Online interventions for anxiety disorders

Helen Christensen[a], *Philip Batterham*[b], *and Alison Calear*[b]

Purpose of review
The present article updates knowledge regarding the evidence base for online interventions for anxiety disorders, and provides an overview of recent advances in online interventions for anxiety over the past 18 months.

Recent findings
Computerized self-help is an effective strategy for providing evidence-based treatments for symptoms of anxiety and depression. Online delivery has numerous advantages for clinicians and patients, including greater accessibility, anonymity, convenience and cost-effectiveness. These may be particularly important for populations experiencing anxiety, which may face more pronounced barriers to accessing care. Recent meta-analyses have confirmed that computerized cognitive behaviour therapy (CBT) for anxiety demonstrates comparable clinical outcomes as face-to-face psychotherapy for individuals with anxiety. This review updates the status of current knowledge by providing a focused review of randomized controlled trials of computerized (including Internet and portable device-delivered) treatments for anxiety.

Summary
Recent studies have confirmed the utility of computerized psychotherapy for anxiety. Future trials are required to elucidate the active constituents of effective programs, evaluate targeted approaches for specific groups, and to ascertain the optimal degree of guidance required. Clarification of these issues will assist in refining effective online programs operating within standalone virtual clinics or incorporated into clinician-supported stepped care approaches.

Keywords
anxiety, guided, internet, online, self-help

INTRODUCTION

Anxiety disorders are now recognized as a major contributor to the global burden of disease [1]. Anxiety is a key risk factor for the development of bipolar disorder, suicide and suicide attempt [2,3].

Online therapies are now considered a viable treatment option for anxiety disorders. The advantages of online anxiety programs include access to treatment for those not wishing to seek professional help, without access to services, including rural and remote dwellers, where waiting lists are long, and for those who prefer to seek help autonomously [4,5]. Additional advantages include lower cost, high availability (24/7) and capacity for rapid dissemination [6,7]. In recent years, governments of countries across the world, such as the United Kingdom, Sweden and Australia, have provided support for the use of these programs through primary care, or directly through online portals. For example, *Fearfighter* [8] and *Beating the Blues* [9] are recommended for use in the United Kingdom through primary care trusts. In Australia, the Department of Health and Ageing supports a portal that provides access to evidence-based e-health applications (http://mindhealthconnect.org.au) [10] and funds open access, free evidence-based e-health applications for managing anxiety and depression, such as *MyCompass* (https://mycompass.com.au) and *MoodGYM* (https://moodgym.anu.edu.au).

This article aims to identify new research examining the effectiveness and usefulness of Internet or computer-based programs for anxiety treatment and prevention. We review four meta-analyses of Internet-based treatment programs, which have been published since 2009 [7,11–13]. In addition, we have identified 29 new randomized controlled trials published in the past year (2012 – June 2013). In this

[a]Black Dog Institute, University of New South Wales, Randwick, New South Wales and [b]Centre for Mental Health Research, Australian National University, Canberra, Australia

Correspondence to Professor Helen Christensen, Black Dog Institute, Hospital Road, Randwick, Sydney, NSW 2031, Australia. Tel: +61 02 9382 9285; e-mail: h.christensen@blackdog.org.au

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KEY POINTS

- Computerized and Internet-delivered self-help CBT is highly effective for anxiety in adults, and shows comparable clinical outcomes as face-to-face psychotherapy.
- CBT remains the dominant Internet therapy.
- Studies in adolescence and youth support the positive findings seen in outcome trials for adults.
- Adherence to online trials is comparable to other forms of psychotherapy.

article, we review the previous meta-analyses, the new effectiveness trials and identify current themes concerning online treatment for anxiety. These themes address evidence for the best type of therapy, the suitability of online interventions for the range of anxiety disorders, the extent to which clinician support is required, the relative effectiveness of face-to-face and online treatments, the use of these programs in adolescents and young people and the issue of adherence.

