Computer-based psychological treatments for depression: A systematic review and meta-analysis

Derek Richards, Thomas Richardson

PII: S0272-7358(12)00027-X
DOI: doi: 10.1016/j.cpr.2012.02.004
Reference: CPR 1225

To appear in: *Clinical Psychology Review*

Received date: 19 July 2011
Revised date: 3 February 2012
Accepted date: 16 February 2012

Please cite this article as: Richards, D. & Richardson, T., Computer-based psychological treatments for depression: A systematic review and meta-analysis, *Clinical Psychology Review* (2012), doi: 10.1016/j.cpr.2012.02.004

Computer-based Psychological Treatments for Depression:

A Systematic Review and Meta-Analysis

Derek Richards[a1], Thomas Richardson[b]

[a]University of Dublin, Trinity College, Dublin, Ireland

[b]Professional Training Unit, School of Psychology, University of Southampton, Southampton, U.K.

[1] Permanent address: Derek Richards is currently on career break, written correspondence can be sent to Bishopshall, Ballynamorahan, Kilmacow, Co.Kilkenny, Ireland. Email. derek.richards@tcd.ie. Tel. 00 353 (0) 87 9343678

Abstract

The aim of the paper was to systematically review the literature on computer-based psychological treatments for depression and conduct a meta-analysis of the RCT studies, including examining variables which may effect outcomes. Database and hand searches were made using specific search terms and inclusion criteria. The review included a total of 40 studies (45 published papers), and 19 RCTs (23 published papers) were included in a standard meta-analysis. The review describes the different computer-based treatments for depression, their design, communication types employed: synchronous, asynchronous, and face-to-face (F:F); alongside various types and frequency of support delivered. The evidence supports their effectiveness and highlights participant satisfaction. However, pertinent limitations are noted. Across 19 studies the meta-analysis revealed a moderate post-treatment pooled effect size $d = 0.56$ (95% confidence interval [CI] -0.71, -0.41), $Z = 7.48$, $p<.001$). Supported interventions yielded better outcomes, along with greater retention. The results reported statistically significant clinical improvement and recovery post-treatment. The review and meta-analysis support the efficacy and effectiveness of computer-based psychological treatments for depression, in diverse settings and with different populations. Further research is needed, in particular to investigate the influence of therapist factors in supported treatments, the reasons for dropout, and the maintenance of gains post-treatment.

Keywords: psychological treatment; CBT; depression; meta-analysis, systematic review; computer-based; internet-delivered

Computer-based Psychological Treatments for Depression:

A Systematic Review and Meta-Analysis

Depression is a serious and growing problem worldwide, displaying high rates of lifetime incidence, early age onset, high chronicity, and role impairment (Richards, 2011). The World Health Organization has estimated that during any 12-month period, about 34 million depressed individuals worldwide go untreated (Kohn, Saxena, Levav, & Saraceno, 2004). Barriers to accessing treatment include a shortage of trained professionals, waiting lists, costs and personal barriers such as stigma (Cuijpers, 1997). In recent years attempts to overcome barriers to access have been addressed through tailored, computer-based, treatment programs. These have become increasingly common administration formats for depression treatment, both in research and slowly in clinical settings (Andersson & Cuijpers, 2009).

Many formats of computer-based interventions have been investigated (Newman, Szkodny, Llera, & Przeworski, 2011). Supported treatments generally yield enhanced results compared to no support (Andersson & Cuijpers, 2009), still, further research is required to determine the best type, frequency, and duration of human support for users (Marks, Cavanagh, & Gega, 2007). Secondly, dropout is a continued cause of concern, with only just over half completing all sessions (Waller & Gilbody, 2009). Whether support predicts dropout is of importance, but has yet to be determined.

The current systematic review and meta-analysis sought to evaluate the overall effectiveness of computer-based treatments for depression, as well as examining the impact of support on dropout rates and clinical outcomes. A number of other reviews and meta-analysis exist to date (Andersson & Cuijpers, 2009; Barak, Hen, Boniel-Nissim, & Shapira, 2008; Griffiths & Christensen, 2006; Spek, Cuijpers et al., 2007). This paper aimed to provide a systematic update to this previous work and to use meta-

analysis to examine the impact of support types on outcomes and other variables; including a consideration of clinical effectiveness at follow-up, which has not previously been conducted.

Method

Literature search and selection of studies

The aim of the literature search was to find all references related to computer-based psychological treatments for depression. A search of three databases (EMBASE, PubMed, and PsychINFO including PsychARTICLES) was conducted for studies published in peer-reviewed journals in the last 10 years (March 2001-March 2011). While work has been carried out previous to March 2001 (e.g. Selmi, Klein, Greist, Sorrell, & Erdman, 1990), the authors decided that the years represented a meaningful timeframe in terms of contemporary technologies, advances in multimedia, and broadband developments. Seven search terms were employed (Online self-help treatment for depression, Web-based intervention for depression, Online depression treatments, Computerized (+Computerised) cognitive behaviour therapy for depression, Internet (+ delivered) treatment for depression), culminating in a total of 21 searches.

All results were assessed at either title, abstract, or by reading the full paper to determine whether the study met the established inclusion criteria. Included studies could be deployed using a variety of different computer-based technologies, synchronously and asynchronously, they could be solely self-administered or therapist-led; or a blended delivery using both. Study participants had to be adults (18+ years) with depression (self-report or diagnosis), established using valid and reliable measures, whom may also have had comorbidity, e.g. anxiety or physical health problems. Studies included were published in peer-reviewed journals in English in the last 10 years, which investigated a computer-based treatment for depression, and included reliable and valid

outcome measures for assessing depression. Participants could be from the general population or a clinical group so long as depression was specifically measured. Preliminary research into recent developments in computerized paradigms for depression such as cognitive bias modification (CBM) based interventions were not considered for inclusion (e.g. Blackwell & Holmes, 2010).

Duplicates were rejected and studies were assessed by the first author, any difficulties discussed with the second author, and a final decision reached. Finally, a hand search was made of papers to identify other relevant studies for inclusion. For the systematic review a comprehensive summary of information extracted from the papers was written, that considered the interventions employed, methodological design, communication and support types used in the studies, clinical outcomes, dropout, participant satisfaction and limitations.

Additional criteria for those papers included in the meta-analysis was that they had to be RCTs, which included a control group, and reported details on their outcomes. Reasons for exclusion at title, abstract, and at paper were recorded for the literature search.

Meta-analysis procedure

A meta-analysis was conducted on selected RCT studies (n = 19; 23 papers), which included all necessary information on outcomes for the interventions and control groups. To ensure a conservative estimate of pooled effect size, intent to treat analyses (ITT) was used instead of completer analyses, where possible. Control conditions which used active placebo groups, such as treatment as usual (TAU), were also included. Effect sizes of self-report measures of depression were estimated via the standardized mean difference (Cohen´s d), weighted by sample size, via a random effects model with 95% confidence intervals. Effect sizes of 0.8 can be considered large, 0.5 moderate,

and 0.2 small (Cohen, 1988). If more than one measure of depression was used both were included in the analysis. Similarly, if there were more than one computerized or online condition in the trial, both were included. The proportion of participants achieving a clinically significant reduction in depression and the proportion who recovered from depression were subjected to an Odds Ratio meta-analysis, using a Mantel-Haenszel random effects model, weighted by sample size, with a 95% confidence interval. Results were calculated using the software package Review Manager 5 (Cochrane, 2008).

Results of the Review

Three databases, PubMed (n = 872), EMBASE (n = 1184), and PsychINFO including PsychARTICLES (n = 263), were searched. Identified papers (n = 2,319) were screened against the established inclusion criteria, yielding 44 papers. A further one paper was identified through hand search (Wright et al., 2005). Figure 1 shows the results of the systematic review. In total, 45 papers met the inclusion criteria and are reviewed below. These include 24 RCT studies (n = 28 papers) and 17 open trials (n = 17 papers).

Programs and their Content

Table 1 outlines selected characteristics of the studies included. A total of 18 different interventions for treating depression have been identified in the review. By far the most researched of these is Beating the Blues (BTB; Proudfoot et al., 2004), with 3 RCTs and 10 open trials. Initially developed in computer disc-read only memory (CD-ROM) format, in recent years it has been transferred to the web. Briefly, it comprised eight sessions of cognitive behavioral therapy (CBT). It included a series of filmed case studies of individuals modelling the symptoms of depression and also the application of

the CBT strategies. It included online exercises and homework tasks alongside a printable post-session summary sheet (Cavanagh et al., 2006).

The structure of BTB is similar to the next most researched programs, MoodGYM (2 RCTs and 2 Open Trials; Christensen, Griffiths, & Korten, 2002) and the Sadness Program (2 RCTs and 1 Open Trial; Perini, Titov, & Andrews, 2008). MoodGYM included modules on cognitive behavioral training, a personal workbook and graphic site characters who modelled patterns of dysfunctional thinking. The content was delivered through text, animated diagrams and interactive exercises, and included downloadable relaxtion audios, and integrated workbook exercises. The six lessons of the Sadness Program were presented in the form of an illustrated story of a woman with depression who with CBT learned new ways of managing her symptoms.

Overcoming Depression on the Internet (ODIN; Clarke et al., 2002) was employed in 3 RCTs and consisted of modules on cognitive restructuring skills. The latest RCT saw the program overhauled and used with a young adult population (18-24 years), additionally it included behavioral activation and a range of interactive and automated feedback (Clarke et al., 2009).

The Colour your Life program (3 RCTs) was initially developed for use with over 50-years population (Spek, Nyklicek et al., 2007) and later adapted for use with an adult population (18-65; de Graaf et al., 2009; Warmerdam, van Straten, Twisk, Riper, & Cuijpers, 2008). It consisted of sessions on psycho-education, cognitive restructuring, behavior change, and relapse prevention. It included text modules, exercises, videos and illustrations.

Deprexis (Meyer et al., 2009) was a 10 module program that tailored content to the users responses to given options. It was organized about simulated dialogues and included drawings, photographs, and multimedia animations. The modules included

content other than CBT, such as childhood experiences and early schema, dreamwork, and positive psychology.

Other interventions too deviated from the standard CBT content, for example, problem-solving therapy (PST; van Straten, Cuijpers, & Smits, 2008), a structured writing intervention (SWI; Kraaij et al., 2010), a combination of face-to-face (F:F) and cognitive therapy (Wright et al., 2005), or mindfulness activities with standard CBT elements delivered in group format online (Thompson et al., 2010).

Two open trials have researched other CD-ROM based interventions, the first, Blues Begone (Purves, Bennett, & Wellman, 2009) compiled a personalized roadmap to recovery for each user. It included information presented in text, audio, through character dialogues, and activities. It also included religious specific text for users who requested it. The second, Overcoming Depression (Whitfield, Hinshelwood, Pashely, Campsie, & Williams, 2006) offered CBT concepts in six sessions, using text, cartoon illustrations, animations, interactivity, audio and video.

Recovery Road (Robertson, Smith, Castle, & Tannenbaum, 2006) was an integrated e-health system that provided 12 sessions of CBT treatment, progress monitoring reports, psychoeducation, an e-consultation system, and a diary. The system also had a clinican side for the management of client cases.

Lastly, a number of RCTs have employed idiosyncratic CBT-based programs, for example, Ruwaard et al. (2009) CBT treatment included inducing awareness, structuring activities, cognitive restructuring, positive self-verbalisation, social skills, and relapse prevention. Andersson et al. (2005) included modules on behavioral activation, cognitive restructuring, sleep and physical health, and relapse prevention, a version of the program was also employed by Vernmark et al. (2010). Other interventions included similar CBT content, but were aimed at a specific population, for

example, those with partially remitted depression (Holländare et al., 2011). Another described an intervention for comorbid depression with diabetes (van Bastelaar, Pouwer, Cuijpers, Riper, & Snoek, 2011). It included 8 lessons of CBT with text, audio, and videos of depressed diabetes patients modelling how they learned to manage their depression.

