The efficacy of internet interventions for depression and anxiety disorders: a review of randomised controlled trials

Kathleen M Griffiths, Louise Farrer and Helen Christensen

Over the past 10 years, there has been increasing interest in the use of the internet for the dissemination of interventions designed to prevent and treat mental disorders, including those targeted at anxiety disorders and depression. There can be little doubt that the potential of the internet to effect or facilitate the delivery of mental health interventions, both with and without practitioner guidance, is high. However, this potential will only be realised if such programs actually work and do no harm.

Since the emergence of the first internet programs for mental disorders, there have been several systematic or quasi-systematic reviews of the effectiveness of depression and anxiety internet interventions. Three of these reviews focused specifically on randomised controlled trials (RCTs) of internet interventions. In particular, our 2006 review of RCTs of internet interventions for mental health and related disorders and a subsequent 2007 update identified 10 trials focusing either on depression (four trials) or anxiety (six trials). Two of the four depression trials and four of the six anxiety trials yielded evidence of reduced symptoms. Subsequently, Spek and colleagues conducted a quantitative meta-analysis of 12 published and in-press RCTs of internet-based cognitive behaviour therapy (CBT) for depression and anxiety, reporting mean effect sizes for these conditions of 0.32 and 0.96, respectively.

Since the publication of these reviews, further RCTs of anxiety and depression internet interventions have been published. This review updates the current state of the evidence concerning the outcomes, nature, quality and growth of published RCTs of preventive and treatment internet interventions for anxiety and depressive disorders, and documents the current availability of effective interventions.

METHODS

Study selection criteria

We updated our previous reviews of internet interventions for mental health and related conditions using the methodology described in the original article. In particular, recent eligible trials were identified by searching the PubMed, PsycINFO and Cochrane Central Register of Controlled Trials databases using the two key search terms (“Internet” OR “Web”) for the period since the last search. However, the most recent PubMed search was limited to “randomized controlled trials”, and a methodological search filter was used to focus the PsycINFO search on randomised controlled trials.

Studies were included only if they: (i) involved a self-help website intervention or a website intervention that incorporated a self-help component; (ii) described the website as targeting a depression or anxiety condition; (iii) tested the efficacy or effectiveness of the intervention; (iv) incorporated a measure of symptom outcome for the targeted condition; (v) employed an RCT design; (vi) included a control group that was not subjected to an active intervention such as a behaviour or cognitive therapy intervention, peer-to-peer forum or medication; and (vii) had been peer-reviewed and published. Dissertations and posters were excluded. Studies involving the guided delivery of a self-help intervention or in which the intervention was partly delivered by a therapist were included. All eligible reports from our original reviews and those of more recent eligible trials (collected in two waves, in February 2009 and mid June 2009) were included, together with any additional relevant trials identified by a search of the health intervention web portal Beacon (see Christensen et al, page S40), a search of the contents of the Journal of Medical Internet Research and our personal knowledge of the field.

Risk of study bias assessment

Each eligible paper was independently rated by KMG and a research assistant on three items of the Cochrane Collaboration’s tool for assessing risk of bias: sequence generation (Did the study employ an appropriate randomisation process? Yes, No, Unclear); allocation concealment (Did the study use an appropriate method of concealing the allocation of participants to conditions? Yes, No, Unclear); and incomplete outcome data (Were incomplete outcome data adequately addressed? Yes, No, Unclear).

Analyses

An effect size difference (ESD) was recorded or calculated for each study. The ESD was calculated by subtracting the Cohen’s d within effect size for the control group from

ABSTRACT

Objective: To review the outcomes, nature and quality of published randomised controlled trials of preventive and treatment internet interventions for depression and anxiety disorders, and to document the availability of effective interventions.

Data sources: Previous reviews of internet interventions for mental health and related conditions were updated using an extension of the original methodology. All studies included in the original reviews and more recent eligible trials (published before June 2009) were included, together with any trials identified from a search of the health intervention web portal Beacon and the Journal of Medical Internet Research.

Study selection: A total of 29 reports describing 26 trials satisfied the inclusion criteria.

Data synthesis: All trials employed a cognitive behaviour therapy intervention program. Of the 26 trials, 23 demonstrated some evidence of effectiveness relative to controls. Effect size differences ranged from 0.42 to 0.65 for depression interventions involving participants with clinically significant symptoms of depression, and 0.29 to 1.74 for anxiety interventions involving participants with a diagnosed anxiety disorder. Of the five effective English-language programs, three are available to the public without charge and two can be accessed at a small cost through health practitioner referral.

