

# The efficacy of internet-delivered treatment for generalized anxiety disorder: A systematic review and meta-analysis



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## ABSTRACT

Generalized Anxiety Disorder (GAD) is typically considered a chronic condition characterized by excessive worry. Lifetime prevalence is 4.3–5.9%, yet only a small percentage seeks treatment. GAD is treatable and in recent years internet-delivered treatment interventions have shown promise. This paper aims to systematically search for literature on internet-delivered psychological interventions for the treatment of GAD and conduct a meta-analysis to examine their efficacy. The purpose of the paper is to inform the community of researchers, program developers and practitioners in internet delivered interventions of the current state-of-the-art and research gaps that require attention. A systematic search of the literature was conducted to find all studies of internet-delivered treatments for GAD ( $N = 20$ ). Using Review Manager 5 all Randomized Controlled Trials (RCTs;  $n = 11$ ) that met our established eligibility criteria were included into a meta-analysis that calculated effect sizes via the standardized mean difference. Compared to the waiting-list controls, the results demonstrate positive outcomes for GAD symptoms ( $d = -0.91$ ) and its central construct of pathological worry ( $d = -0.74$ ). The meta-analysis supports the efficacy of internet-delivered treatments for GAD including the use of disorder-specific (4 studies) and transdiagnostic treatment protocols (7 studies). Caution is advised regarding the results as the data is limited and highly heterogeneous, but revealing of what future research might be needed.

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## 1. Introduction

Generalized Anxiety Disorder (GAD) is characterized by excessive anxiety and worry, which the sufferer describes as difficult to control, occurring more days than not for a period of at least six months (American Psychiatric Association [APA], 2013). Other symptoms of GAD include restlessness, being easily fatigued, difficulty concentrating, irritability, muscle tension, and sleep disturbance. GAD is one of the most prevalent anxiety disorders (Kessler et al., 2005a; Kessler et al., 2005b; Narrow et al., 2002). Its one-year prevalence in community samples in the US is around 3% and its lifetime prevalence around 5% (Blazer et al., 1991; Kessler et al., 2005a; Kessler et al., 2005b; Wittchen, 2002). Studies from other countries revealed roughly similar figures (Bijl et al., 1998; Faravelli et al., 1989; Hunt et al., 2002; Jenkins et al., 1997). GAD patients typically present in primary care settings, where the reported prevalence is up to 8% (Kroenke et al., 2007; Roy-Byrne & Wagner, 2004).

Evidence from retrospective accounts suggest that people with GAD will have their first episode by age 31, with a quarter having their first episode by age 20, with an early onset in childhood or adolescence

(Kessler et al., 2005a). Research suggests that GAD is a chronic and enduring condition (Angst & Vollrath, 1991; Grant et al., 2005). Furthermore, comorbidity is as high as 90%, with 70% being diagnosed with comorbid depression, over 55% with any other anxiety disorder and 48% with a somatoform disorder (Carter et al., 2001). Around 50% of patients with GAD have also a personality disorder, most commonly avoidant and dependent personality disorder (Sanderson et al., 1994). Depression is commonly shown to follow GAD (Kessler et al., 2004), suggesting that chronic GAD may start the onset of depression in some cases (Barlow, 2002).

People with GAD experience significant impairment in quality of life (Loebach Wetherell et al., 2004; Massion et al., 1993). GAD negatively impacts the individual's general sense of well-being and life satisfaction and specifically occupational and family satisfaction (Stein & Heimberg, 2004). GAD represents a significant cost to society due to disability, decreased work productivity and increased use of health care services (Wittchen, 2002).

## 2. GAD and its treatment

As is the case with other anxiety disorders, cognitive-behavioral therapy (CBT), a form of psychological therapy, is the treatment that is

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routinely considered for GAD (National Institute for Health and Clinical Excellence, 2011). CBT for GAD is well studied and is shown to be more effective than wait-list, non-specific control conditions or treatment as usual (Borkovec & Ruscio, 2001; Hunot et al., 2007; National Institute for Health and Clinical Excellence, 2011). Several cognitive-behavioral models of generalized anxiety disorder exist (Brown et al., 2001; Dugas & Robichaud, 2007). In general, these models assume that people with GAD had early experiences of uncontrollability (Brown et al., 2001) or have intolerance of uncertainty on the basis of negative belief (Dugas & Robichaud, 2007). The worry in GAD aims at avoiding future aversive events (Borkovec, 1994; Brown et al., 2001) which brings temporary relief, but also inhibition of emotional processing and maintenance of anxiety-producing thinking and behaviors (Brown et al., 2001). More cognitive and meta-cognitive models of GAD also stress positive beliefs about worry's protective function (Wells, 1999).