PREVIOUS SYSTEMATIC REVIEWS AND META-ANALYSES

Griffiths *et al.* [14] focused on Internet interventions for depression and anxiety disorders, uncovering 26 randomized controlled trials (RCTs), of which 16 targeted an anxiety disorder [panic disorder, five; social phobia, five; posttraumatic stress disorder (PTSD), four; unspecified anxiety, two] and two targeted both anxiety and depression. Independent of type of control condition, all anxiety interventions demonstrated positive results on at least one measure, with the exception of one SP study. Published effect sizes ranged from 0.29 to 1.74, with the majority above 0.65. Cuijpers *et al.* [7] reviewed RCTs of computerized psychotherapy for anxiety disorders, including Internet programs. Twenty-three articles reporting on RCTs were identified, including phobia ($n = 10$); panic disorder/agoraphobia, ($n = 9$); PTSD, ($n = 3$); and obsessive compulsive disorder (OCD) ($n = 1$). The overall mean effect size was found to be 1.08. Based on 13 comparisons, face-to-face therapy did not differ from online delivery of CBT [7]. Effects persisted at 12-month follow-up. Andrews [11] identified 22 studies. Sixteen of these focused on anxiety disorders: panic disorder [6], social phobia [8] or generalized anxiety disorder (GAD) [2]; the remaining six dealt with major depression. Although two of the studies aimed at treating depression included clinic-based computerized CBT, all of the studies that focused on anxiety disorders involved Internet-based CBT (iCBT). The mean effect size was 0.92 for social phobia ($n = 8$); 0.83 for panic disorder ($n = 6$), and 1.12 for GAD ($n = 2$). Two studies directly compared face-to-face treatment for anxiety disorder (panic disorder), and no differences were reported.

Two other meta-analyses have since been reported, although neither focused exclusively on online anxiety programs or included all forms of online programs. The first by Lewis *et al.* [13] examined only self-help interventions for anxiety disorders, including websites, books, CDs and DVDs. The findings indicated large outcomes relative to waitlist control conditions for self-help interventions but negative effect sizes relative to therapist delivered interventions. Finally, Paul *et al.* [15] published a systematic review of web-based approaches to improving psychosocial health, or quality of life, in chronic physical and mental health conditions. However, the coverage of this review is broader than that of anxiety disorders, with its scope encompassing chronic health conditions, and it had a focus on improving well being and quality of life as outcomes of interest.

EFFECTIVENESS TRIALS PUBLISHED IN THE PAST 12 MONTHS

Using search terms for anxiety disorders, RCTs, and computer-based studies we conducted a literature search in PsycInfo and PubMed to identify studies published in the past year (January 2012 to July 2013). Studies focussing on depression were included if anxiety was a secondary outcome. We also searched an existing database of peer-reviewed RCTs reporting on studies of mobile applications for mental health disorders for relevant articles from the past year [16]. A total of 77 articles were retrieved for full text coding from the past year. Twenty nine relevant RCTs were identified. These are summarized in Table 1. [17,18▪▪,19–21,22▪,23,24▪,25▪,26–28,29▪,30,31▪,32,33▪▪,34▪,35–39,40▪,41▪,42▪▪,43–45]

NOTEWORTHY THEMES AND ISSUES

We identified several key themes that arose within the current literature, which we outline and discuss below.

Type of therapy

The bulk of interventions used CBT. An example of these studies is that of Newby [40▪]. This study targeted mixed anxiety and depression, delivering