The computer-based treatments reviewed were varied in terms of the technologies employed and how content was delivered. The majority of the programs are homogenous in that they used similar CBT content and deployed that content using web-based platforms, high-end multimedia, and interactivity. However, some deployed content different to a CBT framework (Kraaij et al., 2010; Meyer et al., 2009; van Straten et al., 2008; Warmerdam et al., 2008). Some too deployed content solely in text format (Andersson et al., 2005; Wright et al., 2005), or through the use of CD-ROM technology (Purves et al., 2009; Whitfield et al., 2006), or used online synchronous chat-based technology to deliver the intervention (Kessler et al., 2009; Thompson et al., 2010).

Methodological Characteristics

Objectives of the studies.

Some RCT studies reported their objective was to establish the efficacy of a computer-based, clinician-assisted, intervention for depression (Andersson et al., 2005; Perini, Titov, & Andrews, 2009; Ruwaard et al., 2009), others examined the efficacy of unsupported computer-based interventions (Clarke et al., 2002; de Graaf et al., 2009; Meyer et al., 2009; Spek, Cuijpers et al., 2007). Others still in examining efficacy included support which was other than therapeutic (Christensen, Griffiths, & Jorm, 2004; Proudfoot et al., 2004; van Straten et al., 2008). Some studies compared the efficacy of more than one active treatment intervention (Christensen et al., 2004; Spek,

Nyklicek et al., 2007; Warmerdam et al., 2008), or delivered the same intervention in different modes: clinician versus technician assisted (Titov et al., 2010), individualised e-mail versus no support (Vernmark et al., 2010). Finally, a number of studies examined the effectiveness of an intervention with a particular population. Cavanagh et al. (2006) write how RCTs alone offer a limited guide to the contribution of an intervention in routine practice. Many open trials complement the RCTs in establishing the generalizibility of the effectiveness in routine care (Table 1).

Some of the studies included an examination of the lasting effects of the intervention, and included varying lenghts of follow-up assessments from 1 to 4 months (Thompson et al., 2010; Titov et al., 2010; Warmerdam et al., 2008; Whitfield et al., 2006), 6 to 8 months (Andersson et al., 2005; Clarke et al., 2002, 2005; Grime, 2004; Holländare et al., 2011; Kessler et al., 2009; Meyer et al., 2009; Proudfoot et al., 2004; Vernmark et al., 2010; Wright et al., 2005), or 1 year and beyond (de Graaf et al., 2011; Mackinnon, Griffiths, & Christensen, 2008; Ruwaard et al., 2009; Spek et al., 2008; Topolovec-Vranic et al., 2010).

Recruitment, Sample Types and Sizes.

Community samples were recruited through a variety of means such as, advertisements and information on the web, and by email. In a number of studies the postal system was used to send prospective participants a letter of invite (Clarke et al., 2009; Clarke et al., 2002, 2005; Christensen et al., 2004; de Graaf et al., 2009; Kraaij et al., 2010). The majority of open trials and some RCTs recruited participants from primary or secondary care services. Several studies prescribed for a particular sample frame, for example, participants over 50 (Spek, Cuijpers et al., 2007), individuals with HIV (Kraaij et al., 2010), or who had diabetes (van Bastelaar et al., 2011), or who had

epilepsy (Thompson et al., 2010), individuals with a brain injury (Topolovec-Vranic et al., 2010), or who had partially remitted depressive symptoms (Holländare et al., 2011).

Sample sizes varied considerably, in one trial there were just 48 in the active condition (Perini et al., 2009). Ruwaard et al. (2009), similarly, had just 36 in the active condition. Studies that advertised and recruited from community populations achieved greater success in the numbers included. Spek, Nyklicek et al. (2007) included 301 participants. Likewise van Straten et al. (2008) recruited 213 participants. Meyer et al. (2009) employed an 80:20 randomization procedure and consequently was able to begin with 320 participants in the active cCBT intervention and 76 in their TAU control. Clarke et al. (2002, 2005, 2009) had access to the records of private health care patients and achieved significant numbers in their trials. Similar to the RCTs reviewed, sample sizes varied in the open trials, some were large with up to 300 or more participants, while others had less than 40 participants (Table 1). The largest sample sizes were those of the Australian studies of MoodGYM. They invited spontaneous users of the website to participate, this gave them access to a worldwide spread of potential participants (Christensen et al., 2002; Christensen, Griffiths, Mackinnon, & Brittliffe, 2006).

Eligibility Criteria Employed.

Participants in the various studies were screened and a wide range of eligibility and exclusion criteria applied. For some studies the eligibility can be considered low, where a screening instrument was employed but with no established cut-off scores, or there was a referral because of low mood or depression, but no official diagnosis. For instance, the criteria for inclusion in one study was the completion of one instance of the Goldberg Depression Scale (GDS; Goldberg, Bridges, Duncan-Jones, & Grayson, 1988), another if participants had elevated scores on the baseline GDS (Goldberg et al., 1988) screening measure employed (Christensen et al., 2002; Christensen et al., 2006).

van Straten et al. (2008) screened participants at baseline, but argued that because they recruited from the general population no inclusion or exclusion criteria were used. Whitfield et al. (2006) included participants referred with depression or low mood as a problem. A number of studies used screening instruments but did not report established cut-off scores for inclusion (Fox, Acton, Wilding, & Corcoran, 2004; Hunt, Howells, & Stapelton, 2006; Van den Berg, Shapiro, Bickerstaffe, & Cavanagh, 2004).

Some studies went further and incorporated what could be considered moderate eligibility and exclusion criteria, where a valid assessment instrument was employed for screening with established cut-off scores, alongside other criteria. In Clarke et al. (2002, 2005, 2009) the eligibility criteria was diagnosed depressed patients and thereafter completion of the baseline depression screening measure. Other studies, in addition, included other criteria such as not currently receiving clinical treatment (Christensen et al., 2004; Learmonth & Rai, 2008), not psychotic (Grime, 2004), no suicidal ideation or plans (Learmonth & Rai, 2008; Mitchell & Dunn, 2007; Pittaway et al., 2009), no alcohol or drug dependence, obsessive-compulsive disorder, or other diagnosed mental health condition (Learmonth & Rai, 2008).

Most of the studies did establish what can be considered robust eligibility criteria as would be found in face-to-face depression research. Namely, a valid screening instrument or an official diagnosis, alongside other well defined exclusion criteria (Holländare et al., 2011; Proudfoot et al., 2004; Thompson et al., 2010; van Bastelaar et al., 2011; Vernmark et al., 2010). For example, in the study by Titov et al. (2010), participants initially completed questionnaires online to determine eligibility. On meeting the inclusion criteria, participants completed, by telephone, the depression section of the Mini International Neuropsychiatric Interview Version 5.0.0 (Lecrubier, Sheehan, Hergueta, & Weiller, 1998) to determine whether they met the Diagnostic and

Statistical Manual for Mental Health Disorders – Fourth Edition (DSM-IV) (American Psychiatric Association [APA], 1994) criteria for depression. Other studies included similar robust criteria (Andersson et al., 2005; de Graaf et al., 2009; Kessler et al., 2009; Ruwaard et al., 2009; Spek, Nyklicek et al., 2007; Wright et al., 2005). Alongside the RCTs a number of open trials also detailed robust eligibility criteria (Cavanagh, Seccombe, & Lidbetter, 2011; Cavanagh et al., 2006; Learmonth & Sadik, 2007; Learmonth, Trosh, Rai, Sewell, & Cavanagh, 2008; Purves et al., 2009; Robertson et al., 2006; Topolovec-Vranic et al., 2010).

Outcome Measures Used.

A variety of valid and reliable instruments were employed in the different studies to measure depressive symptoms (Table 1). They closely align with the symptom content outlined in the DSM-IV (APA, 1994) and/or the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) (World Health Organisation [WHO], 2007).

Three studies in the review used the Clinical Outcomes in Routine Evaluation – Outcome Measure (Evans et al., 2000). It comprises items on symptoms of depression and anxiety, items on functioning including general functioning, social relationships and close relationships, items on trauma, on physical symptoms, and on risk assessment.

Support Type and Communication Mode in the Studies

Support in the studies was offered by therapists, trainee therapists, other health professionals, and non-clinical staff such as receptionists or administrators. The authors have categorised support types as either no support (NS), therapist support (TS) or administrative support (AS), see Table 1[2]. Studies that provided no support (n = 12) were completely self-administered by the participants. Therapist-supported studies (n =

[2] Titov et al. (2010) included both TS and AS. Vernmark et al. (2010) included both TS and NS.

10) included a clinician who offered post-session feedback and support or a clinician-delivered intervention.

Administrative-supported studies (n = 20) supported users of the program, but did not claim to be clinical, but rather sought to guide users, and in some cases they also provided some feedback. This category is broad and includes support delivered through synchronous and asynchronous commmunication, by phone and also F:F. For the most part it is clear that these studies provided support only in logistical or administrative ways and used receptionists, nurses, lay people, research coordinators, administrative staff, or technicians.

Twenty-nine (n = 29) studies deployed support of some type, 11 did not include support for participants in the intervention. Two studies employed synchronous online communication in the delivery of treatment to clients (Kessler et al., 2009; Thompson et al., 2010). Asynchronous online communication was far more common in the studies (n = 11) and many of these used it to offer weekly support or feedback to participants. Telephone contact with participants to direct their use of the intervention was employed by two studies (Christensen et al., 2004; Topolovec-Vranic et al., 2010). Lastly F:F communication was used in 14 studies. Two studies encorporated a mix of support types and communication modes (Titov et al., 2010; Vernmark et al., 2010).

Outcomes, Support Types and Dropout

The results from the collection of studies is positive, yet outcomes varied depending on the type of support provided. The analysis of within groups effect sizes and type of support excluded a number of studies (n = 9) as they used only CORE-OM (Cavanagh et al., 2009; Pittaway et al., 2009), or there was insuficient data to calculate effect size (Christensen et al., 2002; Fox et al., 2004; Mitchell, 2009; Mitchell & Dunn,

2007; Thompson et al., 2010; Topolovec-Vranic et al., 2010; van Bastelaar et al., 2011; Van den Berg et al., 2004).

The analysis included 31 studies reporting a total of 58 post-treatment and 34 follow-up within groups effects based on valid depression outcome measures. The analysis showed that in therapist-supported studies the mean post-treatment effect size was $d = 1.35$ ($n = 18$ effects) and at follow-up $d = 1.29$ ($n = 13$ effects). For administrative-supported studies the mean post-treatment effect size was $d = 0.95$ ($n = 23$ effects) and at follow-up $d = 1.20$ ($n = 10$ effects). For studies that provided no support the mean post-treatment effect was $d = 0.78$ ($n = 17$ effects), and at follow-up $d = 1.13$ ($n = 11$ effects).

The review analysed dropout from the treatment interventions in the studies that provided such data ($n = 36$). A number ($n = 4$) of studies were excluded as they did not provide the information (Clarke et al., 2009; Clarke et al., 2002; Christensen et al., 2002; Thompson et al., 2010). Overall, across 40 studies, 4153/7313 participants dropped out (57%). The data detailing dropout was compared between the different support classifications, namely, no support (NS), administrative-support (AS), and therapist-support (TS). Levels of dropout were 2911/3943 (74%) for NS, 1098/2851 for AS (38.4%), and 144/519 (28%) for TS. The odds ratios (OR) of dropping out between the different types of support comparatively was as follows:

- No support vs Administrative support: OR = 2.45, z = 15.65, p<.001
- No support vs Therapist support: OR = 7.35, z = 19.08, p<.001
- Administrative support vs Therapist support: OR = 3.0, z = 10.21, p<.001

Studies with NS had considerably higher levels of dropout compared to studies with AS and TS. There was little difference between AS and TS, though levels of dropout were slightly higher in AS. The presence of human support, administrative or

therapeutic, can have the impact of reducing dropout rates by up to 30-40%. In consideration of any confounding by trial type the review further analysed dropout between open trials and RCTs. The results showed that dropout was similar: In the open trials 730/1926 (37.9%) dropped out compared to 3487/5467 (63.8%) in the RCTs, producing an OR = 2.89, z = 19.35, p<.001.