CBT for GAD includes a number of specific components such as cognitive restructuring, behavioral exposure to feared consequences, worry exposure (staying with feared outcomes), relaxation training, worry behavior prevention and problem solving (Borkovec & Ruscio, 2001; Brown et al., 2001; Covin et al., 2008; Dugas & Robichaud, 2007). Their main rationale is that the patient overcomes emotional avoidance and learns that anxiety is not debilitating, but manageable and recedes after time. Recently, transdiagnostic CBT protocols for depressive and anxiety disorders have been proposed that also focus on features relevant to GAD such as emotional avoidance (Barlow et al., 2011). Proponents of transdiagnostic interventions argue that the similarities between the anxiety disorders outweigh their individual differences and they can respond to common therapeutic procedures (Allen et al., 2007).

### 3. Access to treatment: the evolution of high and low-intensity interventions

Healthcare providers are increasingly faced with a discrepancy between the burden of mental health conditions and the availability of cost-effective psychological treatments (Kohn et al., 2004). It has been estimated that upwards of 70% of people with anxiety disorders go untreated every year (Andrews et al., 2001; Lepine, 2002). There are multiple barriers to accessing treatment, including waiting-lists, costs, distance from service locations, negative perception of treatments, and personal stigma (Kohn et al., 2004; Mohr et al., 2010).

In recent years a model of stepped-care has evolved, involving high-intensity (e.g., one-to-one therapy) and low-intensity (e.g., bibliotherapy, internet-delivered treatments) interventions (Bower & Gilbody, 2005). Low-intensity internet-delivered interventions have the potential to extend access and reduce costs and possibly can overcome some of the barriers mentioned above.

Several studies have reported positive outcomes for internet-delivered treatments for social phobia, spider phobia, flight and other phobias, panic disorder, obsessive-compulsive disorder (OCD), post-traumatic stress disorder (PTSD), stress-related anxiety, trauma, depression and generalized anxiety disorder (GAD) (Cuijpers et al., 2009; Reger & Gahm, 2009; Richards & Richardson, 2012).

Internet-delivered cognitive behavior therapy treatment protocols have included disorder-specific treatments and transdiagnostic treatments that aim to treat the common elements and symptoms for anxiety disorders in general (Andersson et al., 2012; Bell et al., 2012; Carlbring et al., 2011; Johnston, Titov, Andrews, Spence, & Dear, 2011; Newby et al., 2013; Paxling et al., 2011; Robinson et al., 2010; Titov et al., 2010; Titov et al., 2009; Titov et al., 2011). Few internet-delivered treatments have integrated other therapeutic practices such as brief psychodynamic therapy (Andersson et al., 2012).

### 4. Other reviews and meta-analyses

A number of reviews and meta-analyses of this area have been published. An early narrative review (Przeworski & Newman, 2006) of

technology-assisted CBT for anxiety concluded that the field was in its infancy but that existing research was promising and suggested that technology-based delivery may be efficacious and cost-effective. Reger and Gahm's (2009) meta-analysis concluded that the data supported the use of such delivery systems and that the results are superior to waiting-list or placebo. The study did not review any internet interventions for the treatment of GAD (Reger & Gahm, 2009); there simply were none published at the time. A similar meta-analysis by Cuijpers et al. (2009) found a large effect size ( $d = 1.08$ ) for the active conditions compared to the controls. The authors concluded in favor of the potential of computer-aided delivery of treatments for anxiety disorders (Cuijpers et al., 2009). The meta did not include studies for generalized anxiety disorder. Andrews et al. (2010) published a meta-analysis demonstrating that computerized CBT was superior to outcomes from control groups. In an analysis of 22 studies of comparisons with a control group they reported a post-treatment effect size of  $d = 1.12$  for the studies that examined GAD (Andrews et al., 2010).

To date, the data available for the relevance of internet-delivered treatments on outcomes specifically in GAD-diagnosed subjects is scarce. In recent years, principally using internet-delivery, other studies have been published. A recent meta-analysis by Cuijpers et al. (2014) examined the effectiveness of psychological therapy for GAD. While it included studies using internet interventions it was not their primary focus.

