROM based interventions described above, our research group is conducting a series of studies to investigate the feasibility of using the internet to deliver CBT sessions for child anxiety. Our initial study has examined the efficacy of a partially internet-based CBT program for the treatment of mixed child anxiety disorders (Spence, Holmes, March & Lipp, 2006). In this pilot study, 72 children aged 7 to 14 years diagnosed with separation anxiety, social phobia, generalised anxiety or specific phobia were randomly allocated to one of three conditions; clinic-based group CBT, the same treatment partially delivered via the internet, or a waitlist control. The intervention followed the BRAVE program (Spence, Holmes, & March, 2001), a cognitive-behavioural treatment for childhood anxiety, involving 10 child sessions and 6 parent sessions, plus booster sessions at one and three months after treatment. The anxiety management strategies are represented by the acronym, *BRAVE - B* stands for *Body Signs* (recognising physiological symptoms of anxiety); *R* stands for *Relax* (learning to relax by progressive muscle relaxation, guided imagery, and deep breathing); *A* stands for *Activate Helpful Thoughts* (coping self-talk and cognitive restructuring); *V* stands for *Victory Over*

Fears (overcoming fears by using graded exposure and problem solving approaches); and *E* stands for *Enjoy yourself* (positive self-evaluation and self-reward). The clinic treatment for children involved group sessions of 60 minutes duration, conducted once a week for 10 consecutive weeks. Parent sessions were also 60 minutes in duration, conducted in a group format over 6 weeks.

Families in the combined clinic-internet condition received the same intervention as the clinic group, but half of the sessions were delivered via the internet for parents and children. These internet sessions were designed to be interesting and interactive and included considerable use of colour, animated illustrations, noises, roll-over images, pop-up messages with self-reinforcing statements, and self-assessment quizzes that provided immediate feedback. Pilot work was conducted to ensure readability and comprehension of material. Homework assignments were either completed online or printed out and reviewed at the next clinic session. Program compliance was monitored electronically. Please refer to Spence et al. (2006) for a more detailed description of this intervention.

Data revealed that children in both the standard clinic and the combined clinic-internet conditions showed significantly greater reductions in anxiety from pre- to post-treatment and were more likely to be free of their anxiety diagnoses, compared to the waitlist group. Improvements were maintained at 12-month follow-up for both therapy conditions, with no statistically significant differences in outcomes between interventions.

In addition to examining whether the internet can be an effective way to deliver CBT sessions for child anxiety, our research group was interested to investigate the feasibility of using the internet for the treatment of anxiety in children. Following each

internet session, parents and children were asked to provide descriptive information about any problems they encountered whilst using the website and what they liked most and least about each internet session. Parents most frequently commented that they liked the content presented in the program. Several parents also noted the ease and convenience of using the internet and the enjoyable format, as strengths of the program. The most common difficulty cited by parents was related to the sound player. Suggestions for improvement related to program content and delivery, and therapist contact. For example, some parents reported child and parent sessions were too long and two parents commented that they would like to have gained more therapist advice and feedback with regard to parenting strategies.

The feedback from children revealed that they most enjoyed the stories and quizzes in the program. Many children also commented that they liked the loud noises, pictures and playing games. Some children commented that pages took too long to load and others noted that they disliked the amount of typing associated with completing electronic forms. Common suggestions for improvement included more games and puzzles, shorter sessions and less typing. Overall, the feedback from children and parents suggested that the internet may be an acceptable mode of treatment delivery for child anxiety disorders. Furthermore, the internet treatment content was found to be highly acceptable to families, with minimal drop out and a high level of therapy compliance.

Given the promising results from this initial study, our research group has recently developed and evaluated a fully internet-based version of the BRAVE program (BRAVE for Children - ONLINE; Spence, March, & Holmes, 2005). The content of the material in BRAVE for Children - ONLINE remained identical to that described by

Spence et al., (2006), however, all 10 sessions, plus booster sessions were transformed into internet format and completed by families in their own home. Similar to the partial internet program, BRAVE for Children - ONLINE comprised read material, quizzes, games, flash animations, sounds, and question and answer exercises to ensure that participants remained engaged and interested. The program was designed so that participants could only progress through the pages after providing responses to the activities, and participants were only able to access the next session 7 days after the completion of the previous session.

Based on participant feedback from the partial internet intervention, significant changes were made in the technical development of BRAVE for Children - ONLINE. First, the internet site was developed by a professional web design company using sophisticated graphics and design, including flash and animations, to provide a clean, fresh and modern web site. Examples of the updated web pages are shown in Figure 1. Second, additional quizzes, games and sounds were incorporated to stimulate participants' interest, and attempts were made to limit the amount of text on each page. The functionality of the program was also enhanced with sophisticated web programming.

Holmes, J., March, S., & Spence, S. (2009). Use of the Internet in the Treatment of Anxiety Disorders with Children and Adolescents. *Counselling, Psychotherapy, and Health*, 5(1), The Use of Technology in Mental Health Special Issue, 187-231.