Conclusion: Internet interventions for depression and anxiety disorders offer promise for use as self-help applications for consumers or as an adjunct to usual care.
the equivalent within effect size for the intervention group. The within effect size for each group was calculated by subtracting the mean post-intervention outcome score for the group from the mean baseline outcome score and dividing by the pooled standard deviation of the baseline and post-intervention outcome scores. Where a study reported more than one primary outcome measure, the ESD was based on the measure most frequently used for the target condition by the body of studies included in this review. Given the heterogeneity and potential confounding across studies, systematic quantitative meta-analyses were not conducted.

RESULTS
Box 1 shows that the number of new RCTs of efficacy or effectiveness of depression and anxiety internet interventions has increased approximately linearly over time, since the first trials appeared in the literature in 2001.

Characteristics of studies
Twenty-six trials (described in 29 reports) satisfied the inclusion criteria.14-42 Of these, eight targeted depression, 16 targeted an anxiety disorder (panic disorder, 5; social phobia, 5; post-traumatic stress disorder, 4; unspecified anxiety disorder, 2), and two studies targeted both depression and anxiety (Box 2, pages S8-S11). All trials employed a CBT intervention program (or a component of CBT41), with program durations ranging from 1 to 13 weeks. One trial also included an evidence-based depression education intervention.14

Two of the eight depression trials and almost all of the anxiety trials employed some level of therapist input, with two of the anxiety trials incorporating a face-to-face component.25,32 Mean therapist time per participant ranged from 90 to 376 minutes across studies (median, 155 minutes).

Twenty-three of the 26 trials were community-based, with one based in a clinic25 and two undertaken in the context of a health maintenance organisation in the United States23,24. None of the studies were undertaken in a general practice setting. Most of the samples involved adults with a mean age in the range of 30–50 years. Only one trial targeted an older sample17,18 and two trials involved children or adolescents25,26. None of the studies investigated outcomes for rural participants, although one specifically recruited both rural and city participants.27 Sample sizes ranged from 23 to 786. The median sample size was 300 for depression, and 32, 73 and 66 for panic disorder, social phobia and post-traumatic stress disorder, respectively. Only two of the trials employed longer-term follow-up (at least 6 months) involving a randomised controlled design.16,18

Of the 26 trials, 19, 9 and 17 were rated low-risk for bias in the sequence generation, allocation concealment and incomplete data domains, respectively. Risk of bias was greater in the anxiety trials, with four of the eight depression trials but only one of the 16 anxiety trials rated low-risk for all three domains (Fisher exact test, P = 0.03).

Most of the studies employed an intention-to-treat design. However, recruitment methods varied across studies, as did criteria for study inclusion. Some studies only included participants with a formal diagnosis of a depressive or anxiety disorder, while others selected participants on the basis of a clinically significant cut-off score on a self-report measure. Others selected people with elevated but not necessarily clinically significant levels of symptoms, and one study employed a sample of participants with subthreshold depression, specifically excluding those with a diagnosis of depressive disorder.17 Finally, some studies recruited those who self-selected as requiring self-help.

Studies varied with respect to their control groups, with the majority employing the least conservative wait-list control, three using “treatment as usual” controls, one an attention placebo, and six a passive psychoeducational (information) control.

Effectiveness
Box 2 summarises the outcomes for short- and long-term follow-up, including the short-term ESDs, for each study. Of the 26 trials, 23 demonstrated some evidence of effectiveness. The two trials that investigated long-term effectiveness using an RCT design reported that the interventions were effective over the long term.16,18

Depression
Six of the eight trials targeting depression yielded positive effects for CBT. One also demonstrated evidence of efficacy for an evidence-based depression information internet site relative to an attention control.14 suggesting that passive psychoeducational information may be an effective intervention for depression. As a consequence, trials in Box 2 were separated on the basis of whether they employed a psychoeducational control condition. All five depression trials that used a wait-list, treatment-as-usual or attention placebo control group were effective in both the short term and, for the two RCTs that investigated it, the long term. Of the three trials that exposed the control group to psychoeducational information about depression, one, which employed reminders and involved minimal information, was effective.