In 2013, Cochrane published a review of media-delivered cognitive behavior therapy and behavior therapy (self-help) for anxiety disorders in adults (Mayo-Wilson & Montgomery, 2013). Some of the studies in that review we include here also. The other studies they included for GAD are unpublished data from Kiely (2002), Houghton (2008), and Shoenberger (2008). They included Bowman (1997), but the media used was worksheets on paper (not computer or internet-delivered) and lastly Rosmarin (2010), which included a sub-clinical anxiety group, not GAD symptom-specific group. Their search period ended January 1 2013 and further ( $n = 4$ ) studies have been published since that time. Similarly, Christensen et al. (2014) included a search period of 18 months from 2012 to June 2013 and included two studies for GAD, but since that time other studies have been published.

The current study therefore aimed to be more specific and systematically review and conduct a meta-analysis of internet-delivered psychological therapy for GAD compared to waiting-list control groups. The purpose of the paper is to inform the community of researchers, program developers and practitioners in internet-delivered interventions of the current state of the art and research gaps that require attention. The paper presents a comprehensive search of the literature, an effort to gather discrete data on subjects, and a detailed focus on the efficacy of internet interventions on GAD specific and some co-morbid (depression, distress, disability and quality of life) symptoms.

## 5. Method

### 5.1 Literature search and selection of studies

The aim of our literature search was to find all studies that related to internet-delivered treatment protocols for GAD, including disorder-specific protocols and more recent transdiagnostic protocols. During June 2013, we selected three prominent databases (Embase, PubMed, and PsychINFO including PsychARTICLES) as our search arena. After initial experimentation with several search phrases (online delivered treatments for anxiety/generalis[ed] anxiety, web-based treatment/interventions for anxiety, among others) that were derived from the authors' experiences in internet-delivered treatments and also from known studies, we decided on the use of three key search phrases that we were confident would yield the relevant literature. They were 'internet treatment for generalized anxiety disorder' and 'internet treatment for generalized anxiety disorder' and 'internet treatment for anxiety'.

We used the three search phrases across the three databases chosen, culminating in a total of nine searches.

Initially, search results were excluded at title depending on their relevance, thereafter abstracts were read and further papers excluded. Lastly the remaining papers were read fully and excluded if they were not eligible (for eligibility criteria see below). Finally, the reference lists of accepted papers and other reviews and meta-analysis (Andrews et al., 2010; Cuijpers et al., 2009; Przeworski & Newman, 2006; Reger & Gahm, 2009) were checked for further relevant papers. The process was conducted by the first two authors (DR, TR) and any disagreements that arose were discussed until a final decision was reached.

Eligibility criteria was established to include studies that were randomized controlled trials of an internet-delivered intervention compared to a waiting-list control. The studies were based on adult (18+ years) samples that had a clinical diagnosis of GAD, whom may have had comorbidity with depression and/or impairment in functioning.

So as to include discrete outcomes for patients undergoing treatment for GAD, studies that employed transdiagnostic anxiety treatment protocols had to discriminate outcomes for the different anxiety disorders to be included. In some cases where a transdiagnostic protocol was employed and/or outcomes from several anxiety disorders reported in total for participants, we contacted authors to get the discrete outcomes data for the GAD diagnosed subjects. All the studies were published in peer-reviewed journals in English and included reliable and valid measures for the assessment of outcomes, such as Generalized Anxiety Disorder-Q-IV (Newman et al., 2002) and Generalized Anxiety Disorder-7 (Spitzer et al., 2006) and the Penn State Worry Questionnaire (Meyer et al., 1990).

Post data-analysis and manuscript preparation, we carried out a further search and due to time lapsed, included the original search arena and added the Cochrane database, and then also did a search by cite. The search yielded one further study, but it did not meet our eligibility criteria for inclusion in the meta-analysis (Boettcher et al., 2014).