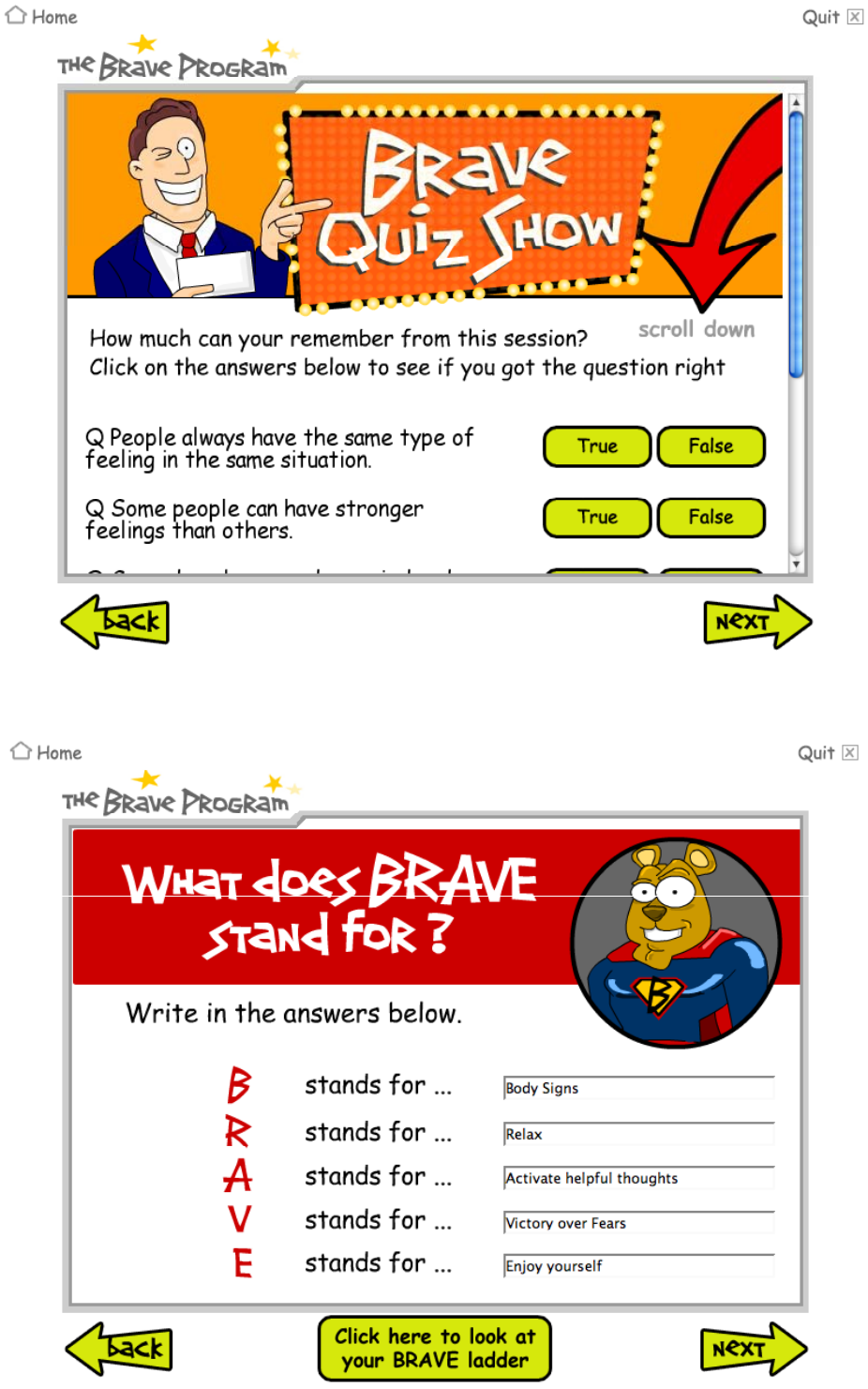

Figure 1. Example screenshots from BRAVE for Children – ONLINE.

In addition, there were several major challenges in transforming a CBT intervention for anxiety into an entirely internet-based method of delivery. Although some of the CBT techniques used in The BRAVE Program (e.g. problem solving, identification of body cues) were relatively straightforward to transform, other complex techniques (e.g. exposure) were more difficult to translate into internet format. Given the complexity of developing exposure hierarchies, it was deemed necessary to complement the exposure session with a mid-point telephone call with the therapist to ensure understanding and comprehension of the exposure technique and to assist the family in the development and implementation of their individual exposure hierarchy.

Subsequently, BRAVE for Children - ONLINE is a therapist assisted internet intervention, rather than a stand alone self-help intervention. In addition to the mid-point exposure telephone call, participants also completed a short telephone consultation with their therapist before starting the program. The aim of this phone call was for the therapist to introduce themselves to the family, explain the treatment program and assist with any queries. In addition to these phone contacts, the program was also structured so that the therapist could view participants' responses to question and answer activities in the administrator section of the program, and each week provide personalised feedback to the child and parent via email. Although these emails were standardised in format and structure, the therapist was able to personally address the participant and respond to any concerns or difficulties experienced during the session.

An additional challenge in creating an entirely online version of BRAVE was the reproduction of a therapeutic alliance between the therapist and client. A number of strategies were implemented in BRAVE-ONLINE to enhance this therapeutic

relationship, including provision of immediate and positive feedback in response to session activities, weekly emails from their BRAVE therapist and an online 'getting to know you' exercise where they 'met' their therapist before starting the program. For a detailed description of strategies employed to enhance therapeutic alliance in BRAVE for Children – ONLINE as well as a general description of the full internet program, please refer to Spence et al. (2008).