ESDs for the CBT programs not employing psychoeducational controls varied across studies: 0.30 to 0.53 for prevention or quasi-prevention trials (targeting participants with elevated depressive symptoms who either had no depressive disorder or who had not been selected on the basis of depressive disorder); 0.42 to 0.65 for participants with clinically significant symptoms; and 0.65 for a trial that employed categorical diagnostic criteria.

Anxiety
All of the anxiety interventions yielded positive results on at least one measure, regardless of the type of control group they employed, except for the non-therapist arm of one social phobia study.36 With this exception, all the anxiety programs without psychoeducational controls employed diagnostic criteria or therapist input and, in most cases, both. The ESDs of all anxiety programs ranged from 0.29 to 1.74, with most exceeding 0.65.

Availability of effective English-language programs
Only five of the programs included in this review are available in the English language. Of the English-language programs, three depression applications are currently publicly accessible on the web without charge to consumers (ODIN, MoodGYM and BluePages,14,16 see Bennett et al, page 548).43 A fourth depression program (Sadness)20...
and a social phobia program (Shyness\textsuperscript{34-36}) are available under restricted licence at a small cost (see Andrews and Titov, page 545).\textsuperscript{44} With the exception of ODIN, each of these English-language programs was developed in Australia and is supported by evidence from additional intervention studies not reported here.

**DISCUSSION**

The findings of this review clearly demonstrate that the internet can be an effective medium for the delivery of interventions designed to reduce the symptoms of depression and anxiety conditions. Moreover, the effect sizes for the depression trials, both with and without therapist input, were at least as large as the standardised effect sizes relative to controls reported in recent meta-analyses of psychological treatment in primary care (0.31)\textsuperscript{45} and antidepressant treatment of depression (0.37).\textsuperscript{46} Similarly, the anxiety effect sizes reported here are consistent with controlled effect sizes reported for face-to-face treatment of panic disorder\textsuperscript{47,48} and social phobia.\textsuperscript{49}

Based on the current available data, it is not possible to reliably draw conclusions about the factors that predict better outcomes. The effect sizes for anxiety trials appear larger than those for depression trials, but participants in the former trials were more often self-selected volunteers and were typically only included in the trial if they also satisfied diagnostic criteria at screening. In addition, as noted in a previous review,\textsuperscript{50} participants in the anxiety trials were more likely to receive therapeutic input in addition to the internet self-help program. Moreover, a greater proportion of the anxiety trials employed less conservative wait-list control designs, and the potential for study bias was greater in the anxiety trials.

A question of considerable practical and policy importance is whether internet programs yield better results if they include input from therapists or lay facilitators, or email reminders. Previous reviews have reported greater effect sizes for internet\textsuperscript{3} and other self-help programs\textsuperscript{50} when the intervention incorporated therapist assistance. However, the latter meta-analysis found no clear advantage of therapeutic support compared with simple monitoring.\textsuperscript{50} The findings from our review and other trials\textsuperscript{51} suggest that internet programs can be effective without therapist input. However, due to the variation in the methodologies of the studies reviewed, such as participant and control group characteristics, it was not possible to evaluate the effect of the presence, type or intensity of guidance by comparing effect sizes across studies.

One of the reviewed studies did directly compare self-guided with therapist-guided delivery of a program,\textsuperscript{50} finding superior outcomes for the latter. In this study, participants with social phobia received a 6-week, web-based, self-help CBT program and chat group, or the same intervention with the addition of email contact with a therapist (requiring an average of 2.5 hours of therapist time per participant). Unfortunately, the study did not include a condition involving an equivalent degree of guidance from a lay facilitator or the use of an automated ongoing email reminder system. Including these conditions would have assisted in determining the effect of substituting automated reminders or trained lay facilitators for trained therapists in delivering these programs. Moreover, it is not known how much guidance is optimal. A recent study reported no advantage of substantial therapist input compared with minimal therapist input.\textsuperscript{52}

One study recently reported that an internet program for panic disorder was as effective when administered by general practitioners as by clinical psychologists.\textsuperscript{53} However, a methodological weakness of the study was that the participants seen by the GPs were recruited from a primary care setting, whereas those seen by the psychologists were not. Moreover, since the GPs involved had received mental health training, the result may not be generalisable to GPs without such training.