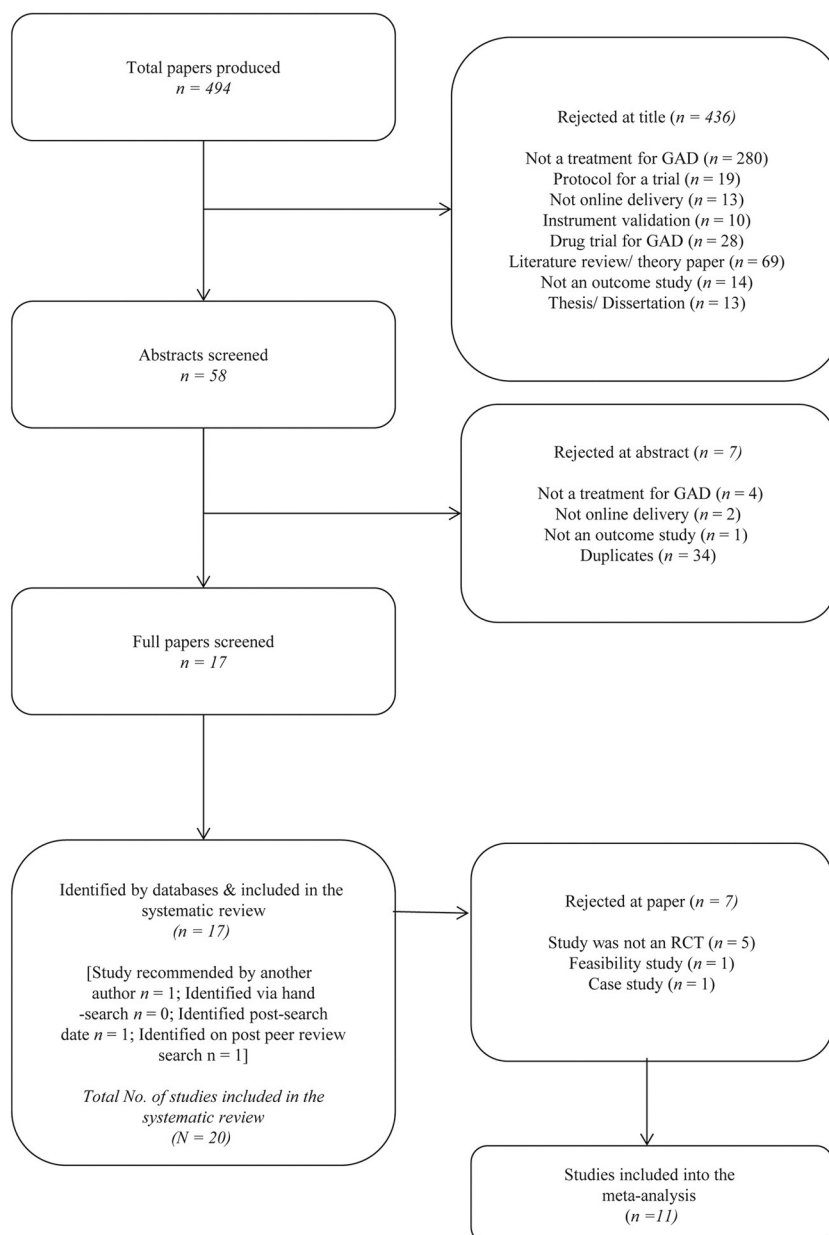


Fig. 1. Results from the systematic search.