Satisfaction

Satisfaction reports provide knowledge about how clients have experienced computer-based interventions (Proudfoot et al., 2004; Wright et al., 2005). For instance, Meyer et al. (2009) reported that 80% of users were generally satisfied with the online program (Deprexis). Similarly, 82% felt the program benefitted them, and that the program met or exceeded their expectations (78%). The majority (74%) felt the program equalled or was better than a 'real' therapist and 95% would recommend the program to others. No one reported any adverse affects from using the program (Meyer et al., 2009).

Learmonth and Rai (2008) reported that participants using the Beating the Blues program found it useful, relevant, and easy to use. Similarly, Cavanagh et al. (2011) reported that the majority (93%) were satisfied with the treatment they received. Perini et al. (2009), reported acceptable levels of satisfaction on behalf of participants with their experiecne of the Sadness Program and that it was considered helpful. Additionally, the majority (71%) reported that the quality of the communication with the therapist support as excellent or good. Whitfield et al. (2006), reported high overall satisfaction ratings from participants using the Overcoming Depression program. The majority found it useful, easy to use, perferred it over a workbook, and reported that it improved their mood.

Topolovec-Vranic et al. (2010) reported that some patients found the MoodGYM program demanding and perhaps more geared for a younger age group. Although the population may have found it more difficult giving they carried traumatic brain injury.

Limitations

Often it is the case that the studies were analysing data from heterogeneous samples and this limits generalization. Eligibility criteria, for instance, can often cause heterogeneity. For example, highly educated groups (Spek, Nyklicek et al., 2007), or only for those with mild to moderate depressive symptoms (Ruwaard et al., 2009), or those who were more computer literate. Such limitations are duly noted and open trials in naturalistic settings certainly complement RCTs.

Some studies included in this review had small sample sizes, consequently it is difficult to make any statement about the significance of the results beyond the sample included. The Australian studies note a particular limitation in that their sampling frame, because it was self-defined, therefore lacked clarity about the specific characteristics of the sample (Christensen et al., 2002; Christensen et al., 2006).

Another concern regards the perennial problem of missing data. Researchers were often left using ITT analysis, using, for example, Last Observation Carried Forward (LOCF) or other procedure to account for missing data, however, this may have underestimated the true extent of change for the sample. Follow-up data is often collected, analysed, and reported, but uncontrolled for. Therefore participants may have accessed other treatments during follow-up and consequently impacted the results.

Another limitation is that many studies relied on self-report data to the exclusion of an official diagnosis. It is the case that independent ratings by clinicians would

certainly strengthen the self-report and minimise any potential errors in appropriately excluding or including participants (Andersson & Cuijpers, 2009).

The issue of online data collection and whether it adversely affected the validity as compared with the traditional paper-and-pencil administrations is a potential limitation (de Graaf et al., 2009). However, research to date comparing different administrations of standard instruments have yielded similar results (Carlbring et al., 2007).

Results from the Meta-Analysis

Using the search terms outlined in the method section, and the established eligibility criteria, 19 RCT studies (representing 23 papers) were included into the meta-analysis (Figure 1).

Characteristics of the Studies Included

Although the systematic search identified 24 randomized studies (representing 28 papers) the meta-analysis included 19 of these (representing 23 studies). A number were excluded as they did not have a control group (Christensen et al., 2006; Learmonth & Sadik, 2007) or they did not report sufficiently their outcomes (Thompson et al., 2010; van Bastelaar et al., 2011), or in one case treatment included F:F alongside computer-based treatment (Wright et al., 2005). The studies (n = 19; 23 papers) included 1553 participants in active treatment interventions and 1443 in control comparisons. Select characteristics of the studies can be found in Table 1. All used valid and reliable depression screening and outcome instruments and twelve studies included participants with a formal diagnosis of depression. Community samples were represented in twelve studies, and primary and secondary care samples were represented in seven studies. Waiting list control was used in ten studies, TAU used in eight studies,

and another type of control used in one. Six of the studies included more than one computer-based intervention, or different modes of delivery against a control group. CBT interventions were employed in seventeen studies, Problem Solving Therapy (PST) by two studies, and one employed a Structured Writing Intervention. Two studies examined a stand-alone computer delivered intervention, the remainder used the internet to deliver the intervention. A variety of support types were employed alongside communication modes.

The Cochrane´s method for assessing the risk of bias (Higgins & Green, 2009) was used and data entered and analysed by Review Manager. This showed that the randomized controlled trials included in the meta-analysis were of high quality (See Figure 2), though the risk of missing data was relatively high. Studies were conducted in the U.S., Sweden, Australia, The Netherlands, U.K., and Germany. Overall improvement in depression throughout the studies was estimated via the standardized mean difference (Cohen´s *d*), using a random effects model. Subgroups analyses were performed on select study characteristics to compare effect sizes and whether they influenced outcome.

Improvements in Depression Compared with Control Groups: Overall Effects

As previously stated, for studies which had more than one measure, or more than one computer-based intervention group, both sets of data were included. There was statistically significant heterogeneity for the included studies across this variable (χ = 167.37, p<.001, I^2 = 81%). Across 19[3] studies (33 post-treatment effects) and a total of *n*

[3] Andersson et al., 2005; Christensen et al., 2004 & Mackinnon et al., 2008; Clarke et al., 2005; Clarke et al., 2002; Clarke et al., 2009; de Graff et al., 2009, 2011; Grime, 2004; Holländare et al., 2011; Kessler et al., 2009; Kraaij et al., 2010; Meyer et al., 2009; Perini et al., 2009; Proudfoot et al., 2003, 2004; Ruwaard et al., 2009; Spek, Nyklicek et al., 2007, 2008; Titov et al., 2010; Van Straten et al., 2008; Vernmark et al., 2010; Warmerdam et al., 2008.

= 1443 in the control groups and n = 1553 in the computer-based intervention groups, there was a pooled effect size of d = 0.56 (-0.71, -0.41) for self-reported depression post-treatment, which was statistically significant: Z = 7.48, p<.001. Across the 14[4] studies (22 follow-up effects) which reported scores on these measures at follow-up compared to a control, the average effect size was d = 0.20 (-0.31, -0.09), which was statistically significant: Z = 3.50, p<.01. All results were in favour of the computer-based treatments for depression. Post-treatment effect sizes and 95% CIs of the individual contrast groups are plotted in Figure 3.

Inspection of the forest plot demonstrated wide variation in the effect sizes. The funnel plot also suggested variation and possible publication bias.

The proportion of participants in the computer-based interventions and the control conditions who achieved clinically significant improvements in levels of depression was included in an odds ratio meta-analysis. This was reported for seven studies[5] and produced a pooled odds ratio of 3.68 (2.12, 6.40), which was statistically significant: Z = 4.61, p<.001. The proportion of participants who recovered from depression (reported in eight studies[6]), produced a pooled odds ratio of 4.14 (2.01, 8.53) which was statistically significant: Z = 3.86, p<.001. The proportion who had recovered at follow up was only reported by one study so could not be subjected to analysis.

[4] Andersson et al., 2005; Christensen et al., 2004 & Mackinnon et al., 2008; Clarke et al., 2005; Clarke et al., 2002; Clarke et al., 2009; de Graff et al., 2009, 2011; Grime, 2004; Holländare et al., 2011; Kessler et al., 2009; Meyer et al., 2009; Proudfoot et al., 2003, 2004; Spek, Nyklicek et al., 2007, 2008; Vernmark et al., 2010; Warmerdam et al., 2008.
[5] de Graff et al., 2009, 2011; Meyer et al., 2009; Spek, Nyklicek et al., 2007, 2008; Titov et al., 2010; Van Straten et al., 2008; Vernmark et al., 2010; Warmerdam et al., 2008.
[6] Clarke et al., 2002; Clarke et al., 2005; Kessler et al., 2009; Meyer et al., 2009; Perini et al., 2009; Ruwaard et al., 2009; Titov et al., 2010; Van Straten et al., 2008.

Subgroup Analysis

Subgroups analyses were performed on study characteristics to compare effect sizes and whether they influenced outcomes. There was insufficient data to examine such effects for follow-up or odds ratios, so the effects on self-report measures of depression post-treatment were examined. Table 2 displays the results of these analyses.

All subgroups still had significantly reduced self-reported depression post-treatment, but pooled effect sizes differed. Studies which used therapist support and administrative support had a similar pooled effect size (d = 0.78 and d = 0.58), but the effect size for no support was lower (d = 0.36). Chi-square analysis of differences between subgroups for support was not significant for no support vs administrative support, χ = 1.19, p>.05, nor for administrative support vs therapist support, χ = 1.37, p>.05, but was significant for no support vs therapist support, χ = 7.86, p<.05. Surprisingly, the pooled effect size for studies which used less than eight sessions was considerably higher than studies which used eight or more sessions (d = 0.75 vs. d = 0.29) and this was shown to be significant, χ = 7.48, p<.01.

Pooled effect sizes were similar between studies conducted in community settings and primary or secondary care settings (d = 0.52 vs. d = 0.46), with no significant difference, χ = 0.08, p>.05. The pooled effect size reached was almost twice as large for the general clinical treatment studies compared to studies performed on specific populations (d = 0.60 vs. d = 0.33) and was significant, χ = 5.09, p<.05. Studies that provided support asynchronously yielded greater effects than did studies that provided support synchronously (d = 0.70 vs. d = 0.28), but not significantly so, χ = 1.64, p>.05. Lastly, subgroup analysis revealed that studies which used a waiting list control yielded greater effects than those which used a treatment as usual control group

(d = 0.68 vs. d = 0.39) however, comparisons demonstrated no significant difference, χ = 3.13, p>.05.

Discussion

The aim of the paper was to systematically review the literature on computer-based psychological treatments for depression and conduct a meta-analysis on the available RCTs. Across 40 studies (45 published papers), eighteen different interventions were identified and described. While the majority were CBT-based programs, alternative content was described for some interventions. The majority were delivered online and four delivered through standalone CD-ROM, although one of these, Beating the Blues, has in recent years been transferred online. One intervention was delivered in group format, the others individual format. A range of support types were included in the studies and their delivery was asynchronous, synchronous and also F:F. Participants were recruited from primary and secondary care and also from the community. Some studies recruited from specific populations.

Given the effect sizes reported in the review for different interventions there is little doubt as to the usefulness of support of some type. The meta-analysis revealed an overall effect size of d = 0.56. The estimate is useful, but the data showed an effect size of d = 0.78 for therapist-supported studies and d = 0.58 for administrative-supported studies. These contrast an effect size of d = 0.36 for studies that included no support. Although analysis of subgroups showed that support was only significantly different between studies with no support vs therapist support. However, while effects are superior in supported interventions, they are still present in studies of unsupported interventions. Given the worldwide growth of depression and the unmet need for

treatment, unsupported programs have the potential to increase access, at minimal cost, especially where human resources are limited.