The efficacy of BRAVE for Children - ONLINE has recently been examined within a sample 63 children aged between 7 and 12 years, with a primary anxiety diagnosis of separation anxiety disorder, social phobia, generalised anxiety disorder or specific phobia (March, Spence, & Donovan, 2008). Children were randomly allocated to one of two conditions; the full internet intervention or no therapy. At post-treatment, results indicated no significant difference between the two groups in terms of the percentage of children free of their primary anxiety diagnoses (WL 10.3% vs. NET 30%), although children in the internet condition did show significantly greater reductions in clinician severity ratings and global assessment of functioning, compared to the wait-list.

Children who received internet therapy also demonstrated significant reductions on parent measures of child anxiety at post-treatment, compared to those who received no intervention. Interestingly, the percentage of children free of their primary anxiety diagnosis was far greater at 6-month follow-up, with 75% of children in the internet condition no longer meeting diagnostic criteria. This rate of improvement is consistent with those found elsewhere in the anxiety literature (see James, Soler, & Weatherall, 2005 for a review). Improvements were also found for ratings of diagnostic severity, global functioning and on some self-report measures of anxiety at 6-month follow-up.

However, the lack of a comparison group at the follow-up period makes it difficult to determine whether these positive effects are due to the intervention, or simply the passage of time. Furthermore, poor compliance with the internet intervention may have impacted on initial findings. For instance, only 33.3% of children and 60% of parents had completed all of the internet sessions by the post-treatment period, whereas by 6-month follow-up the majority of children (62%) and parents (72.3%) had completed these sessions. This lag in session completion may account for the lack of immediate findings for diagnostic status at post-treatment. Despite initial low compliance with internet sessions, the intervention was considered credible and acceptable by families, with high rates of program satisfaction and minimal rates of attrition.

The next step in our research has been the development of a full internet intervention for adolescents. BRAVE for Teenagers – ONLINE (Spence, Holmes, Donovan, & Kenardy, 2006) mirrors the child internet program in session content and structure but takes into account the developmental differences in adolescence, in terms of cognition, emotion and behaviour. The material in BRAVE for Teenagers – ONLINE is presented in a more sophisticated manner, with graphic, content and scenarios suitable for youth aged between 13 and 18 years. Example screenshots from BRAVE for Teenagers – ONLINE are shown in Figure 2. For a detailed description of this intervention, please refer to Spence, et al. (2008).

The efficacy of BRAVE for Teenagers – ONLINE is currently being evaluated in a randomised controlled trial comparing the internet intervention to standard clinic treatment and a wait-list control. A second study is investigating the predictors of treatment outcome, in order to determine the characteristics of teenagers and their

families that may predict more favourable outcomes to online therapy. Results from both trials are pending.

Preliminary support for the efficacy of this intervention has been provided by a single case study of a 17-year-old female diagnosed with social phobia, generalised anxiety and specific phobia of darkness (Spence et al., 2008). At the end of treatment the participant no longer met diagnostic criteria for *any* anxiety disorder. Significant improvements were also found on self-report indicators of anxiety, clinician ratings of diagnostic severity, and measures of overall functioning. Although these results appear promising, conclusions regarding the efficacy of this intervention cannot be drawn until results from the randomised controlled trial are available.

In summary, there are a number of programs currently being developed which examine alternative methods for delivering CBT interventions to children and adolescents with anxiety disorders. Some include computer, CD-ROM based programs (Cunningham et al., 2007; Cool Teens CD-ROM; Cunningham et al., 2006b; CCAL; Kendall & Khanna, 2008), while others include programs delivered via the internet (BRAVE for Teenagers - ONLINE; Spence et al., 2006; BRAVE for Children - ONLINE; Spence et al., 2005). Preliminary results suggest that both CD-ROM and internet-based methods of delivery might be acceptable to youth with anxiety disorders (Cunningham et al., 2006a; March et al., 2008; Spence et al., 2008; Spence et al., 2006), however results of randomised controlled trials are only available for BRAVE for Children – ONLINE and the partial internet intervention described by Spence et al. (2006). To date, results indicate that internet-based therapy may be effective for a significant proportion of children suffering from anxiety, whether sessions are delivered partially (Spence et al., 2006) or entirely over the internet (March et al., 2008). However, firm conclusions cannot be drawn until the results of further trials are available.

Future Directions in Internet-Delivery of CBT for Clinically Anxious Children

The available literature suggests that use of the internet might be a feasible way to deliver CBT for the treatment of child anxiety, either as a stand-alone internet treatment or a combined clinic and internet program. However it remains to be determined whether the full program can be delivered effectively using this medium as compared to a clinic-based treatment program. Indeed, the next study conducted by our research team examines the benefits of full-internet therapy compared to clinic-based CBT and a waitlist control for adolescents suffering from anxiety disorders. Such trials need to be replicated with younger populations as well, to determine whether an internet approach offers a viable alternative to traditional clinic-based treatments.