Well controlled studies are required to investigate the relative efficacy of automated reminder systems compared with human guidance, the relationship between outcomes and training, and the extent to which time spent facilitating self-help determines outcomes. In addition, there is a need to investigate whether internet mental health interventions work equally well for different individuals and groups and in different settings. In our original review, we found no trials involving rural residents, older people or children and adolescents.\textsuperscript{1} Little has changed, with none of the studies reviewed here targeting older adolescents, rural residents, or people with low educational backgrounds, and only one trial targeting older people. There is still much that we do not know.

What we do know is that many people who might benefit from conventional face-to-face psychological treatment or preventive intervention will not receive it, either by preference or because of geographical or mobility barriers or a shortage of trained therapists.\textsuperscript{54-57} In such circumstances, it is justified for a health care provider to prescribe an internet intervention that has been shown in community trials to have efficacy at least equivalent to that resulting from treatment as usual in primary care; and self-referral of a consumer to a self-help internet service of demonstrated efficacy is similarly justified.

**ACKNOWLEDGEMENTS**

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**COMPETING INTERESTS**

Kathleen Griffiths and Helen Christensen are coauthors of several depression internet programs, including MoodGYM and BluePages.

**AUTHOR DETAILS**

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**REFERENCES**


### (i) Depression interventions

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<tr>
<th>Study (first author, year)</th>
<th>Program Type</th>
<th>Length (weeks)</th>
<th>Control type</th>
<th>Therapist/duration*</th>
<th>Reminder</th>
<th>Participants</th>
<th>Setting; recruitment method; age</th>
<th>ITT analysis</th>
<th>Effective overall</th>
<th>Group or subgroup</th>
<th>Effect size (ES) difference‡</th>
<th>Within ES for control</th>
<th>Follow-up</th>
<th>Effective</th>
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<td>Yes</td>
<td>525</td>
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<td>Pre</td>
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<td>Prev</td>
<td>Pre</td>
<td>CSD</td>
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<td>0.1&lt;sup&gt;ITT&lt;/sup&gt;C</td>
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<td>Yes</td>
<td>48</td>
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<td>0.57&lt;sup&gt;C&lt;/sup&gt;</td>
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<td>9</td>
<td>WLC + TAU</td>
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<td>No</td>
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<td>No</td>
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<td>Yes</td>
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<td>TAU + PE</td>
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<td>Yes</td>
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### Summary of randomised controlled trials (RCTs) of internet intervention programs targeted at (i) depression, (ii) anxiety and (iii) both depression and anxiety (continued)

#### (ii) Anxiety interventions

<table>
<thead>
<tr>
<th>Study (first author), year</th>
<th>Program</th>
<th>Length (weeks)</th>
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<td>309</td>
<td>Psychology clinic; referral from mental health clinics and school counsellors; aged 7–14 years</td>
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<td>Yes (DS)</td>
<td>D&lt;sub&gt;x&lt;/sub&gt;</td>
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<td>Yes</td>
<td>SS/D&lt;sub&gt;x&lt;/sub&gt;</td>
<td>0.88&lt;sup&gt;ITT,pf§&lt;/sup&gt; -0.60&lt;sup&gt;IT&lt;/sup&gt;</td>
</tr>
<tr>
<td>CBT + StressM</td>
<td>8</td>
<td>PE + SM/WLC</td>
<td>Yes/309</td>
<td>Yes</td>
<td>Community; panic and other mental health websites, general media; mean age, 31.9 years</td>
<td>Yes</td>
<td>Yes</td>
<td>SS/D&lt;sub&gt;x&lt;/sub&gt;</td>
<td>1.74&lt;sup&gt;ITT,pf§&lt;/sup&gt; -0.60&lt;sup&gt;IT&lt;/sup&gt;</td>
<td>No —</td>
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</tr>
</tbody>
</table>
### Summary of randomised controlled trials (RCTs) of internet intervention programs targeted at (i) depression, (ii) anxiety and (iii) both depression and anxiety (continued)