The findings are similar to those of other recent meta-analysis regarding the differences in supported and non-supported studies (Andersson & Cuijpers, 2009; Spek, Cuijpers et al., 2007). Andersson and Cuijpers (2009) reported an overall effect size of d = 0.41, but when considered by support type, supported studies yielded an effect size of d = 0.61 compared to d = 0.25 for unsupported studies. The current meta-analysis extends the evidence, especially in terms of the number and variety of studies included (n = 19) compared to Andersson et al. (2009) (n = 12) and Spek, Cuijpers et al. (2007) (n = 13). Further, the results showed a statistically significant effect size (d = 0.20) at follow-up in favour of computer-based interventions compared to a control.

The meta-analysis complements what the review reported regarding the attainment of greater post-treatment and follow-up effects with supported treatments compared to no support. Open studies have confirmed this difference too (Cavanagh et al., 2011; Christensen et al., 2006; Hunt et al., 2006; Purves et al., 2009; Robertson et al., 2006). However, it is important to note the considerable difference in effect size between post-treatment and follow-up, which suggests that the benefits of computerized interventions maybe relatively short-term. The studies included varying lengths of follow-up; further research regarding the maintenance of benefits in computer-based treatments is welcome. Perhaps interventions with booster sessions may be of use to maintain improvements (Hollon et al., 2005).

The effects of support versus no support are not new (Andersson & Cuijpers, 2009; Spek, Cuijpers et al., 2007), however, the analysis showed clearly that support of some administrative type, not delivered by a mental health professional and not having the aim of being therapeutic, works equally well as therapist-supported studies. The

type and frequency of delivery of such support is broad, thus providing some information to answer Marks et al. (2007) question as to finding the optimal support type and frequency of delivery for computer-based interventions. However, it also highlights the need to explore and establish an empirical base regarding to the role of therapist factors in computer-based interventions.

In many of the open trials context dictates the type and frequency of support. Large demands on services necessitate a model of brief support, it is clear and it does what it porports to do. In other cases support was manualized in its delivery, and at times adherence measures were employed to map the adequate delivery of such support (e.g. Kessler et al., 2009). Perhaps users, when they know what to expect by way of support, can often accept it for what it is and progress. Evidence for such, for instance, comes from studies where dropout across different modes of delivering the same treatment are similar, irrespective of the type of support offered (e.g. Titov et al., 2010).

In terms of support provided in the studies other potential confounding variables are any contact at all, through snail mail, automated emails, reminder emails, phone calls, or in person interviews. Future studies would do well to make more detail available on any supports and their possible influence. Some studies, for instance, delivered support using health professionals (Ormrod, Kennedy, Scott, & Cavanagh, 2010), a health psychologist (van Bastelaar et al., 2011), or with master students in clinical psychology (van Straten et al., 2008; Warmerdam et al., 2008). While claiming the support was not clinical (van Straten et al., 2008; Warmerdam et al., 2008), one has to speculate about any uncontrolled for therapeutic benefits of having such support.

The paper included seven studies in an odds ratio analysis of clinically significant improvement at post-treatment, demonstrating a pooled odds ratio of 3.68, which was statitically significant. Similarly, a statistically significant odds ratio of 4.14

was established for an analysis of recovery post-treatment across eight studies in the meta-analysis. While definitions for clinical change and recovery were different across the studies, the results suggest that as well as reductions in self-reported symptoms, computer-based interventions can also produce clinically significant improvements and recovery in depression. This gives further support to the efficacy of these interventions.

Success in treatment can be understood as adherence to treatment, completing a sufficient dose of treatment, and producing successful outcomes. Dropout from treatment is a continued cause of concern, especially with interventions that offer no support (Eysenbach, 2005). Despite an overall attrition rate of 57% across the forty studies included in the review, a compelling picture is built as to the efficacy and effectiveness of computer-based treatments for depression. The current review confirms a high dropout rate (74%) for unsupported treatments. Dropout is similar in therapist supported (28%) and administrative supported (38%) studies and can be considered at the lower end of dropout when compared to dropout in F:F treatments for depression, where dropout is anywhere between 30-60% (Piper et al., 1999; Reis & Brown, 1999).

The meta-analysis odds ratio of dropping out between the different categories of support types comparatively confirms the significance of support. Supported studies can have the benefit of increasing retention up to 30-40% compared to studies that offer no support. While not negating the potential for unsupported treatments, it can be concluded that support is important in computer-based treatments for depression. This supports the wisdom that a blended approach is preferable, the more successful programs usually incorporate some therapist/ human support, whether that is online, or by phone, or in person (Christensen et al., 2006). It is the case, generally, that RCTs provide more structure, information and support to participants, yet despite what one

might expect to find dropout was not different between the RCT studies compared to the open trials.

A conservative approach was adopted to calculate dropout in the current review, recording dropout over time that was based on completers. This however does not provide a completely accurate reflection of the success of any intervention. It ignores the substantial porportion of participants who receive less (and often much less) than the entire dose and still demonstrate significant improvements (Mitchell & Dunn, 2007; Warmerdam et al., 2008). Warmerdam et al. (2008) highlighted that many participants showed rapid improvement within the first five weeks of treatment. Similarly, Meyer et al. (2009) observed how participants showed lasting effects even after receiving only a small number of sessions.

Dropout from computer-based psychological treatments for depression is something to be investigated further. Including a follow-up questionnaire for dropout pre-treatment and during treatment asking about the reasons may yield significant information. Some studies have collected such data (Andersson et al., 2005; Proudfoot et al., 2003), suggesting difficulties using the computer, negative features of the program, perceived as too demanding, and poor clinical progress, or other extraneous reasons independent of the intervention were cited. Warmerdam et al. (2008) reported on reasons for droput that included receiving alternative treatment, feeling better, lack of time, and problems understanding the computer program.

Both van Straten et al. (2008) and Warmerdam et al. (2008) have highlighted the potential for shorter treatment interventions. The meta-analysis results supports the effectiveness of treatments that were less than 8-sessions, the pooled effect size for studies that had less than eight sessions was considerably higher than studies with eight sessions. However, it is important to note that these studies and interventions may have

differed on other unmeasured key variables such as the type and content of the interventions and how the interventions were deployed: it is not certain that the differences in effect size are due to the number of sessions alone. The results highlight the potential for future research

The meta-analysis demonstrated no significant differences between the pooled effect sizes of studies conducted in the community or in primary and secondary settings. Underscoring the potential for computerized interventions to be used in a wide variety of settings, with different client groups, and symptom severity.

It is only recently that research has attempted to use computer-based interventions for treating depression in specific population groups. One early study by Spek, Nyklicek et al. (2007, 2008) investigated the efficacy of an online intervention for treating subthreshold depression in over 50´s. The subgroup analysis demonstrated a post-treatment effect size of $d = 0.34$ for studies with specific populations which contrasts a pooled effect size of $d = 0.60$ for all other RCT studies and comparisons showed the difference to be significant. The results support the overall effectiveness of computer-based interventions for depression, however the potential for specific populations, while encouraging, is unclear at present and future research is needed.

The delivery of support using different modes of computer mediated communication (CMC) potentially influences outcome (Barak et al., 2008). Asynchronous CMC may be superior to synchronous CMC; perhaps because of the benefits associated with asynchronous communication such as disinhibition and more time to reflect and compose ones responses (Suler, 2004). Although caution is advised as the subgroups comparison showed that any differences were not significant. Also the number of studies included in the synchronous category was small ($n = 2$) and the differences between the communication types employed (synchronous chat vs phone

contact) alongside other unmeasured key variables, such as those mentioned in relation to different treatment lengths above, cannot be overlooked; there is potential for future research.

The use of a waiting list control group showed some potential for better outcomes compared to TAU control group, however any differences were not significant.

The meta-analysis has a number of limitations. Overall there was considerable heterogeneity across the studies, and thus the results should be interepreted with caution. In addition, as previously mentioned, some of sub-analyses had only a few studies included. It is also unclear to what extent the studies differ on other variables. For example, supported studies may have had different intervention components than those without support. Thus it is not clear that any differences between these studies occured solely on the basis of support levels.

RCT studies are largely heterogeneous regarding samples and treatments. It is therefore important to be tenative about the extent to which the results can generalize to all those with depression. Also research in naturalistic settings does not require nor seek to achieve the same levels of eligibility and exclusion as do many RCTs.

The interventions themselves may be problematic, perhaps there is a lack of functionality, multimedia, interactivity, that might engage any user and support adherence. Proudfoot et al. (2005) reported negative features of the program as a cause of dropout. Meyer et al. (2009) noted that with their program it would be interesting to investigate what added components might enhance the program and increase engagement and adherence.

Conclusion

The review and meta-analysis support the efficacy and effectiveness of computer-based psychological treatments for depression, in community, primary, and secondary care, and with diverse populations. As well as reductions in self-reported symptoms, computer-based interventions can also produce clinically significant improvements and recovery in depression. Supported interventions yield better outcomes, along with greater retention. Further research is needed, in particular to investigate the influence of therapist factors in supported treatments, the reasons for dropout, the maintenance of gains post-treatment, the potential for shorter treatments, and treatments with diverse population groups.

References

American Psychiatric Association [APA]. (1994). *Diagnostic and statistical manual of mental disorders (DSM-IV)*. Washington D.C.: American Psychiatric Association.

Andersson, G., Bergstorm, J., Holländare, F., Varlbring, P., Kaldo, V., & Ekselius, L. (2005). Internet-based self-help for depression: Randomised controlled trial. *British Journal of Psychiatry, 187*, 456-461. doi: 10.1192/bjp.187.5.456

Andersson, G., & Cuijpers, P. (2009). Internet-based and other computerized psychological treatments for adult depression: A meta-analysis. *Cognitive Behaviour Therapy, 38*(4), 196-205. doi: 10.1080/16506070903318960

Barak, A., Hen, L., Boniel-Nissim, M., & Shapira, N. (2008). A comprehensive review and a meta-analysis of the effectiveness of internet-based psychotherapeutic interventions. *Journal of Technology in Human Services, 26*(2), 109 - 160. doi: 10.1080/15228830802094429

Blackwell, S. E., & Holmes, E. A. (2010). Modifying interpretation and imagination in clinical depression: A single case series using cognitive bias modification. *Applied Cognitive Psychology, 24*(3), 338-350. doi: 10.1002/acp.1680

Carlbring, P., Brunt, S., Bohman, S., Austin, D., Richards, J., Ost, L., & Andersson, G. (2007). Internet vs. paper and pencil administration of questionnaires commonly used in panic/agoraphobia research. *Computers in Human Behavior, 23*(3), 1421-1434. doi: 10.1016/j.chb.2005.05.002

Cavanagh, K., Seccombe, N., & Lidbetter, N. (2011). The implementation of computerized cognitive behavioural therapies in a service user-led, third sector self help clinic. *Behavioural and Cognitive Psychotherapy, First View*, 1-16. doi: 10.1017/S1352465810000858

Cavanagh, K., Shapiro, D. A., Van Den Berg, S., Swain, S., Barkham, M., & Proudfoot, J. (2006). The effectiveness of computerized cognitive behavioural therapy in routine care. *British Journal of Clinical Psychology, 45*(4), 499-514. doi: 10.1348/014466505x84782

Cavanagh, K., Shapiro, D. A., Van Den Berg, S., Swain, S., Barkham, M., & Proudfoot, J. (2009). The acceptability of computer-aided cognitive behavioural therapy: A pragmatic study. *Cognitive Behaviour Therapy, 38*(4), 235-246. doi: 10.1080/16506070802561256

Clarke, G., Kelleher, C., Hornbrook, M., DeBar, L., Dickerson, J., & Gullion, C. (2009). Randomized effectiveness trial of an internet, pure self-help, cognitive behavioral intervention for depressive symptoms in young adults. *Cognitive Behaviour Therapy, 38*(4), 222-234. doi: 10.1080/16506070802675353

Clarke, G., Reid, E., Eubanks, D., O'Connor, E., DeBar, L. L., Kelleher, C., . . . Nunley, S. (2002). Overcoming depression on the internet (ODIN): A randomized controlled trial of an internet depression skills intervention program. *Journal of Medical Internet Research, 4*(3), e14. doi: 10.2196/jmir.4.3.e14

Clarke, G., Reid, E., Eubanks, D., O'Connor, E., DeBar, L. L., Kelleher, C., . . . Nunley, S. (2005). Overcoming depression on the internet (ODIN-2): A randomized trial of a self-help depression skills program with reminders. *Journal of Medical Internet Research, 7*(2), e16. doi: 10.2196/jmir.7.2.e16

Cochrane. (2008). Review Manager (RevMan) (Version 5). Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2 ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Cuijpers, P. (1997). Bibliotherapy in unipolar depression: A meta-analysis. *Journal of Behavior Therapy and Experimental Psychiatry, 28*(2), 139-147.