Another challenge in the next phase of our research is to investigate whether internet approaches may also be effective when completed as a self-help treatment by families, without the assistance of a therapist, as the present version of the BRAVE program requires. The major challenge in producing an entirely self-help intervention is to find an effective way of guiding children and their parents through the development of an exposure hierarchy, given the complexities of hierarchy design and the high level of comorbidity of anxiety disorders in children. It is also important to examine whether the therapeutic alliance can be re-created in online interventions, by comparing the quality of the therapeutic relationship between participants receiving internet and clinic therapy. Given that this factor has been shown to be associated with treatment outcome (Creed & Kendall, 2005), it is important to determine ways of enhancing the working alliance between children and their therapist within online interventions. A further challenge is to

include methods that facilitate treatment adherence and encourage children and their parents to persist with a self-help approach to treatment. Despite the inclusion of techniques such as the use of personal names in emails, provision of immediate and positive feedback and rewards following the completion of on-line tasks, compliance with sessions was still relatively low in BRAVE for Children – ONLINE, which may have contributed to the lack of significant findings at post-treatment. Alternative methods for enhancing compliance with sessions need to be explored to determine whether increased compliance can enhance the effectiveness of internet-based interventions, particularly in the short term. Finally, another research question that remains to be examined is the level of personalized contact (via telephone or email) that is required, in order to optimize treatment outcomes.

Conclusions

Despite the existence of highly effective clinic-based treatments for child anxiety and children's skill and interest in computer applications, it is only recently that researchers have started to examine the feasibility and efficacy of computer-delivered therapy for childhood anxiety. Given the positive findings with adults, there is strong justification for the development and evaluation of computer-delivered CBT for child and adolescent anxiety disorders. One advantage of the late development of research into computer-based treatments for child and adolescent anxiety is that researchers can draw significantly on the knowledge gained from the adult literature. The limited data available on computer-based treatment of child anxiety suggests that it is feasible to deliver CBT using the internet, with a high level of parent and child satisfaction associated with both partial and full internet delivery. For the CBT intervention delivered partially over the

internet, there were no significant differences in treatment outcomes, in comparison to full clinic delivery of the program (Spence et al., 2006). For the one trial examining CBT delivered entirely over the internet however, rates of improvement were lower at post-treatment, but similar at 6-month follow-up compared to more traditional forms of face-to-face therapy, as described elsewhere in the literature (March et al., 2008). At present, there is insufficient evidence to enable us to draw firm conclusions about the feasibility and efficacy of full-delivery of CBT programs for child anxiety using computer technologies, although it seems that internet approaches may be acceptable and beneficial for a significant proportion of children with anxiety.

References

Agras, W. S., Taylor, C. B., Feldman, D. E., Losch, M., & Burnett, K. F. (1990). Developing computer-assisted therapy for the treatment of obesity. *Behavior Therapy, 21*(1), 99-109.

Anderson, P., Jacobs, C., & Rothbaum, B. O. (2004). Computer-supported cognitive behavioral treatment of anxiety disorders. *Journal of Clinical Psychology, 60*(3), 253-267.

Anderson, P., Rothbaum, B. O., & Hodges, L. F. (2003). Virtual reality exposure in the treatment of social anxiety. *Cognitive & Behavioral Practice, 10*(3), 240-247.

Andersson, G., Bergstrom, J., Carlbring, P., & Lindefors, N. (2005). The use of the Internet in the treatment of anxiety disorders. *Current Opinion in Psychiatry, 18*(1), 73-77.

Australian Bureau of Statistics. (2004). *Household use of information technology, Australia, 2002 and 2003 (No.8146.0)*. Canberra, Australian Capital Territory: Australian Bureau of Statistics.

Baer, L., Minichiello, W. E., Jenike, M. A., & Holland, A. (1988). Use of a portable computer program to assist behavioral treatment in a case of obsessive compulsive disorder. *Journal of Behavior Therapy & Experimental Psychiatry, 19*(3), 237-240.

Barrett, P. M., Dadds, M. R., & Rapee, R. M. (1996). Family treatment of childhood anxiety: A controlled trial. *Journal of Consulting & Clinical Psychology, 64*(2), 333-342.

Barrett, P. M., Duffy, A. L., Dadds, M. R., & Rapee, R. M. (2001). Cognitive-behavioral treatment of anxiety disorders in children: Long-term (6-year) follow-up. *Journal of Consulting & Clinical Psychology, 69*(1), 135-141.

Barrett, P. M., Rapee, R. M., Dadds, M. M., & Ryan, S. M. (1996). Family enhancement of cognitive style in anxious and aggressive children. *Journal of Abnormal Child Psychology, 24*(2), 187-203.

Biglan, A., Villwock, C., & Wick, S. (1979). The feasibility of a computer controlled program for the treatment of test anxiety. *Journal of Behavior Therapy & Experimental Psychiatry, 10*(1), 47-49.

Bornas, X., Tortella-Feliu, M., Llabres, J., & Fullana, M. A. (2001). Computer-assisted exposure treatment for flight phobia: A controlled study. *Psychotherapy Research, 11*(3), 259-273.

Botella, C., Banos, R. M., Villa, H., Perpina, C., & Garcia-Palacios, A. (2000). Virtual reality in the treatment of claustrophobic fear: A controlled, multiple-baseline design. *Behavior Therapy, 31*(3), 583-595.

Buglione, S. A., DeVito, A. J., & Mulloy, J. M. (1990). Traditional group therapy and computer-administered treatment for test anxiety. *Anxiety Research, 3*(1), 33-39.