Table 1. Basic characteristics of studies included in current review

Reference	Country conducted	Target population (Age)	Disorder targeted by intervention	Type of intervention
[17]	USA	Adults	Social anxiety	Bias modification
[18▪▪]	Sweden	Adults	Social anxiety	CBT
[19]	Sweden	Adults	GAD	Psychodynamic / CBT
[20]	Canada	Adults	Misc.	CBT/stress management
[21]	NZ	Adults	Anxiety disorders	CBT
[22▪]	UK	Adults	Misc.	CBT
[23]	Sweden	Adults	Social anxiety	Bias modification
[24▪]	Germany	Adolescents	Misc.	CBT
[25▪]	Sweden	Adults	Misc.	CBT
[26]	Netherlands	Adolescents	Depression and anxiety	PST
[27]	Sweden	Adults	Depression	CBT
[28]	Netherlands	Adults	Misc.	CBT
[29▪]	Australia	Adolescents	Anxiety	CBT
[30]	Australia	Adults	Depression	Bias modification
[31▪]	Netherlands	Adolescents and Adults (16–25)	Depression	CBT
[32]	USA	Adults	Misc.	Social cognitive therapy/psychoeducation
[33▪▪]	Netherlands	Adolescents	Social anxiety	Bias modification
[34▪]	USA	Adults	Stress	Stress management
[35]	Australia	Adults	Social anxiety	Bias modification
[36]	Canada	N.R.	Misc.	CBT
[37]	Australia	Adults	Bipolar disorder	Psychoeducation
[38]	UK	Adults	Misc.	CBT
[39]	UK	Adults	Depressive symptoms	CBT
[40▪]	Australia	Adults	Anxiety and depression	CBT
[41▪]	Germany	Adults	Social anxiety	Bias modification
[42▪▪]	NZ	Adolescents	Depression	CBT
[43]	NZ	Adolescents	Depression	CBT
[44]	Sweden	Adults	Panic attacks	CBT
[45]	Italy	Adults	Stress	Stress management

Adolescents, 12–17 years; adults, 18–64 years; CBT, Cognitive Behaviour Therapy; GAD, generalized anxiety disorder; Misc, Miscellaneous conditions – included a range of conditions including disfigurement-related distress, eating disorder symptomatology, insomnia, maladaptive perfectionism, perfectionism, postdisaster trauma, severe health anxiety, wellbeing; NZ, New Zealand; N.R, Not reported; PST, problem solving therapy; UK, United Kingdom; US, United States.

a 10-week, therapist-assisted program. Findings indicated a relatively large between-group effect size of 0.8. This effect size is indicative of studies of this type, the mean effect size being 0.8 (range 0.2–1.6). Notably, the second most common type of intervention was bias modification. This may, in part, be a reflection of the critical role of attentional and cognitive biases in the development and maintenance of anxiety [20,46,47]. A notable example of a bias modification study is that of Neubauer [41▪]. This study is an RCT of Internet-delivered attention modification training for social phobia which examined the effectiveness of a 4.5-week intervention delivered to adults meeting criteria for social phobia. As was the trend for studies concerning bias modification in this review, no significant effects were found between the intervention and control groups at posttest or final follow-up (4 months in this case), and the effect size was fairly modest. Overall, the evidence for the efficacy of bias modification interventions for anxiety was somewhat lacking, with effect sizes for bias modification studies 0.07–0.42 and most/all effects nonsignificant. Three computerized stress-management interventions were evaluated. A good example of these is Rose [34▪]. This study tested a 6-week computer-based self-guided stress management and resilience training program that contained

animated game-like activities focusing on day-to-day management of stress.

Type of anxiety

The majority of studies meeting criteria for this review included anxiety as a secondary outcome to other mental health problems such as depression and depressive symptoms, bipolar disorder, anorexia, hypochondriasis, general mental well being and insomnia. Of the eight studies that focused primarily on anxiety, the major target was social phobia (five studies [1,10,30,37,44]), with only one study [44] targeting panic disorder, and two targeting symptoms of anxiety.

New targets for online therapy were uncovered. The study by Fichter *et al.* [24▪] examined a 36-week CBT Internet-based prevention program for anorexia nervosa relapse. This study included a measure of phobic anxiety, finding that a significant difference between intervention and control groups in phobic anxiety at posttest, and an effect size of 0.22. Also of interest is the study by Bessel *et al.* [22▪] on the effectiveness of an 8-week computer-based CBT intervention for disfigurement-related distress and the study by Hedman *et al.* [25▪] of the long-term effectiveness of a 12-week iCBT course for severe health anxiety/hypochondriasis.