Christensen, H., Griffiths, K. M., & Jorm, A. F. (2004). Delivering interventions for depression by using the internet: randomised controlled trial. *British Medical Journal, 31*(328), 265. doi: 10.1136/bmj.37945.566632.EE

Christensen, H., Griffiths, K. M., & Korten, A. (2002). Web-based cognitive-behaviour therapy: Analysis of site usage and changes in depression and anxiety scores. *Journal of Medical Internet Research, 4*(1), 1-8. doi: 10.2196/jmir.4.1.e3

Christensen, H., Griffiths, K. M., Mackinnon, A. J., & Brittliffe, K. (2006). Online randomized controlled trial of brief and full cognitive-behaviour therapy for depression. *Psychological Medicine, 36*(12), 1737-1746. doi: 10.1017/S0033291706008695

de Graaf, L. E., Gerhards, S. A. H., Arntz, A., Riper, H., Metsemakers, J. F. M., Evers, S. M. A. A., . . . Huibers, M. J. H. (2009). Clinical effectiveness of online computerised cognitive-behavioural therapy without support for depression in primary care: randomised trial. *British Journal of Psychiatry, 195*(1), 73-80. doi: 10.1192/bjp.bp.108.054429

de Graaf, L. E., Gerhards, S. A. H., Arntz, A., Riper, H., Metsemakers, J. F. M., Evers, S. M. A. A., . . . Huibers, M. J. H. (2011). One-year follow-up results of unsupported online computerized cognitive behavioural therapy for depression in primary care: A randomized trial. *Journal of Behavior Therapy and Experimental Psychiatry, 42*(1), 89-95. doi: 10.1016/j.jbtep.2010.07.003

Evans, C., Mellor-Clark, J., Margison, F., Barkham, M., McGrath, G., Connell, J., & Audin, K. (2000). Clinical Outcomes in Routine Evaluation: The CORE-OM. *Journal of Mental Health, 9*, 247-242\255.

Eysenbach, G. (2005). The law of attrition. *Journal of Medical Internet Research, 7*(1), e11. doi: 10.2196/jmir.7.1.e11

Fox, E., Acton, T., Wilding, B., & Corcoran, S. (2004). Service development report: An assistant psychologist`s perspective on the use of computerised CBT in a GP practice in Barnet. *Quality in Primary Care, 12*, 161-165.

Goldberg, D., Bridges, K., Duncan-Jones, P., & Grayson, D. (1988). Detecting anxiety and depression in general medical settings. *BMJ, 297*(6653), 897-899. doi: 10.1136/bmj.297.6653.897

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. doi: 10.1080/13284200500378696

Grime, P. R. (2004). Computerized cognitive behavioural therapy at work: a randomized controlled trial in employees with recent stress-related absenteeism. *Occupational Medicine, 54*(5), 353-359. doi: 10.1093/occmed/kqh077

Higgins, J. P. T., & Green, S. (Eds.). (2009). *Cochrane Handbook for Systematic Reviews of Interventions*. Sussex, England: John Wiley & Sons Ltd.

Holländare, F., Johnsson, S., Randestad, M., Tillfors, M., Carlbring, P., Andersson, G., & Engström, I. (2011). Randomized trial of internet-based relapse prevention for partially remitted depression. *Acta Psychiatrica Scandinavica*, Early View. doi: 10.1111/j.1600-0447.2011.01698.x

Hollon, S. D., DeRubeis, R. J., Shelton, R. C., Amsterdam, J. D., Salomon, R. M., O'Reardon, J. P., . . . Gallop, R. (2005). Prevention of relapse following cognitive therapy vs medications in moderate to severe depression. *Archives of General Psychiatry, 62*(4), 417-422.

Hunt, S., Howells, E., & Stapelton, B. (2006). The addition of a computersed cognitive behavioural therapy program, to a stepped care, primary care mental health service. *Journal of Primary Care Mental Helath, 9*(2), 34-38.

Kessler, D., Lewis, G., Kaur, S., Wiles, N., King, M., Weich, S., . . . Peters, T. J. (2009). Therapist-delivered internet psychotherapy for depression in primary care: A randomised controlled trial. *The Lancet, 374*(9690), 628 - 634. doi: 10.1016/S0140-6736(09)61257-5

Kohn, R., Saxena, S., Levav, I., & Saraceno, B. (2004). The treatment gap in mental health care. *Bulletin of the World Health Organization, 82*, 858-866.

Kraaij, V., Van Emmerik, A., Garnefski, N., Schroevers, M. J., Lo-Fo-Wong, d., Van Empelen, P., . . . Maes, S. (2010). Effects of a cognitive behavioral self-help program and a computerized structured writing intervention on depressed mood for HIV-infected people: A pilot randomized controlled trial. *Patient education and counseling, 80*, 200-204.

Learmonth, D., & Rai, S. (2008). Taking computerized CBT beyond primary care. *British Journal Clinical Psychology, 47*(1), 111-118. doi: 10.1348/014466507x248599

Learmonth, D., & Sadik, R. (2007). Establishing the effectiveness of computerised cognitive-behavioural therapy for secondary/tertiary mental health care service users with and without physical co-morbidities. *Health Psychology Update, 16*(3), 42-48.

Learmonth, D., Trosh, J., Rai, S., Sewell, J., & Cavanagh, K. (2008). The role of computer-aided psychotherapy within an NHS CBT specialist service. *Counselling and Psychotherapy Research, 8*(2), 117-123. doi: 10.1080/14733140801976290

Lecrubier, Y., Sheehan, D., Hergueta, T., & Weiller, E. (1998). The mini international neuropsychiatric interview. *European Psychiatry, 13*, 198s-198s.

Mackinnon, A., Griffiths, K. M., & Christensen, H. (2008). Comparative randomised trial of online cognitive-behavioural therapy and an information website for depression: 12-month outcomes. *British Journal of Psychiatry, 192*(2), 130-134.

Marks, I. M., Cavanagh, K., & Gega, L. (2007). *Hands on help: computer-aided psychotherapy* (Vol. 49). Hove: Psychology Press.

Meyer, B., Berger, T., Caspar, F., Beevers, G. C., Andersson, G., & Weiss, M. (2009). Effectiveness of a novel integrative online treatment for depression (Deprexis): Randomized controlled trial. *Journal of Medical Internet Research, 11*(2), e15. doi: 10.2196/jmir.1151

Mitchell, N. (2009). Computerised CBT self-help for depression in Higher Education: Reflections on a pilot. *Counselling and Psychotherapy Research: Linking research with practice, 9*(4), 280 - 286. doi: 10.1080/14733140902993343

Mitchell, N., & Dunn, K. (2007). Pragmatic evaluation of the viability of cCBT self-help for depression in higher education. *Counselling and Psychotherapy Research: Linking research with practice, 7*(3), 144 - 150.

Newman, M. G., Szkodny, L. E., Llera, S. J., & Przeworski, A. (2011). A review of technology-assisted self-help and minimal contact therapies for anxiety and depression: Is human contact necessary for therapeutic efficacy? *Clinical Psychology Review, 31*(1), 89-103. doi: 10.1016/j.cpr.2010.09.008

Ormrod, J. A., Kennedy, L., Scott, J., & Cavanagh, K. (2010). Computerised cognitive behavioural therapy in an adult mental health service: A pilot study of outcomes and alliance. *Cognitive Behaviour Therapy, 39*(3), 188-192. doi: 10.1080/16506071003675614

Perini, S., Titov, N., & Andrews, G. (2008). The Climate Sadness program: An open trial of Internet-based treatment for depression. *E-journal of Applied Psychology*, *4*(2), 18-24.

Perini, S., Titov, N., & Andrews, G. (2009). Clinician-assisted internet-based treatment is effective for depression: Randomized controlled trial. *Australian and New Zealand Journal of Psychiatry*, *43*(6), 571 - 578. doi: 10.1080/00048670902873722

Piper, W. E., Ogrodniczuk, J. S., Joyce, A. S., McCallum, M., Rosie, J. S., O'Kelly, J. G., & Steinberg, P. I. (1999). Prediction of dropping out in time-limited, interpretive individual psychotherapy. *Psychotherapy: Theory, Research, Practice, Training 36*(2), 114-122.

Pittaway, S., Cupitt, C., Palmer, D., Arowobusoye, N., Milne, R., Holttum, S., . . . Patrick, H. (2009). Comparative, clinical feasibility study of three tools for delivery of cognitive behavioural therapy for mild to moderate depression and anxiety provided on a self-help basis. *Mental Health in Family Medicine, 6, 145-154. , 6*, 145-154.

Proudfoot, J., Goldberg, D., Mann, A., Everitt, B., Marks, I., & Gray, I. A. (2003). Computerised, interactive, multimedia cognitive-behavioural program for anxiety and depression in general practice. *Psychological Medicine, 33*, 217-227. doi: 10.1017/S0033291702007225

Proudfoot, J., Ryden, C., Everitt, B., Goldberg, D., Tylee, A., Gray, J. A., . . . Shapiro, D. A. (2004). Clinical efficacy of computerised cognitive-behavioural therapy for anxiety and depression in primary care: Randomised controlled trial. *British Journal of Psychiatry, 185*(1), 46-54. doi: 10.1192/bjp.185.1.46

Purves, D. G., Bennett, M., & Wellman, N. (2009). An open trial in the NHS of Blues Begone®: A new home-based computerized CBT program. *Behavioural and Cognitive Psychotherapy, 37*(05), 541-551. doi: 10.1017/S1352465809990282

Reis, B. F., & Brown, L. G. (1999). Reducing psychotherapy dropouts: Maximizing perspective convergence in the psychotherapy dyad. *Psychotherapy: Theory, Research, and Practice, 36*(2), 123-136.

Richards, D. (2011). Prevalence and clinical course of depression: A review. *Clinical Psychology Review, 31*(7), 1117-1125. doi: 10.1016/j.cpr.2011.07.004

Robertson, L., Smith, M., Castle, D., & Tannenbaum, D. (2006). Using the internet to enhance the treatment of depression. *Australasian Psychiatry, 14*(4), 413-417. doi: 10.1111/j.1440-1665.2006.02315.x

Ruwaard, J., Schrieken, B., Schrijver, M., Broeksteeg, J., Dekker, J., Vermeulen, H., & Lange, A. (2009). Standardized Web-based CBT of mild to moderate depression: A randomized controlled trial with a long-term follow-up. *Cognitive Behaviour Therapy, 38*(3), 1-19. doi: 10.1080/16506070802408086

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

Spek, V., Cuijpers, P., Nyklícek, I., Riper, H., Keyzer, J., & Pop, V. (2007). Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: a meta-analysis. *Psychological Medicine, 37*(3), 319-328.