Calam, R., Cox, A., Glasgow, D., Jimmieson, P., & Larsen, S. G. (2000). Assessment and therapy with children: Can computers help? *Clinical Child Psychology & Psychiatry, 5*(3), 329-343.

Carlbring, P., Ekselius, L., & Andersson, G. (2003). Treatment of panic disorder via the Internet: a randomized trial of CBT vs. applied relaxation. *Journal of Behavior Therapy & Experimental Psychiatry, 34*(2), 129-140.

Carlbring, P., Furmark, T., SteczkÃ, J., Ekselius, L., & Andersson, G. (2006). An open study of internet-based bibliotherapy with minimal therapist contact via email for social phobia. *Clinical Psychologist, 10*(1), 30-38.

Carlbring, P., Nilsson-Ihrfelt, E., Waara, J., Kollenstam, C., Buhrman, M., Kaldo, V., et al. (2005). Treatment of panic disorder: Live therapy vs. self-help via the Internet. *Behaviour Research and Therapy, 43*(10), 1321-1333.

Carlin, A. S., Hoffman, H. G., & Weghorst, S. (1997). Virtual reality and tactile augmentation in the treatment of spider phobia: A case report. *Behaviour Research & Therapy, 35*(2), 153-158.

Chandler, G. M., Burck, H., Sampson, J. P., & Wray, R. (1988). The effectiveness of a generic computer program for systematic desensitization. *Computers in Human Behavior, 4*(4), 339-346.

Chandler, G. M., Burck, H. D., & Sampson, J. P. (1986). A generic computer program for systematic desensitization: Description, construction and case study. *Journal of Behavior Therapy & Experimental Psychiatry, 17*(3), 171-174.

Choi, Y. H., Jang, D. P., Ku, J. H., Shin, M. B., & Kim, S. I. (2001). Short-term treatment of acrophobia with virtual reality therapy (VRT): A case report. *CyberPsychology & Behavior, 4*(3), 349-354.

Clark, A., Kirkby, K. C., Daniels, B. A., & Marks, I. M. (1998). A pilot study of computer-aided vicarious exposure for obsessive-compulsive disorder. *Australian & New Zealand Journal of Psychiatry, 32*(2), 268-275.

Cobham, V. E., Dadds, M. R., & Spence, S. H. (1999). Anxious children and their parents: What do they expect? *Journal of Clinical Child Psychology, 28*(2), 220-231.

Costello, E., Angold, A., Burns, B. J., Stangl, D., Tweed, D., Erkanli, A., et al. (1996). The Great Smoky Mountains Study of youth: Goals, design, methods, and the prevalence of DSM-III-R disorders. *Archives of General Psychiatry, 53*(12), 1129-1136.

Creed, T. A., & Kendall, P. C. (2005). Therapist Alliance-Building Behavior Within a Cognitive-Behavioral Treatment for Anxiety in Youth. *Journal of Consulting and Clinical Psychology, 73*(3), 498-505.

Cunningham, M., Rapee, R., & Lyneham, H. (2006a). Feedback to a prototype self-help computer program for anxiety disorders in adolescents [Electronic Version]. *AeJAMH (Australian e-Journal for the Advancement of Mental Health), 5*, 1-9,

Cunningham, M., Rapee, R., & Lyneham, H. (2007). Overview of the cool teens cd-rom for anxiety disorders in adolescents. *The Behavior Therapist, 30*(1), 15-19.

Cunningham, M., Rapee, R. M., & Lyneham, H. (2006b). The Cool Teens CD-ROM: A multimedia self-help program for adolescents with anxiety. *Youth Studies Australia, 25*(1), 51-56.

Dewis, L. M., Kirkby, K. C., Martin, F., Daniels, B. A., Gilroy, L. J., & Menzies, R. G. (2001). Computer-aided vicarious exposure versus live graded exposure for spider phobia in children. *Journal of Behavior Therapy & Experimental Psychiatry, 32*(1), 17-27.

Emmelkamp, P. G., Bruynzeel, M., Drost, L., & Van Der Mast, C. A. P. G. (2001). Virtual reality treatment in acrophobia: A comparison with exposure in vivo. *CyberPsychology & Behavior, 4*(3), 335-339.

Emmelkamp, P. G., Krijn, M., Hulsbosch, A. M., de Vries, S., Schuemie, M. J., & van der Mast, C. A. P. G. (2002). Virtual reality treatment versus exposure in vivo: A comparative evaluation in acrophobia. *Behaviour Research & Therapy, 40*(5), 509-516.

Essau, C. A., Conradt, J., & Petermann, F. (2000). Frequency, comorbidity, and psychosocial impairment of anxiety disorders in German adolescents. *Journal of Anxiety Disorders, 14*(3), 263-279.

Essau, C. A., Conradt, J., & Petermann, F. (2002). Course and outcome of anxiety disorders in adolescents. *Journal of Anxiety Disorders, 16*(1), 67-81.

Fung, D. S. S., Manassis, K., Kenny, A., & Fiksenbaum, L. (2002). Web-based CBT for selective mutism. *Journal of the American Academy of Child and Adolescent Psychiatry, 41*(2), 112-113.