**Table 1**  
Studies included in the systematic review.

| Study                    | Participants                                                                        | Sample                                                                          | Design                                               | Intervention                                                                                                  | Support                                                                                                                                         | Measures                                                                               | Country                                                                          |
|--------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| *Andersson et al. (2012) | Telephone administered SCID-I diagnosis for GAD                                     | Community ( $n = 81$ )                                                          | RCT:<br>ICBT: 27<br>IPDT: 27<br>WL: 27               | ICBT<br>IPDT – SUBGAP<br>8 content modules/8 weeks                                                            | Therapistv (final year clinical psychology trainees and one licensed psychologist)                                                              | PSWQ<br>GAD-IV<br>MADRS-S<br>BAI<br>BDI-II<br>QOLI<br>STAI                             | Sweden                                                                           |
| *Bell et al. (2012)      | Referrals to anxiety disorder unit. SCID-I administered in person.                  | Clinical ( $n = 83$ )                                                           | RCT:<br>CCBT: 7<br>WL: 7                             | CCBT: 4 sessions of CBT within 12 weeks<br>WL                                                                 | Research assistant (not clinical) telephone call every 2 weeks for compliance.                                                                  | WASA<br>GADI<br>PSWQ<br>BDI-II                                                         | New Zealand                                                                      |
| *Berger et al. (2013)    | Telephone administered SCID-I diagnosis for GAD                                     | Community ( $n = 132$ : sample recruited from Germany, Switzerland and Austria) | RCT<br>TAICBT: 44<br>STiCBT: 44<br>WL: 44            | ICBT – 8-content modules/8 weeks                                                                              | Masters level therapists (final year clinical psychologists, a qualified psychologist, and a qualified CBT therapist) weekly written feedback.  | BAI<br>BDI-II<br>GSI (BSI)<br>SPS<br>SIAS<br>ACQ<br>BSQ<br>MIA<br>MIB<br>PSWQ          | Switzerland                                                                      |
| Boettcher et al. (2014)  | Telephone administered SCID-I diagnosis for anxiety disorder                        | Community ( $n = 91$ )                                                          | RCT<br>IBMT: 45<br>WL: 46                            | Internet-based mindfulness treatment for anxiety disorders (transdiagnostic) 8 modules/8 weeks                | None for intervention group. Supervised discussion forum for WL group.                                                                          | BAI<br>BDI-II<br>ISI<br>QOLI                                                           | Sweden<br>(recruitment through website and newspaper adverts)                    |
| Carlbring et al. (2011)  | In person administered SCID for diagnosis of an anxiety disorder                    | Community ( $n = 54$ )                                                          | RCT<br>iCBT: 27<br>Control: 27                       | Individually tailored CBT for comorbid anxiety disorders (and depression). 6–10 modules (out of 16)/10 weeks. | Advanced MSc Clinical Psychology students. Weekly e-mail feedback.                                                                              | BAI<br>CORE-OM<br>MADRS-S<br>QOLI                                                      | Sweden<br>(recruitment through website, radio interviews, and newspaper adverts) |
| Craske et al. (2011)     | MINI for diagnosis of 1 or more anxiety disorders.                                  | Clinical ( $n = 1004$ )                                                         | RCT<br>iCBT: 503 (270 GAD)<br>Control: 501 (279 GAD) | iCBT disorder-specific (PD, PTSD, GAD, SAD) 8 modules/10–12 weeks                                             | Practitioners (social workers, nurses, MSc and PhD-level psychologists) worked collaboratively with Ps in person as they completed the program. | PDSS-SR<br>GADSS<br>SPIN<br>PCL-C                                                      | USA<br>(recruitment through referral in primary care setting)                    |
| Dear et al. (2011)       | MINI telephone-administered                                                         | Community ( $n = 32$ )                                                          | Open trial (single-sample)                           | iCBT transdiagnostic depression and anxiety disorders 5 modules/8 weeks                                       | Clinical Psychologist<br>Weekly telephone or text-based support                                                                                 | DASS-21<br>PHQ-9<br>PSWQ<br>SIAS6/SPS6<br>PDSS-SR<br>GAD-7<br>K-10<br>SDS<br>NEO-FFI-N | Australia                                                                        |
| Draper et al. (2008)     | In person administered SCID for diagnosis of GAD                                    | Clinical ( $n = 3$ )                                                            | Multiple case series                                 | iCBT (GAD-specific) 11 modules/11 weeks                                                                       | Encouragement provided by “occasional” telephone contact (do not specify who provided contact)                                                  | PSWQ<br>GADQ-IV<br>MCQ-30                                                              | Australia                                                                        |
| *Johansson et al. (2013) | Telephone administered MINI interview diagnosis for depression and anxiety disorder | Community ( $n = 100$ )                                                         | RCT:<br>IPDT: 50<br>WL: 50                           | Based on APT model 8 content modules/10 weeks                                                                 | Masters level therapists. Weekly written feedback.                                                                                              | PHQ-9<br>GAD-7<br>EPS-25<br>FFMQ                                                       | Sweden                                                                           |
| *Johnston et al. (2011)  | Telephone administered MINI diagnosis for GAD, social phobia, or panic disorder     | Community ( $n = 139$ )                                                         | RCT:<br>ICBT-CL: 46<br>ICBT-CO: 47<br>WL: 46         | Anxiety Program of 8 content modules/10 weeks                                                                 | Weekly telephone or email contact from either clinician or coach                                                                                | GAD-7<br>DASS-21<br>PSWQ<br>SIAS-6<br>SPS-6<br>PDSS-SR<br>PHQ-9                        | Australia                                                                        |

(continued on next page)

Table 1 (continued)