Spek, V., Nyklicek, I., Smits, N., Cuijpers, P., Riper, H., Keyzer, J., & Pop, V. (2007). Internet-based cognitive behavioural therapy for subthreshold depression in people over 50 years old: A randomized controlled clinical trial. *Psychological Medicine, 37*, 1797-1806. doi: 10.1017/S0033291707000542

Spek, V., Nyklicek, I., Smits, N., Cuijpers, P., Riper, H., Keyzer, J., & Pop, V. (2008). One-year follow-up results of a randomized controlled clinical trial on Internet-based cognitive behavioural therapy for subthreshold depression in people over 50 years. *Psychological Medicine, 38*, 635-639. doi: 10.1017/S0033291707002590

Suler, J. (2004). The online disinhibition effect. *CyberPsychology & Behavior, 7*(3), 321-326. doi: 10.1089/1094931041291295

Thompson, N. J., Walker, E. R., Obolensky, N., Winning, A., Barmon, C., DiIorio, C., & Compton, M. T. (2010). Distance delivery of mindfulness-based cognitive therapy for depression: Project UPLIFT. *Epilepsy & Behavior, 19*(3), 247-254. doi: 10.1016/j.yebeh.2010.07.031

Timulak, L. (2010). Significant events in psychotherapy: An update of research findings. *Psychology and Psychotherapy: Theory, Research and Practice*, 1-29. doi: 10.1348/147608310X499404

Titov, N., Andrews, G., Davies, M., McIntyre, K., Robinson, E., & Solley, K. (2010). Internet treatment for depression: A randomized controlled trial comparing clinician vs. technician assistance. *PLoS ONE, 5*(6). doi: 10.1371/journal.pone.0010939.g001

Topolovec-Vranic, J., Cullen, N., Michalak, A., Ouchterlony, D., Bhalerao, S., Masanic, C., & Cusimano, M. D. (2010). Evaluation of an online cognitive behavioural therapy program by patients with traumatic brain injury and depression. *Brain Injury, 24*(5), 762-772. doi: 10.3109/02699051003709599

van Bastelaar, K. M. P., Pouwer, F., Cuijpers, P., Riper, H., & Snoek, F. J. (2011). Web-based depression treatment for Type 1 and Type 2 diabetic patients. *Diabetes Care, 34*(2), 320-325. doi: 10.2337/dc10-1248

Van den Berg, S., Shapiro, D. A., Bickerstaffe, D., & Cavanagh, K. (2004). Computerised cognitive-behaviour therapy for anxiety and depression: A practical solution to the shortage of trained therapists. *Journal of Psychiatric and Mental Health Nursing, 11*(5), 508. doi: 10.1111/j.1365-2850.2004.00745.x

van Straten, A., Cuijpers, P., & Smits, N. (2008). Effectiveness of a web-based self-help intervention for symptoms of depression, anxiety, and stress: Randomized controlled trial. *Journal of Medical Internet Research, 10*(1), 1-10. doi: 10.2196/jmir.954

Vernmark, K., Lenndin, J., Bjärehed, J., Carlsson, M., Karlsson, J., Öberg, J., . . . Andersson, G. (2010). Internet administered guided self-help versus individualized e-mail therapy: A randomized trial of two versions of CBT for major depression. *Behaviour Research and Therapy, 48*(5), 368-376. doi: 10.1016/j.brat.2010.01.005

Waller, R., & Gilbody, S. (2009). Barriers to the uptake of computerized cognitive behavioural therapy: a systematic review of the quantitative and qualitative evidence. *Psychological Medicine, 39*(05), 705-712. doi: 10.1017/S0033291708004224

Warmerdam, L., van Straten, A., Twisk, J., Riper, H., & Cuijpers, P. (2008). Internet-based treatment for adults with depressive symptoms: Randomized controlled trial. *Journal of Medical Internet Research, 10*(4), e44. doi: 10.2196/jmir.1094

Whitfield, G., Hinshelwood, R., Pashely, A., Campsie, L., & Williams, C. (2006). The Impact of a novel computerized CBT CD-ROM (Overcoming Depression) offered to patients referred to clinical psychology. *Behavioural and Cognitive Psychotherapy, 34*(01), 1-11. doi: 10.1017/S135246580500250X

World Health Organisation [WHO]. (2007). International Statistical Classification of Diseases and Related Health Problems 10th Revision Retrieved 26th August, 2009, from http://apps.who.int/classifications/apps/icd/icd10online/

Wright, J. H., Wright, A. S., Albano, A., Basco, M. R., Goldsmith, L. J., Raffield, T., & Otto, M. W. (2005). Computer-assisted cognitive therapy for depression: maintaining efficacy while reducing therapist time. *American Journal of Psychiatry*, *162*(6), 1158-1164. doi: 10.1176/appi.ajp.162.6.1158

Table 1

Studies included in the review and meta-analysis

Study	Participants	Sample	Design	Intervention	Support	Measures	Country
*Anderssson et al. (2005)	Adults, met criteria for MDD + score 15-30 MADRS-S	117 community sample	RCT: CCBT + DB, *n* = 57 DB only, *n* = 60	5 Modules of CBT - ID netCBT	TS by email - feedback after each module	BDI MADRS-S	Sweden
Cavanagh et al. (2006)	Adults referred by GP	219 primary & secondary care sample	Open Trial	8 Modules of CBT - SA BTB	AS - 5 min F:F beginning and end of sessions, clinical helper (receptionist or administrator).	CORE-OM	U.K.
Cavanagh et al. (2011)	Adults referred to CCBT service	295 primary care sample	Open Trial	8 Modules CBT – ID BTB	AS - end of sessions 0-10 mins F:F, checking progress report and support. Service volunteers	PHQ-9	U.K.
Christensen et al. (2002)	Adults who completed at least 1 instance of GDS	1574 community sample	Open Trial	5 Modules of CBT - ID MoodGYM	NS	GDS	Australia
*Christensen et al. (2004) & MacKinnon et al. (2008)	Adults, self-reported depression on K-10 >22	525 community sample	RCT: BluePages, *n* = 166 CCBT, *n* = 182 Control, *n* = 178	5 Modules of CBT - ID MoodGYM	AS - Weekly phone call to direct use of website by lay interviewers	CES-D	Australia

Christensen et al. (2006)	Adults, self-reported elevated scores on GDS	2231 community sample	RCT: Participants Randomized to six versions of CCBT	CBT - ID MoodGYM	NS	GDS	Australia
*Clarke et al. (2002)	Adults depressed + non depressed from primary care	299 primary care sample	RCT: CCBT, *n* = 144 TAU, *n* = 155	7 Modules CBT - ID ODIN	NS	CES-D	U.S.
*Clarke et al. (2005)	Adults depressed + non depressed from primary care	255 primary care sample	RCT: CCBT+PCR, *n* = 75 CCBT+TEL, *n* = 80 TAU, *n* = 100	8 Modules CBT - ID ODIN	NS	CES-D	U.S.
*Clarke et al. (2009)	Young Adults (18-24) depressed and non-depressed from primary care	160 primary care sample	RCT: CCBT+PCR, *n* = 83 TAU, *n* = 77	4 Modules of CBT – ID ODIN	NS	PHQ-9	U.S.
*de Graff et al. (2009) & de Graff et al. (2011)	Adults, BDI ≥16 + CIDI-auto to confirm diagnosis	303 community sample	RCT: CCBT, *n* = 100 CCBT+TAU, *n* = 100 TAU, *n* = 103	8 Modules CBT - ID Colour Your Life	NS	BDI	Netherlands
Fox et al. (2004)	Adults referred by GP	56 primary care sample	Open Trial	8 Modules CBT - SABTB	AS - clinical helper F:F, clinical and technical issues	BDI	U.K.
*Grime	Adults	48 work	RCT:	8 Modules	NS	HADS	U.K.

(2004)	with 10 days absent from work +GHQ ≥4	place sample	CCBT+TAU, *n* = 24 TAU, *n* = 24	CBT - SA BTB			
Hunt et al. (2006)	Adults referred by GP	164 primary care sample	Open Trial	8 Modules CBT - SA BTB	AS - assistant psychologist F:F, 5 mins per session	BDI	U.K.
* Holländare et al. (2011)	Adults, partial remitted depression. Semi-structured interview + case conference decision	84 community sample	RCT: CCBT, *n* = 42 Control, *n* = 42	10 weeks CBT + Therapist email	TS - weekly email from a personal therapist	MADRS-S BDI	Sweden
*Kessler et al. (2009)	Adults, BDI ≥14 and ICD-10 diagnosis of depression	255 secondary care sample	RCT: CCBT+TAU, *n* = 149 TAU, *n* = 148	10 sessions CBT	TS - Synchronous text-based counseling	BDI	U.K.
*Kraaij et al. (2010)	Adults with HIV, depressive symptoms HADS	73 sample from patient organization	RCT: CBS, N=24 SWI, N=25 WL, N=24	2 Hours weekly over 4 weeks	NS	HADS	Netherlands
Learmonth et al. (2007)	Adults referred to mental health care service	590 secondary care sample	RCT: CCBT, N=407 CCBT(PC), N=97 WL, N=86	8 Modules CBT - SA BTB	AS - F:F administrator on hand, not clinical	BDI	U.K.

Learmonth, Trosh et al. (2008)	Adults referred to CBT therapist and assessment made, including likely to benefit from cCBT	555 secondary care sample	Open Trial	8 Modules CBT - SA BTB	AS - F:F administrator on hand, not clinical	BDI	U.K.
Learmonth and Rai et al. (2008)	Adults referred to CBT therapist and assessment made, including likely to benefit from cCBT	104 secondary care sample	Open Trial	8 Modules CBT - SA BTB	AS - F:F administrator on hand, not clinical	BDI	U.K.
*Meyer et al. (2009)	Adults, included participants who completed at least 50% of BDI	396 community sample	RCT: CCBT+TAU, *n* = 320 TAU, *n* = 76	12 Modules CBT Deprexis	NS	BDI	Germany
Mitchell and Dunn (2007) & Mitchell (2009)	Adults referred by GP, or through adverts. BDI ≥14	27 secondary care sample	Open Trial	8 Modules CBT - BTB	AS - F:F administrative during sessions	BDI	U.K.
Ormrod et al. (2010)	Adult referred to mental health care service	23 secondary care sample	Open Trial	8 Modules CBT – ID BTB	AS - F:F community psych nurse or occupational therapist monitored sheets at end of sessions	BDI	U.K.