Garcia-Lopez, L.-J., Olivares, J., Turner, S. M., Beidel, D. C., Albano, A. M., & Sanchez-Meca, J. (2002). Results at long-term among three psychological

treatments for adolescents with generalized social phobia (II): Clinical significance and effect size. *Psicologia Conductual, 10*(2), 371-385.

Ghosh, A., Marks, I. M., & Carr, A. C. (1988). Therapist contact and outcome of self-exposure treatment for phobias: A controlled study. *British Journal of Psychiatry, 152*, 234-238.

Gilroy, L. J., Kirkby, K. C., Daniels, B. A., Menzies, R. G., & Montgomery, I. M. (2000). Controlled comparison of computer-aided vicarious exposure versus live exposure in the treatment of spider phobia. *Behavior Therapy, 31*(4), 733-744.

Gilroy, L. J., Kirkby, K. C., Daniels, B. A., Menzies, R. G., & Montgomery, I. M. (2003). Long-term follow-up of computer-aided vicarious exposure versus live graded exposure in the treatment of spider phobia. *Behavior Therapy, 34*(1), 65-76.

Greist, J. H., Marks, I. M., Baer, L., Kobak, K. A., Wenzel, K. W., Hirsch, M. J., et al. (2002). Behavior therapy for obsessive-compulsive disorder guided by a computer or by a clinician compared with relaxation as a control. *Journal of Clinical Psychiatry, 63*(2), 138-145.

Griffiths, K. M., & Christensen, H. (2006). Review of randomised controlled trials of internet interventions for mental disorders and related conditions. *Clinical Psychologist, 10*(1), 16-29.

Gruber, K., Moran, P. J., Roth, W. T., & Taylor, C. B. (2001). Computer-assisted cognitive behavioral group therapy for social phobia. *Behavior Therapy, 32*(1), 155-165.

Harcourt, L., Kirkby, K., Daniels, B., & Montgomery, I. (1998). The differential effect of personality on computer-based treatment of agoraphobia. *Comprehensive Psychiatry, 39*(5), 303-307.

Harris, S. R., Kemmerling, R. L., & North, M. M. (2002). Brief virtual reality therapy for public speaking anxiety. *CyberPsychology & Behavior, 5*(6), 543-550.

James, A., Soler, A., & Weatherall, R. (2005). Cognitive behavioural therapy for anxiety disorders in children and adolescents. *Cochrane Database Systematic Reviews*, Issue 4. Art. No.: CD004690. DOI: 004610.001002/14651858.CD14004690.pub14651852.

Kaltenthaler, E., Brazier, J., De Nigris, E., Tumur, I., Ferriter, M., Berverley, C., et al. (2006). Computerised cognitive behaviour therapy for depression and anxiety update: A systematic review and economic evaluation. *Health Technology Assessment, 10*(33), 1-186.

Kenardy, J. A., & Adams, C. (1993). Computers in cognitive-behaviour therapy. *Australian Psychologist, 28*(3), 189-194.

Kenardy, J. A., Dow, M. G. T., Johnston, D. W., Newman, M. G., Thomson, A., & Taylor, C. B. (2003). A Comparison of Delivery Methods of Cognitive-Behavioral Therapy for Panic Disorder: An International Multicenter Trial. *Journal of Consulting & Clinical Psychology, 71*(6), 1068-1075.

Kenardy, J. A., McCafferty, K., & Rosa, V. (2003). Internet-deliverered indicated prevention for anxiety disorders: A randomized controlled trial. *Behavioural & Cognitive Psychotherapy, 31*(3), 279-289.

Kenardy, J. A., McCafferty, K., & Rosa, V. (2006). Internet-delivered indicated prevention for anxiety disorders: Six-month follow-up. *Clinical Psychologist, 10*(1), 39-42.

Kendall, P. C. (1990). *The coping cat workbook.* Ardmore, PA: Workbook publishing.

Kendall, P. C. (1994). Treating anxiety disorders in children: results of a randomized clinical trial. *Journal of Consulting & Clinical Psychology, 62*(1), 100-110.

Kendall, P. C., Flannery Schroeder, E., Panichelli Mindel, S. M., Southam Gerow, M., Henin, A., & Warman, M. (1997). Therapy for youths with anxiety disorders: a second randomized clinical trial. *Journal of Consulting & Clinical Psychology, 65*(3), 366-380.

Kendall, P. C., & Khanna, M. (2008). *Camp Cope-A-Lot*. Ardmore, PA: Workbook Publishing.

Kendall, P. C., & Southam Gerow, M. A. (1996). Long-term follow-up of a cognitive-behavioral therapy for anxiety-disordered youth. *Journal of Consulting & Clinical Psychology, 64*(4), 724-730.

Kenwright, M., Liness, S., & Marks, I. (2001). Reducing demands on clinicians by offering computer-aided self-help for phobia/panic: Feasibility study. *British Journal of Psychiatry, 179*(5), 456-459.

Klein, B., & Richards, J. C. (2001). A brief Internet-based treatment for panic disorder. *Behavioural and Cognitive Psychotherapy, 29*(1), 113-117.

Klein, B., Richards, J. C., & Austin, D. W. (2006). Efficacy of internet therapy for panic disorder. *Journal of Behavior Therapy and Experimental Psychiatry, 37*(3), 213-238.