Level of clinician support

The majority of identified studies were either solely or primarily self-help in conjunction with minimal therapist guidance (generally weekly, via E-Mail, with 24-h turnaround, concerning homework feedback and facilitating completion of intervention). Some studies featured unique types of guidance, for example peer support coaching by bipolar sufferers alongside psychoeducation [37], online group CBT sessions hosted by a therapist [31▪] and therapist support via telephone to both parents and adolescents [29▪]. The heterogeneity among the studies in amount and type of guidance made it difficult to draw consistent conclusions about the utility of clinician support. Andersson *et al.* [18▪▪] concluded that the degree of therapist experience in the delivery of Internet programs did not appear to make a difference to clinical outcome but might speed up protocol administration.

Comparison with face-to-face

Only two of the studies identified compared an online intervention with a face-to-face intervention. Sportel *et al.* [33▪▪] compared an online cognitive bias modification (CBM) intervention for social anxiety with a face-to-face CBT intervention for social anxiety with assessment only. There was no significant difference in reduction of social anxiety symptoms between the active conditions at posttest. The second study [22▪] compared an online intervention with standard face-to-face CBT for facial-disfigurement distress, and found both conditions differed from the control.

New technologies

Although there have been significant gains in technology afforded by the rise of smartphones and tablet devices, only one of the identified RCTs tested a mobile application [45]. This study was a small RCT of stress management for nurses ($n = 16$), and reported significant improvements in anxiety for the treatment group [45].

Adolescence and youth

Previous reviews [48,49] completed in 2010 identified only three online trials of two programs targeting youth: *BRAVE-Online*, a cognitive behavior therapy (CBT) program designed to treat anxiety in children and adolescents (7–14 years), and the CBT-based *MoodGYM* depression prevention program in an adolescent (13–17 years) school-based population.

During the past 12 months, another five RCTs have been published [26,29▪,33▪▪,42▪▪,43] recruiting adolescents. Two of these trials [42▪▪,43] evaluated the effectiveness of the *SPARX* program, a CBT-based depression treatment program for adolescents (12–19 years). One of the trials [42▪▪] reported a significant effect for generalized anxiety at postintervention, while the other did not find an effect for anxiety [43]. Two [26,33▪▪] of the three remaining trials also did not report positive outcomes for anxiety, but these interventions used PST for mild anxiety or depression [26] and CBM for social and test anxiety [33▪▪]. As noted above (type of therapy) CBT interventions appear to be the most reliable in effecting positive outcomes. The final study evaluated the CBT-based *Cool Teens* program, which found a significant reduction in anxiety symptoms amongst adolescents (14–17 years) with a primary diagnosis of anxiety [29▪]. As with adults, online CBT appears to be the most reliable means to shift anxiety in adolescents using technology.

Adherence and dropout

Among the 29 anxiety studies identified from the past year, 25 reported rates of dropout at posttest, with mean dropout of 18% (SD = 14%, range

0–64%) and only five studies with dropout rates above 30%. These high rates of retention are comparable to those found in previous reviews of online anxiety interventions [7,11,50]. Definitional issues remain problematic [50–52]. Two of the identified studies focused on intervention adherence as an outcome [37,40▪]. One of these [37] found that adherence was greater when the online program included a peer support component, while females and older participants were also more likely to adhere to the program. The other [40▪] reported that adherence was high in a defined clinical population but lower in a primary care setting, despite large effect sizes. Adherence and dropout have also been examined as predictors of effectiveness. One study reported greater adherence was associated with greater intervention effectiveness [24▪], whereas another found no difference in outcomes for completers and noncompleters [26].

CONCLUSION

Online therapies, particularly those using CBT, are effective for anxiety disorders and anxiety symptoms secondary to disorders such as major depression. However, there remain gaps in the literature. No direct comparisons have yet been published of anxiolytics/antidepressants and online therapies. Refinements in the type of intervention delivered are also required. Online programs for GAD and OCD are lacking with few research trials.