Perini et al. (2008)	Adults, PHQ-9 score 5-23, + met criteria for MDD, assessed by MINI	13 community sample	Open Trial	6 Modules CBT + DB - ID Sadness Program	TS - Therapist email after each completed lesson	PHQ-9 DASS	Australia
*Perini et al. (2009)	Adults, PHQ-9 score 5-23, + met criteria for MDD, assessed by MINI	45 community sample	RCT: CCBT, *n* = 29 WL, *n* = 19	6 Modules CBT + DB - ID Sadness Program	TS - Therapist email feedback after each completed lesson	BDI PHQ-9	Australia
Pittaway et al. (2009)	Adults referred from GP + CORE-OM (excluded on risk items)	50 secondary care sample	Open Trial	8 Modules CBT – ID BTB	AS - F:F Research coordinator, not clinical	CORE-OM	U.K.
*Proudfoot et al. (2003) & Proudfoot et al. (2004)	Adults, GHQ-12≥4 + CIS-R≥12	274 primary care sample	RCT: CCBT, *n* = 146 TAU, *n* = 128	8 Modules CBT - SA BTB	AS - F:F practice nurse beginning and end of sessions	BDI	U.K.
Purves et al. (2009)	Adults referred by GP or secondary care professional	100 primary/ secondary care sample	Open Trial	30 episodes of CBT – SA BluesBegone	NS	BDI	U.K.
Robertson et al. (2006)	Adults referred from public and private clinics	104	Open Trial	12 Modules CBT Recovery Road	TS	DSS	Australia
*Ruwaard et al. (2009)	Adults, BDI score 10-	45 community	RCT: CCBT, *n* = 36	11 Modules CBT – ID	TS - Therapists email	BDI SCL-90-R	Netherlands

	29	sample	WL, *n* = 18		feedback after each session		
*Spek, Nyklicek et al., (2007) & Spek, Nyklicek et al., (2008)	Older adults (50+) with subthreshold depression, EDS>12 & F:F CIDI	301 community sample	RCT: CCBT, *n* = 102 GCBT, *n* = 99 WL, *n* = 100	8 Modules CBT - ID Colour your Life	NS	BDI	Netherlands
Thompson et al. (2010)	Adults with epilepsy, score >13-38 on CES-D	53 sample from hospital-based epilepsy clinic	RCT: Internet intervention, *n* = 12 Phone intervention, *n* = 13 WL, *n* = 27	8 Modules CBT - ID, delivered in groups	AS - Sessions facilitated by layperson and a master of public health student, supervised by clinical psychologist	BDI	U.S.
*Titov et al. (2010)	Adults, PHQ-9 score 10-23, if >2 on item 9 (suicide) excluded	141 community sample	RCT: CCBT-T, *n* = 47 CCBT-C, *n* = 49 WL, *n* = 45	6 Modules of CBT - ID Sadness Program	TS - weekly email or telephone contact with clinican, therapeutic. AS-weekly email or telephone contact not clinical	BDI PHQ-9	Australia
Topolovec-Vranic et al. (2010)	Adults with traumatic brain injury + ≥12 PHQ-9	21 outpatient clinic sample	Open Trial	6 Modules CBT – ID MoodGYM	AS - Weekly phone contact to direct use of website and assess	PHQ-9 CED-D	Canada

					depression		
van Bastelaar et al. (2011)	Adults with diabetes, CES-D score ≥16	255	RCT: CCBT, *n* = 125 WL, *n* = 130	8 Modules CBT – ID	AS - Feedback email on homework from health psychologist	CES-D	Netherlands
Van den Berg et al. (2004)	Adults, GHQ-12≥4	115 secondary care sample	Open Trial	8 Modules CBT - SA BTB	AS - F:F beginning and end of sessions administrator	Self-rated depression weekly. CORE-OM	U.K.
*van Straten et al. (2008)	Adults, no inclusion or exclusion used	213 community sample	RCT: PST, *n* = 107 WL, *n* = 106	5 Modules of PST - ID	AS – Email feedback end of each session, master level psychology students feedback on exercises, not therapeutic	CES-D MDI	Netherlands
*Vernmark et al. (2010)	Adults, score 14-32 on MADRS-S, + F:F SCID-I-CV interview	88 community sample	RCT: Email, *n* = 30 Self-help, *n* = 29 WL, *n* = 29	7 Modules CBT - ID	TS - individualized CBT email therapy weekly, master psychology students NS - Self-help	BDI MADRS-S	Netherlands
*Warmer	Adults,	263	RCT:	8 modules	AS –	CES-D	Netherla

dam et al. (2008)	self report CES-D ≥16	community sample	CCBT, *n* = 88 CPST, *n* = 88 WL, *n* = 87	CBT - ID Colour your Life 5 modules PST – ID	Email feedback end of each session, master level psychology students, not therapeutic		nds
Whitfield et al. (2006)	Adults, referrals to secondary care for depression	20 secondary care sample	Open Trial	6 Modules CBT- SA Overcoming Depression	AS - F:F support nurse available to answer queries	BDI	Scotland
Wright et al. (2005)	Adults, F:F SCID met criteria for MDD + BDI ≥14	45 community sample	RCT: F:F CT, *n* = 15 CCT, *n* = 15 WL, *n* = 15	9 CT - ID	TS - 25 minutes F:F +25 min CCT	HDRS BDI	U.S.

Note. RCT: Randomized controlled trial; CCBT: Computerized Cognitive Behavior Therapy; CCBT+PCR: Postcard reminders; CCBT+TEL: Telephone reminders; CCBT(PC): Physical comorbidity; GCBT: Group Cognitive Behavior Therapy; ECBT: Email Cognitive Behavior Therapy; CPST: Computerized Problem Solving Therapy; PST-ID: Internet Delivered; CT: Cognitive Therapy; CCT: Computerized Cognitive Therapy; F:F: Face to Face; DB: discussion boards; CCBT-ID: Internet Delivered; CCBT-SA: Standalone; TS: Therapist support; AS: Administrative support; NS: No support; GP: General practitioner; MDD: Major Depressive Disorder; WL: Waiting List; TAU: Treatment as Usual; MADRS-S: Montgomery-Åsberg depression rating scale- self-rated; BDI: Beck Depression Inventory; GDS: Goldberg Depression Scale; CORE-OM: Clinical Outcomes in Routine Evaluation - Outcome Measure; CES-D: Centre for Epidemiological Studies-Depression Scale; PHQ-9: Patient Health Questionnaire; SCL-90-R: Symptom Checklist-90-Revised; MDI: Major Depression Inventory; EDS: Edinburgh Depression Scale; K-10: Kessler-10; ICD-10: International Classification for Diseases-10; MINI: Mini International Neuropsychiatric Interview Version 5.0.0; SCID-I-CV: Structured Clinical Interview for DSM-IV – Axis I disorders, clinical version; CIDI-auto: Composite International Diagnostic Interview; CIS-R: Clinical Interview Schedule – Revised. *denotes RCTs included in the meta-analysis

Table 2

Sub-group analyses on self-report measures post-treatment

Variable	Studies included	*d*	95% CI	*Z*	Significance	Difference between subgroups (Chi Square)
Support Type						
Therapist Support	$n = 7$[7]	0.78	(-0.92, -0.64)	10.79	p<.001	NS vs. TS, χ = 7.86, p<.05
Administrative Support	$n = 5$[8]	0.58	(-0.88, -0.28)	3.67	p<.001	NS vs. AS, χ = 1.19, p>.05
No Support	$n = 9$[9]	0.36	(-0.61, -0.10)	2.72	p<.01	AS vs. TS, χ = 1.37, p>.05
Number of Sessions						
Less than 8	$n = 9$[10]	0.75	(-1.02, -0.49)	5.55	p<.001	χ = 7.48, p<.01
8 or more	$n = 10$[11]	0.39	(-0.56, -0.22)	4.46	p<.001	
Clinical Setting						
Community	$n = 12$[12]	0.60	(-0.76, -0.44)	7.32	p<.001	χ = 0.08, p>.05
Primary /Secondary Care	$n = 7$[13]	0.46	(-0.84, -0.09)	2.42	p<.05	
Communication Mode						

[7] Andersson et al., 2005; Holländare et al., 2011; Kessler et al., 2009; Perini et al., 2009; Ruwaard et al., 2009; Titov et al., 2010; Vernmark, et al., 2010.
[8] Christensen et al., 2004 & MacKinnon et al., 2008; Proudfoot et al., 2003, 2004, Titov et al., 2010; Van Straten et al., 2008; Warmerdam et al., 2008.
[9] Clarke et al., 2002; Clarke et al., 2005; Clarke et al., 2009; de Graff et al., 2009, 2011; Grime, 2004; Kraaij et al., 2010; Meyer et al., 2009; Spek et al., 2007, 2008; Vernmark et al., 2010.
[10] Andersson et al., 2005; Christensen et al., 2004 & MacKinnon et al., 2008; Clarke et al., 2002; Clarke et al., 2009; Kraaij et al., 2010; Perini et al., 2009; Titov et al., 2010; Van Straten et al., 2008; Vernmark et al., 2010.
[11] Clarke et al., 2005; de Graaf et al., 2009, 2011; Grime, 2004; Holländare et al., 2011; Kessler et al., 2009; Meyer et al., 2009; Proudfoot et al., 2003, 2004; Ruwaard et al., 2009; Spek et al, 2007, 2008; Warmerdam et al., 2008.
[12] Andersson et al., 2005; Christensen et al., 2004 & MacKinnon et al., 2008; de Graaf et al., 2009, 2011; Holländare et al., 2011; Meyer et al., 2009; Perini et al., 2009; Ruwaard et al., 2009; Spek et al., 2007, 2008; Titov et al., 2010; Van Straten et al., 2008; Vernmark et al., 2010; Warmerdam et al., 2008.
[13] Clarke et al., 2002; Clarke et al., 2005; Clarke et al., 2009; Kessler et al., 2009; Proudfoot et al., 2003, 2004, Grime, 2004; Kraaij, et al., 2010.

		0.70	(-0.85,			χ = 1.64, p>.05
Asynchronous	n = 8[14]		-0.55)	9.17	p<.001	
		0.28	(-0.91,			
Synchronous	n = 2[15]		0.35)	0.88	p>.05	
Population						
		0.34	(-			χ = 5.09, p<.05
Specific			0.54, -			
populations	n = 3[16]		0.14)	3.32	p<.001	
		0.60	(-			
General			0.77, -			
populations	n = 16[17]		0.43)	6.88	p<.001	
Control Group						
Treatment as		0.39	(-0.66,			χ = 3.13, p>.05
Usual	n = 8[18]		-0.12)	2.87	p<.01	
		0.68	(-0.85,			
Waiting List	n = 8[19]		0.52)	8.16	p<.001	

Note. Mantel-Haenszel random effect model, 95% Confidence Interval; CI – Confidence Interval

[14] Andersson et al., 2005 ; Holländare et al., 2011 ; Perini et al., 2009 ; Ruwaard et al., 2009 ; Vernmark et al., 2010; Titov et al., 2010; Van Straten et al., 2008 ; Warmerdam et al., 2008.
[15] Christensen et al., 2004 & MacKinnon et al., 2008; Kessler et al., 2009.
[16] Spek et al., 2007; Kraaij et al., 2010; Holländare et al., 2011.[17] Andersson et al., 2005; Christensen et al., 2004 & MacKinnon et al., 2008; Clarke et al., 2002; Clarke et al., 2005; Clarke et al., 2009; de Graaf et al., 2009, 2011; Grime, 2004; Kessler et al., 2009; Meyer et al., 2009; Perini et al., 2009; Proudfoot et al., 2003, 2004; Ruwaard et al., 2009; Titov et al., 2010; Van Straten et al., 2008; Vernmark et al., 2010; Warmerdam et al., 2008.
[17] Andersson et al., 2005; Christensen et al., 2004 & MacKinnon et al., 2008; Clarke et al., 2002; Clarke et al., 2005; Clarke et al., 2009; de Graaf et al., 2009, 2011; Grime, 2004; Kessler et al., 2009; Meyer et al., 2009; Perini et al., 2009; Proudfoot et al., 2003, 2004; Ruwaard et al., 2009; Titov et al., 2010; Van Straten et al., 2008; Vernmark et al., 2010; Warmerdam et al., 2008.
[18] Clarke et al., 2002; Clarke et al., 2005; Clarke et al., 2009; de Graaf et al., 2009, 2011; Grime, 2004; Kessler et al., 2009; Meyer et al., 2009; Proudfoot et al., 2003, 2004.
[19] Kraaij et al., 2010 ; Perini et al., 2009 ; Ruwaard et al., 2009 ; Spek et al., 2007, Titov et al., 2010; Van Straten et al., 2008; Vernmark et al., 2010; Warmerdam et al., 2008.