#### (ii) Anxiety interventions (continued)

<table>
<thead>
<tr>
<th>Study (first author), year</th>
<th>Program</th>
<th>Length (weeks)</th>
<th>Control type</th>
<th>Therapist/ duration§ Reminder</th>
<th>Human input</th>
<th>Participants</th>
<th>Short-term follow-up</th>
<th>Long-term RCT follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social phobia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Andersson, 2006[32]</td>
<td>CBT</td>
<td>9</td>
<td>WLC</td>
<td>Yes$/\text{180}$ Unclear</td>
<td>64</td>
<td>Community; media and national anxiety website; mean age, 37.3 years</td>
<td>Yes</td>
<td>Yes (LSAS)</td>
</tr>
<tr>
<td>Carlbring, 2007[33]</td>
<td>CBT</td>
<td>9</td>
<td>WLC</td>
<td>Yes$/\text{150}$ Yes</td>
<td>60</td>
<td>Community; nr; mean age, 32.6 years</td>
<td>Quasi</td>
<td>Yes</td>
</tr>
<tr>
<td>Titov, 2008[34]</td>
<td>CBT</td>
<td>10</td>
<td>WLC</td>
<td>Yes$/\text{125}$ Yes</td>
<td>105</td>
<td>Community; nr; mean age, 38.1 years</td>
<td>Quasi X</td>
<td>Yes</td>
</tr>
<tr>
<td>Titov, 2008[35]</td>
<td>CBT</td>
<td>10</td>
<td>WLC</td>
<td>Yes$/\text{127}$ Yes</td>
<td>88</td>
<td>Community; nr; mean age, 36.7 years</td>
<td>Quasi X</td>
<td>Yes</td>
</tr>
<tr>
<td>Titov, 2008[36]</td>
<td>CBT with therapist</td>
<td>10</td>
<td>WLC</td>
<td>No</td>
<td>73</td>
<td>Community; nr; mean age, 37.9 years</td>
<td>Quasi X</td>
<td>No</td>
</tr>
<tr>
<td>Comparison to psychoeducational control</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Lange, 2001[40]</td>
<td>CBT</td>
<td>5</td>
<td>WLC</td>
<td>Yes/nr na</td>
<td>184</td>
<td>Community; media; mean age, 39.0 years</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Hirai, 2005[37]</td>
<td>CBT</td>
<td>8</td>
<td>WLC</td>
<td>No</td>
<td>36</td>
<td>Community; media; mean age, 29.4 years</td>
<td>No</td>
<td>No$^{\text{IRR}}$</td>
</tr>
<tr>
<td>Knaevelsrud, 2007[38]</td>
<td>CBT</td>
<td>5</td>
<td>WLC</td>
<td>Yes/nr na</td>
<td>96</td>
<td>Community; media and website for selected groups; mean age, 35.0 years</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Comparison to wait-list control, treatment as usual, or attention placebo control</td>
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<tr>
<td>Post-traumatic stress disorder</td>
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<td></td>
</tr>
<tr>
<td>Lange, 2003[37]</td>
<td>CBT</td>
<td>5</td>
<td>WLC</td>
<td>Yes/nr na</td>
<td>184</td>
<td>Community; media; mean age, 39.0 years</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
## Summary of randomised controlled trials (RCTs) of internet intervention programs targeted at (i) depression, (ii) anxiety and (iii) both depression and anxiety (continued)

### (iii) Depression and anxiety interventions

<table>
<thead>
<tr>
<th>Study (first author), year</th>
<th>Program</th>
<th>Type</th>
<th>Control</th>
<th>Therapist/duration *</th>
<th>Reminder</th>
<th>Participants</th>
<th>Short-term follow up</th>
<th>Long-term RCT follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>van Straten, 2008&lt;sup&gt;41&lt;/sup&gt;</td>
<td>PS 5</td>
<td>WLC</td>
<td>Yes/nr</td>
<td>Yes 213</td>
<td>Community; print media; adults</td>
<td>Yes</td>
<td>Yes</td>
<td>Depression: SS CSD Dx Anxiety: SS CSA</td>
</tr>
<tr>
<td>Billings, 2008&lt;sup&gt;42&lt;/sup&gt;</td>
<td>CBT 13</td>
<td>WLC</td>
<td>No No 98</td>
<td>Workplace; employees on company health promotion list and attendees at health fair; aged 20-69 years</td>
<td>No na</td>
<td>Depression: SS CSD Dx Anxiety: SS CSA</td>
<td>0.10&lt;sup&gt;C&lt;/sup&gt;, CES-D 0.07&lt;sup&gt;C,BAI&lt;/sup&gt; 0.10&lt;sup&gt;C&lt;/sup&gt;</td>
<td>0.06&lt;sup&gt;C&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

* Mean therapist time (minutes) per participant. † Total number of participants randomly assigned to a condition. ‡ Difference between treatment and control within effect sizes (see text). § Calculated from means and SDs or other relevant data in report. ¶ For overall regression analysis.