| Study                    | Participants                                                                                                                      | Sample                         | Design                                                            | Intervention                                                                     | Support                                                                                                                    | Measures                                                                        | Country   |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------|
| Klein et al. (2011)      | "e-PASS" online Ax (540 items corresponding to DSM-IV-TR criteria) to refer clients to program appropriate to their difficulties. | Community (n = 225)            | Quasi-experimental (naturalistic participant choice).<br>GAD = 88 | 5 iCBT programs specific to GAD, PD/A, OCD, PTSD, or SAD.<br>12 modules/12 weeks | e-mail support.<br>Therapists or postgraduate psychology students.                                                         | SDS<br>K-6<br>e-PASS                                                            | Australia |
| Mewton et al. (2012)     | Referred by practitioners.                                                                                                        | Clinical (n = 588)             | Naturalistic single-sample                                        | iCBT GAD specific 6 modules/time not specified                                   | Nature of support not specified. Prescribing practitioner received updates on client progress                              | GAD-7<br>K-10<br>WHODAS                                                         | Australia |
| *Newby et al. (2013)     | telephone administered MINI to confirm diagnosis of GAD and/or MDD                                                                | Community (n = 109)            | RCT:<br>ICBT: 49<br>WL: 60                                        | Worry and sadness program – 6 content modules/10 weeks                           | Regular therapist contact for first two modules, as needed subsequently. (telephone/e-mail)                                | PHQ-9<br>GAD-7<br>K-10<br>WHODAS-II<br>BDI-II<br>PSWQ<br>NEO-FFI-N              | Australia |
| *Paxling et al. (2011)   | Telephone administered SCID-I diagnosis for GAD                                                                                   | Community (n = 89)             | RCT:<br>ICBT: 44<br>WL: 45                                        | ICBT – 8 content modules/8 weeks                                                 | Therapist – weekly email feedback                                                                                          | PSWQ<br>GAD-IV<br>STAI<br>BAI<br>BDI<br>MDRS<br>QOLI                            | Sweden    |
| *Robinson et al. (2010)  | Telephone administered MINI diagnosis for GAD                                                                                     | Community (n = 150)            | RCT:<br>ICBT-TA: 50<br>ICBT-CA: 51<br>WL: 49                      | ICBT 6 content modules/10 weeks                                                  | Weekly supportive e-mail or telephone contact from Therapist (clinical psychologist) or technician (clinic administrator). | PSWQ<br>GAD-7<br>K-10<br>SDS<br>PHQ-9                                           | Australia |
| Sunderland et al. (2012) | Primary diagnosis of GAD or depression, referred by GP/mental health professional.                                                | Clinical (n = 663)             | Naturalistic single-sample<br>iCBT dep: 302<br>iCBTanx: 361       | iCBT for GAD (and iCBT for depression) 6 modules/10 weeks                        | Progress overseen by prescribing clinician (level and method of contact not specified)                                     | K-10<br>PHQ-9<br>GAD-7                                                          | Australia |
| *Titov et al. (2009)     | Telephone administered MINI diagnosis for GAD                                                                                     | Community (n = 48)             | RCT:<br>ICBT: 25<br>WL: 23                                        | ICBT 6 content modules/9 weeks                                                   | Weekly therapist support (clinical psychologist)                                                                           | GAD-7<br>PSWQ<br>PHQ-9<br>K-10<br>SDS                                           | Australia |
| *Titov et al. (2010)     | Telephone administered MINI diagnosis for GAD, social phobia, panic disorder                                                      | Community (n = 86)             | RCT:<br>ICBT: 42<br>WL: 44                                        | ICBT Anxiety 6 content modules/8 weeks                                           | Weekly text-based and/or telephone contact from therapist (clinical psychologist)                                          | GAD-7<br>PSWQ<br>SPSQ<br>PDSS-SR<br>PHQ-9<br>K-10<br>SDS                        | Australia |
| *Titov et al. (2011)     | Telephone administered MINI diagnosis for anxiety disorder or depression                                                          | Community (n = 78)             | RCT:<br>ICBT: 39<br>WL: 38                                        | Wellbeing program – 8 content modules/10 weeks                                   | Weekly text-based and/or telephone from therapist (clinical psychologist)                                                  | DASS-21<br>DASS-21<br>PHQ-9<br>PSWQ<br>SP-12<br>PDSS-SR<br>GAD-7<br>K-10<br>SDS | Australia |
| Zou et al. (2012)        | Telephone administered MINI for diagnosis of an anxiety disorder                                                                  | Older adult community (n = 22) | Single sample                                                     | iCBT for anxiety disorders (transdiagnostic) 5 modules/8 weeks                   | Clinical psychologist. Weekly telephone or e-mail support.                                                                 | GAD-7<br>DASS-21<br>PHQ-9<br>SDS<br>K-10                                        | Australia |