Klein, R. A. (2000). Virtual reality exposure therapy in the treatment of fear of flying. *Journal of Contemporary Psychotherapy. Special Treatments of anxiety disorders, 30*(2), 195-207.

Kornfield, S. (1996). A computerized multimedia intervention to improve self-esteem in adolescents by modifying irrational beliefs. *Dissertation Abstracts International Section A: Humanities & Social Sciences, 57*(5-A), 1962.

Krijn, M., Emmelkamp, P. G., Olafsson, R. P., & Biemond, R. (2004). Virtual reality exposure therapy of anxiety disorders: A review. *Clinical Psychology Review, 24*(3), 259-281.

Lange, A., Rietdijk, D., Hudcovicova, M., van de Ven, J. P., Schrieken, B., & Emmelkamp, P. G. (2003). Interapy: A controlled randomized trial of the standardized treatment of posttraumatic stress through the internet. *Journal of Consulting & Clinical Psychology, 71*(5), 901-909.

Lange, A., van de Ven, J.-P., & Schrieken, B. (2003). Interapy: Treatment of post-traumatic stress via the Internet. *Cognitive Behaviour Therapy, 32*(3), 110-124.

Lange, A., van de Ven, J. P., Schrieken, B., & Emmelkamp, P. G. (2001). Interapy. Treatment of posttraumatic stress through the Internet: A controlled trial. *Journal of Behavior Therapy & Experimental Psychiatry, 32*(2), 73-90.

Maltby, N., Kirsch, I., Mayers, M., & Allen, G. J. (2002). Virtual reality exposure therapy for the treatment of fear of flying: A controlled investigation. *Journal of Consulting & Clinical Psychology, 70*(5), 1112-1118.

March, S., Spence, S. H., & Donovan, C. L. (2008). The Efficacy of an Internet-Based Cognitive-Behavioral Therapy Intervention for Child Anxiety Disorders. *Journal of Pediatric Psychology* September 15, 1-14. Retrieved October 6, 2008, from http://jpepsy.oxfordjournals.org/cgi/reprint/jsn099v1

Marks, I., Kenwright, M., McDonough, M., Whittaker, M., & Mataix-Cols, D. (2004). Saving clinician's time by delegating routine aspects of therapy to a computer: A randomized controlled trial in phobia/panic disorder. *Psychological Medicine, 34*, 9-18.

Muhlberger, A., Wiedemann, G., & Pauli, P. (2003). Efficacy of a one-session virtual reality exposure treatment for fear of flying. *Psychotherapy Research, 13*(3), 323-336.

Nauta, M. H., Scholing, A., Emmelkamp, P. G., & Minderaa, R. B. (2003). Cognitive-behavioral therapy for children with anxiety disorders in a clinical setting: No additional effect of a cognitive parent training. *Journal of the American Academy of Child & Adolescent Psychiatry, 42*(11), 1270-1278.

Nelissen, I., Muris, P., & Merckelbach, H. (1995). Computerized exposure and in vivo exposure treatments of spider fear in children: Two case reports. *Journal of Behavior Therapy & Experimental Psychiatry, 26*(2), 153-156.

Newman, M. G. (2004). Technology in Psychotherapy: An Introduction. *Journal of Clinical Psychology, 60*(2), 141-145.

Newman, M. G., Consoli, A. J., & Taylor, C. B. (1999). A palmtop computer program for the treatment of generalized anxiety disorder. *Behavior Modification, 23*(4), 597-619.

Newman, M. G., Kenardy, J. A., Herman, S., & Taylor, C. B. (1997). Comparison of palmtop-computer-assisted brief cognitive-behavioral treatment to cognitive-behavioral treatment for panic disorder. *Journal of Consulting & Clinical Psychology, 65*(1), 178-183.

NICE. (2006). *Computerised cognitive behaviour therapy for depression and anxiety*. London, UK: National Institute for Clinical Excellence.

Nicholas, J., Oliver, K., Lee, K., & O'Brien, M. (2004). Help-seeking behaviour and the Internet: An investigation among Australian adolescents [Electronic Version]. *AeJAMH (Australian e-Journal for the Advancement of Mental Health), 3*, [np]. Retrieved August, 15, 2008, from http://www.auseinet.com/journal/vol3iss1/index.php

North, M. M., North, S. M., & Coble, J. R. (1996). Effectiveness of virtual environment desensitisation in the treatment of agoraphobia. *Presence: Teleoperators and Virtual Environments, 5*, 346-352.

Przeworski, A., & Newman, M. G. (2004). Palmtop Computer-Assisted Group Therapy for Social Phobia. *Journal of Clinical Psychology, 60*(2), 179-188.

Przeworski, A., & Newman, M. G. (2006). Efficacy and utility of computer-assisted cognitive behavioural therapy for anxiety disorders. *Clinical Psychologist, 10*(2), 43-53.

Rassau, A., & Arco, L. (2003). Effects of chat-based on-line cognitive behavior therapy on study related behavior and anxiety. *Behavioural & Cognitive Psychotherapy, 31*(3), 377-381.

Richards, J. C., & Alvarenga, M. E. (2002). Extension and replication of an internet-based treatment program for panic disorder. *Cognitive Behaviour Therapy, 31*(1), 41-47.