Figure 1 *Results from the Systematic Review search*

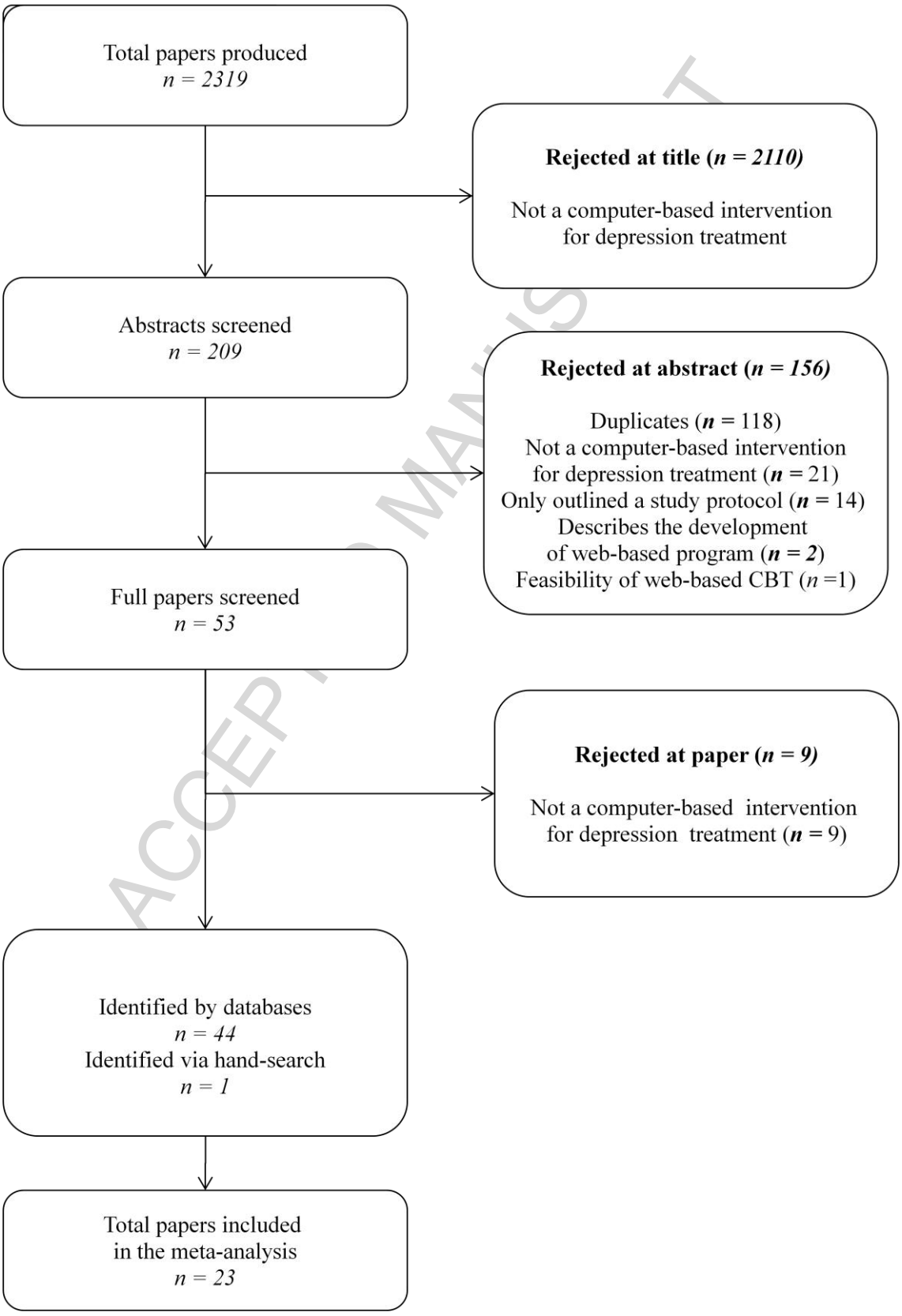


Figure 2:

Risk of Bias Graph

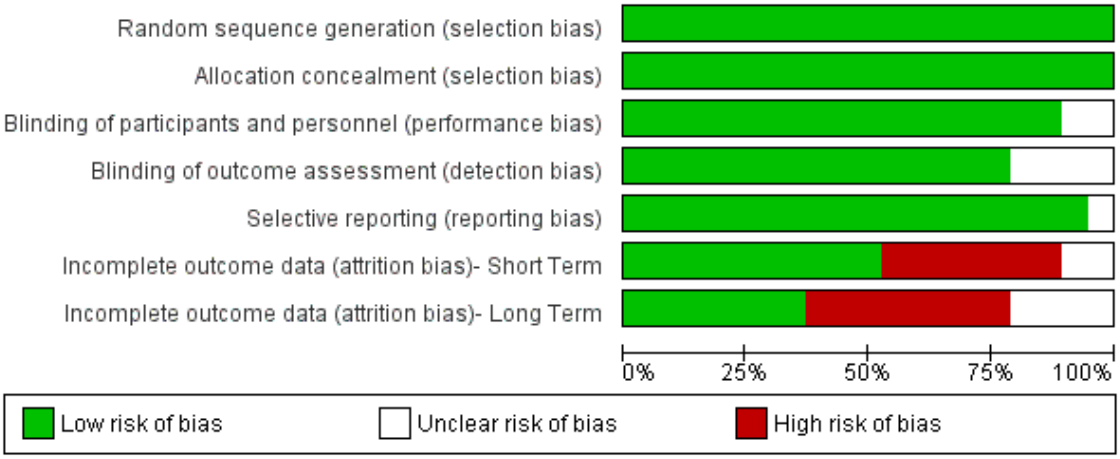
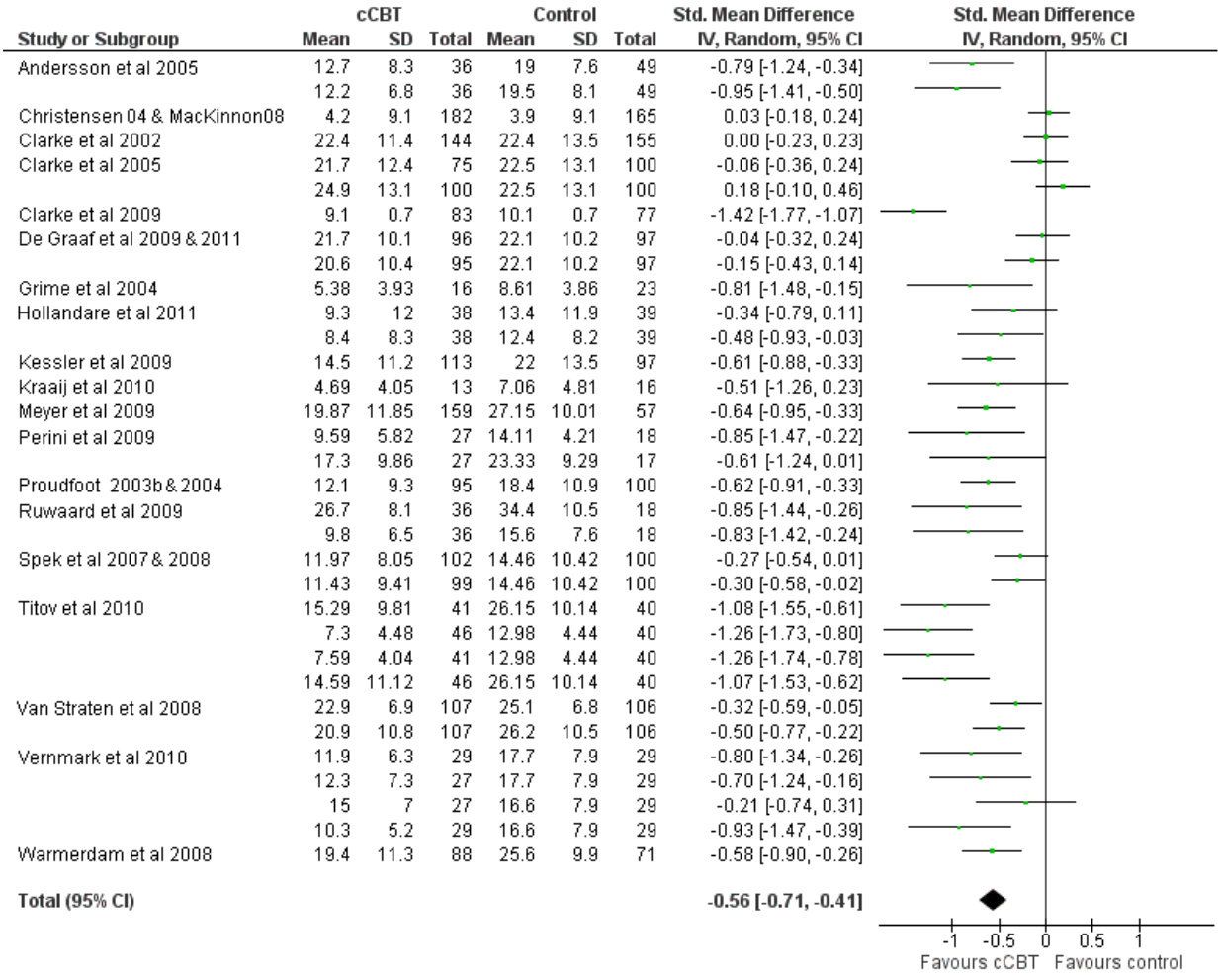


Figure 3:

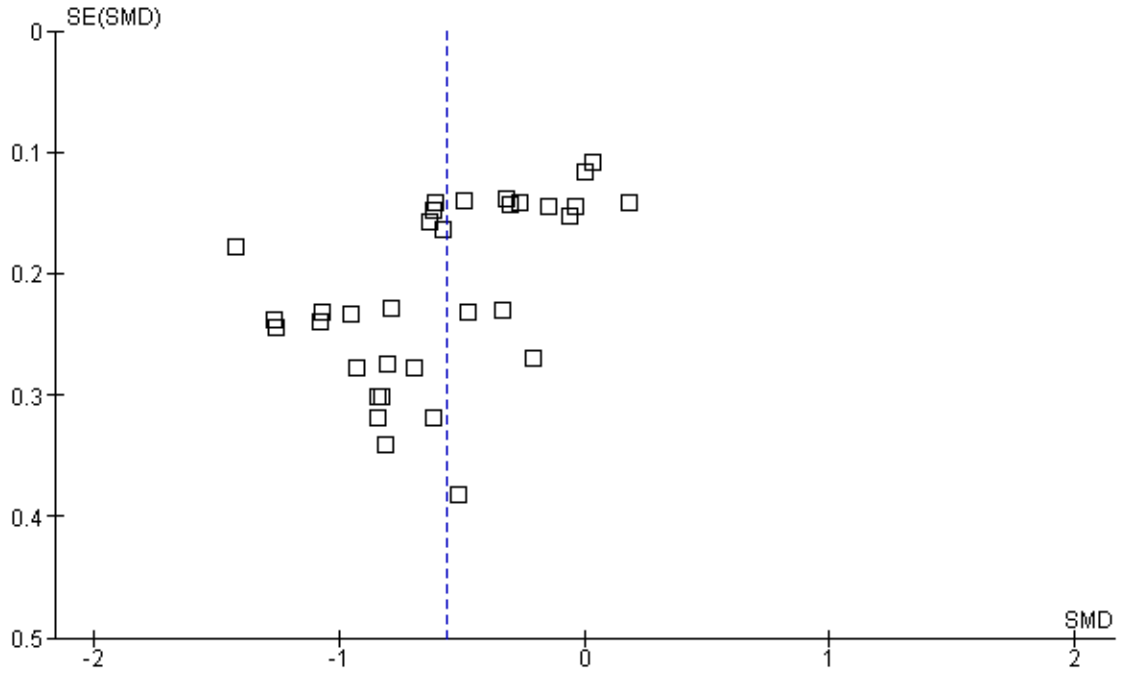
Forest plot of self-report measures post-treatment



Note: more than one number is given for some studies, if they used more than one standardised measure or more than one cCBT condition.

Figure 4:

Funnel Plot



Highlights

Computer-based psychological interventions for depression are effective

A range of different interventions, communication types and support types exist

Improvements in depression are significant post-treatment with many recovering

Improvements are maintained at follow-up, but less pronounced

Supported interventions yield better outcomes and greater retention