Nevertheless, the evidence from previous work as well as from the current crop of RCTs remains strong enough to support the promotion of online programs to the public and to clinicians for use within their practice. There is also a need to switch the focus from efficacy and effectiveness studies to implementation trials within healthcare settings. This may involve the development of new models of care through 'direct to the public' virtual clinics, integration across healthcare systems in clinician-supported stepped care models, or through workforce channels or school settings. New developments into the future will include training of General Practitioners in e-health, the escalation of e-health programs as part of 'low intensity' interventions in primary care, developments in General Practitioners's prescription software to facilitate referral to online programs, and other developments linked with country-specific healthcare models.

Both clinicians and the public recognize the importance of the information that is required to assure the quality of websites and programs. In response, the Beacon website at the Australian National University (https://beacon.anu.edu.au/) was established to summarize the features and research evidence for online and mobile applications for mental health, including those targeting anxiety. We recommend this reference site for clinicians and the general public [53,54▪].

To date, most online interventions have focused on the treatment rather than the prevention of anxiety disorders. However, the Internet offers a solution to the delivery of prevention programs, given its capacity for rapid dissemination of evidence-based programs, at low cost [6]. A recent meta-analysis of anxiety prevention in youth [55] demonstrated an overall effect size at postintervention of 0.18. In light of these positive findings, the potential of online programs for broad reach and the fact that the majority of young people are active online [56] suggests that universal prevention of anxiety in schools through the Internet is likely to be a significant opportunity in the near future.

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Conflicts of interest

No conflicts of interest are reported.

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- ▪ of special interest
- ▪▪ of outstanding interest

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This is the first clinical trial to test (and demonstrate) the efficacy of an evidence-based e-mental health intervention in reducing anxiety and appearance-related distress in people with a facial disfigurement. This article builds a strong foundation for the future of online interventions for people with appearance-related distress as a first step in a stepped-care approach.

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This study examined a 36-week internet-based prevention program for anorexia nervosa relapse. This is the first study looking at an internet intervention for anorexia nervosa, and utilises online Cognitive Behavioural Therapy. This study included a measure of phobic anxiety, finding that a significant difference between intervention and control groups in phobic anxiety at posttest, and an effect size of 0.22.

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This study examined the long-term effectiveness of a 12-week iCBT course for severe health anxiety/hypochondriasis. This is of interest as it focuses on severe health anxiety, a less researched problem, and looks at long-term outcomes as well as cost-effectiveness. A between-group effect size at posttest of 1.62 was found, although this study did not find significant effects between intervention and control groups at posttest or final follow-up.

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This was the first clinical trial to test the efficacy of CBM in early intervention in a multidimensional CBM approach.

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Tested a novel 6-week computer-based self-guided stress management and resilience training program that contained animated game-like activities focusing on day-to-day management of stress, and for this reason it has been included for annotation. Of the three studies included in this review that dealt with stress management, two reported a between-group effect size – this study (e.s. = 0.14) and Villani *et al.* 2011 (e.s. = 0.67), demonstrating that there is need for further exploration in this area.

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This study targeted mixed anxiety and depression, delivering a 10-week, therapist-assisted program. Findings indicated a relatively large between-group effect size of 0.8, and this is fairly indicative of studies of this sort (i.e. CBT-based), making it of interest because it is representative of this area of research.

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An RCT of internet delivered attention modification training for social phobia in which the effectiveness of a 4.5-week intervention delivered to adults meeting criteria for social phobia. As was the trend for studies concerning bias modification in this review, no significant effects were found between the intervention and control groups at posttest or final follow-up (4 months in this case), and the effect size was fairly modest at 0.31 [which was fairly representative of bias modification studies found, with the exception of Amir *et al.* (2012), who reported a very large effect]. This article has been chosen for annotation as it represents the bias modification literature included in this review fairly well.

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This study shows the effectiveness of a game SPARX for depression in adolescents in a well controlled noninferiority trial. Although this study targeted depression, rather than anxiety, it is of significance because it uses an interactive game, which was acceptable and appealed to adolescents, and showed effectiveness against current treatment provided through health providers. Moreover, it shows the type of research design that might be replicated for anxiety disorders as the primary target.

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