Note. \* = indicates studies included in the meta-analysis; SCID-I = Structured Clinical Interview for DSM-IV Axis I Disorders; DSM-IV = Diagnostic and Statistical Manual for Mental Health Disorders-IV; MINI = International Neuropsychiatric Interview; GAD = Generalized Anxiety Disorder; MDD = Major Depressive Disorder; RCT = Randomized Controlled Trial; ICBT = Internet Cognitive Behavior Therapy; IPDT = Internet Psychodynamic Therapy; WL = Waiting-List; APT = Affect-Phobia Therapy; TAiCBT = Tailored internet cognitive behavior therapy; StiCBT = Standardized internet cognitive behavior therapy; PSWQ = Penn State Worry Questionnaire; GAD-IV = Generalized Anxiety Disorder-IV; MADRS-S =



## 5.2 Meta-analysis method

All studies included were assessed for data which could be included in a meta-analysis of effects sizes at post-treatment comparing internet-delivered therapy to waiting-list controls. Any variable (e.g. symptoms of generalized anxiety and worry and co-morbid depression) which was reported by two or more studies was analyzed. We included the analysis of depression symptoms, as typically these are measured in both single diagnosis focused studies and transdiagnostic. Eleven studies reported data for both active interventions and control groups (all were waiting-list controls) which could be used. If different measures were used these were combined if they measured the same construct. For example studies reporting scores on the PHQ-9 (Spitzer et al., 1999) and Beck Depression Inventory-II (Beck et al., 1996) were combined into a 'self-reported depression' category. Three studies (Andersson et al., 2012; Johnston et al., 2011; Robinson et al., 2010) had two active intervention conditions as they compared different types of internet-delivered therapy. Data from both intervention conditions was included in the meta-analysis. We decided to exclude comorbid anxiety disorders in the analysis due to the fact that many of the studies were transdiagnostic, multiple anxiety disorders focused, and interventions.

All available data was continuous and was therefore analyzed using standardized mean difference (Cohens  $d$ ), weighted by sample size via a random effects model with 95% confidence interval to compare post-treatment scores between waiting-list controls and active samples. There was insufficient data to analyze outcomes at follow-up. The principal measures for GAD symptoms were the Generalized Anxiety Disorder-Q-IV (Newman et al., 2002) and Generalized Anxiety Disorder-7 (Spitzer et al., 2006), and for pathological worry the measure was the Penn State Worry Questionnaire (Meyer et al., 1990).

We also calculated homogeneity of effect size using the  $I^2$ -statistic that indicates heterogeneity as a percentage. A value of 0% indicates no observed heterogeneity, larger values represent increases in heterogeneity, for instance 25% is considered low, 50% as moderate and 75% considered high heterogeneity (Higgins et al., 2003).

### 5.2.1 Assessment of the quality of the included studies

To assess the validity of the included studies we employed the risk of bias assessment developed by Higgins and Green (2009) for the Cochrane Collaboration. The first two authors (DR, TR) assessed the studies on four key questions; 1. Was the allocation sequence adequately generated (Selection Bias)? 2. Was allocation adequately concealed (Selection Bias)? 3. Was knowledge of the allocated interventions adequately prevented during the study (Performance Bias)? and 4. Were outcome assessments adequately managed (Detection Bias)?

## 6. Results

### 6.1 Selection and inclusion of studies

From the database searches twenty studies ( $n = 20$ ) were included into the systematic review. Twelve of these studies were selected for inclusion in the meta-analysis. Four studies were GAD specific samples and interventions (Andersson et al., 2012; Paxling et al., 2011; Robinson et al., 2010; Titov et al., 2009), the remainder were transdiagnostic. One author alerted us to another study that we missed in our search in June 2013 as the paper was published in July 2013 (Johansson et al., 2013); we also came upon a newly published paper in our second search before submitting the manuscript for publication (Berger et al., 2013), we decided to include these studies as they complied with our established eligibility criteria.

One study conducted telephone MINI interviews to confirm diagnosis of GAD and/or MDD (Major Depressive Disorder) (Newby et al., 2013). We decided to include the data from this study as all had primary diagnosis of GAD or had a diagnosis of MDD with significant subthreshold GAD

symptoms. In conclusion, we received discrete outcomes for GAD diagnosed subjects from the authors of 7 transdiagnostic studies (Bell et al., 2012; Berger et al., 2013; Johansson et al., 2013; Johnston et al., 2011; Newby et al., 2013; Titov et al., 2010; Titov et al., 2011).

We had to exclude the use of data from 1 study (the authors could not supply the discrete data for GAD diagnosed participants), which meant that we included data from 11 studies in this meta-analysis. Fig. 1 shows the results of the systematic search and the reasons for exclusion.