Richards, J. C., Klein, B., & Austin, D. W. (2006). Internet cognitive behavioural therapy for panic disorder: Does the inclusion of stress management information improve end-state functioning? *Clinical Psychologist, 10*(1), 2-15.

Ritterband, L. M., Cox, D. J., Gordon, T. L., Borowitz, S. M., Kovatchev, B. P., Walker, L. S., et al. (2006). Examining the added value of audio, graphics, and interactivity in an Internet intervention for pediatric encopresis. *Children's Health Care, 35*(1), 47-59.

Ritterband, L. M., Cox, D. J., Walker, L. S., Kovatchev, B., McKnight, L., Patel, K., et al. (2003). An Internet intervention as adjunctive therapy for pediatric encopresis. *Journal of Consulting & Clinical Psychology, 71*(5), 910-917.

Rothbaum, B. O., Hodges, L., Alarcon, R., Ready, D., Shahar, F., Graap, K., et al. (1999). Virtual reality exposure therapy for PTSD Vietnam veterans: A case study. *Journal of Traumatic Stress, 12*(2), 263-271.

Rothbaum, B. O., Hodges, L., Smith, S., Lee, J. H., & Price, L. (2000). A controlled study of virtual reality exposure therapy for the fear of flying. *Journal of Consulting & Clinical Psychology, 68*(6), 1020-1026.

Rothbaum, B. O., Hodges, L. F., Kooper, R., Opdyke, D., Williford, J., & North, M. M. (1995a). Virtual reality graded exposure in the treatment of acrophobia: A case report. *Behavior Therapy, 26*(3), 547-554.

Rothbaum, B. O., Hodges, L. F., Kooper, R., Opdyke, D., Williford, J., & North, M. M. (1995b). Effectiveness of computer-generated (virtual reality) graded exposure in the treatment of acrophobia. *American Journal of Psychiatry, 152*(4), 626-628.

Selmi, P. M., Klein, M. H., Greist, J. H., Sorrell, S. P., & Erdman, H. (1990). Computer-administered cognitive-behavioral therapy for depression. *American Journal of Psychiatry, 147*(1), 51-56.

Shaw, S. C., Marks, I., & Toole, S. (1999). Lessons from pilot tests of computer self-help for agora/claustrophobia and panic. *MD Computing, July/August*, 44-48.

Silverman, W. K., Pina, A. A., & Viswesvaran, C. (2008). Evidence-Based Psychosocial Treatments for Phobic and Anxiety Disorders in Children and Adolescents. *Journal of Clinical Child & Adolescent Psychology, 37*(1), 105-130.

Smith, K. L., Kirkby, K. C., Montgomery, I. M., & Daniels, B. A. (1997). Computer-delivered modeling of exposure for spider phobia: Relevant versus irrelevant exposure. *Journal of Anxiety Disorders, 11*(5), 489-497.

Spence, S. H., Donovan, C., & Brechman Toussaint, M. (2000). The treatment of childhood social phobia: The effectiveness of a social skills training-based, cognitive-behavioural intervention, with and without parental involvement. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 41*(6), 713-726.

Spence, S. H., Donovan, C. L., March, S., Gamble, A., Anderson, R., Prosser, S., et al. (2008). Online CBT in the Treatment of Child and Adolescent Anxiety Disorders: Issues in the Development of BRAVE?ONLINE and Two Case Illustrations. *Behavioural and Cognitive Psychotherapy, 36*(Special Issue 04), 411-430.

Spence, S. H., Holmes, J., Donovan, C. L., & Kenardy, J. A. (2006). *BRAVE for Teenagers - ONLINE: An internet based program for adolescents with anxiety*. Brisbane, Australia: School of Psychology, University of Queensland.

Spence, S. H., Holmes, J. M., & March, S. (2001). *The BRAVE program for children: A cognitive-behavioural group treatment for childhood anxiety*. Brisbane, Australia: University of Queensland.

Spence, S. H., Holmes, J. M., March, S., & Lipp, O. V. (2006). The Feasibility and Outcome of Clinic Plus Internet Delivery of Cognitive-Behavior Therapy for Childhood Anxiety. *Journal of Consulting and Clinical Psychology, 74*(3), 614-621.

Spence, S. H., March, S., & Holmes, J. (2005). *BRAVE for Children - ONLINE: An internet based program for children with anxiety*. Brisbane, Australia: School of Psychology, University of Queensland.

Vincelli, F., Anolli, L., Bouchard, S., Wiederhold, B. K., Zurloni, V., & Riva, G. (2003). Experiential Cognitive Therapy in the Treatment of Panic Disorders with Agoraphobia: A Controlled Study. *CyberPsychology & Behavior, 6*(3), 321-328.

Wald, J., & Taylor, S. (2000). Efficacy of virtual reality exposure therapy to treat driving phobia: A case report. *Journal of Behavior Therapy & Experimental Psychiatry, 31*(3-4), 249-257.

White, J., Jones, R., & McGarry, E. (2000). Cognitive behavioural computer therapy for the anxiety disorders: A pilot study. *Journal of Mental Health (UK), 9*(5), 505-516.

Wilson, F. R., Omeltschenko, L., & Yager, G. G. (1991). Coping with test stress: Microcomputer software for treatment of test anxiety. *Journal of Behavior Therapy & Experimental Psychiatry, 22*(2), 131-139.