### 6.2 Overview of the studies included

Selected characteristics of the studies can be found in Table 1. In total we were able to include 11 distinct studies that reported on outcomes from disorder-specific or transdiagnostic treatments for generalized anxiety disorder. In the 11 studies 771 participants were included either as part of active treatments ( $n = 371$ ) or as waiting-list controls ( $n = 400$ ).

The majority of participants were recruited via a website where they visited or had already registered their interest prior to the trial. It seems that all of the Australian studies recruited through a website ([www.virtualclinic.org.au](http://www.virtualclinic.org.au)) alongside a community-based newspaper advert in one case (Johnston et al., 2011). Most other studies also relied on self-recruitment through websites advertising the studies and adverts in local community newspapers. In one case recruitment was from several countries (Berger et al., 2013). Samples were community-based, apart from Bell et al. (2012) who recruited from a clinical population, and ranged in size from 48 participants (Titov et al., 2011) to 150 participants (Robinson et al., 2010), the mean sample size across the 11 studies was 99 participants.

After completing initial screening and intake questionnaires, all of the studies administered either the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; First et al., 1997), the Mini International Neuropsychiatric Interview Version 5.0.0 (MINI; Sheehan et al., 1998), or an interview based on the MINI (Johansson et al., 2013) to establish a formal diagnosis of GAD. The majority administered the interview over phone while one administered the interview in person (Johansson et al., 2013; Newby et al., 2013). All of the studies employed what can be considered robust and usual measures to assess outcomes from treatment. These included for the most part the Generalized Anxiety Disorder Inventory-7 (GAD-7), and the Penn State Worry Questionnaire (PSWQ). Berger et al. (2013) argued that because not all participants suffered from the same primary anxiety disorder, disorder-unspecific measures were employed to assess primary outcomes, namely the Beck Anxiety Inventory (BAI; Beck & Robert, 1993). The study did include secondary outcome measures for specific anxiety disorders, such as the Social Phobia Scale (SPS). Something similar is witnessed in some studies that delivered a transdiagnostic treatment, a mix of primary and secondary measures were used to discretely assess outcomes among the anxiety disorders (Johnston et al., 2011; Titov et al., 2010; Titov et al., 2011).

Four of the studies can be considered disorder-specific, whose interventions directly address generalized anxiety disorder (Andersson et al., 2012; Paxling et al., 2011; Robinson et al., 2010; Titov et al., 2009). The remaining seven studies were transdiagnostic in that they were directed at either multiple anxiety disorders (Berger et al., 2013; Johnston et al., 2011; Titov et al., 2010) or anxiety disorders and depression (Johansson et al., 2013; Newby et al., 2013; Titov et al., 2011). The treatment intervention delivered in 9 of the 11 studies was based on cognitive and behavioral principles. Two studies employed a psychodynamic intervention (Andersson et al., 2012; Johansson et al., 2013). All of the studies involved an individual treatment format and the treatments were predominately delivered over 8 sessions of content on a weekly basis (Andersson et al., 2012; Berger et al., 2013; Johnston et al., 2011; Paxling et al., 2011; Titov et al., 2011), or with an extended delivery time of 10 weeks (Johnston et al., 2011; Titov et al., 2011; Johansson et al., 2013). Four interventions were delivered in 6 modules of content

over 8 to 10 weeks (Newby et al., 2013; Robinson et al., 2010; Titov et al., 2010; Titov et al., 2009). The GAD treatment in Bell et al. (2012) consisted of 4 lessons to be completed within 12 weeks.

In line with best practice in internet-delivered treatments for anxiety and depression (Newman et al., 2011; Richards & Richardson, 2012) support for participants was provided in most of the treatment conditions. Support was provided by therapists in all conditions at various stages of training in clinical psychology, masters or doctorate courses. In some cases, qualified and experienced therapists/clinical psychologists provided participant support. In the case of Johnston et al. (2011) the coach supporter was a graduate psychologist with no further postgraduate training. Bell et al. (2012) did not provide therapeutic support for their participants; a research assistant provided short, highly structured phone calls every 2 weeks.

### 6.3 Overview of the studies excluded

Studies that did not meet our eligibility criteria as outlined in the method were therefore excluded from the meta-analysis. Selected characteristics of the studies can be found in Table 1. In these studies, 2682 participants were included either as part of active treatments ( $n = 2108$ ) or as waiting-list controls ( $n = 574$ ). Participants were recruited from the community through websites (Boettcher et al., 2014; Carlbring et al., 2011; Dear et al., 2011; Klein et al., 2011), or from clinical populations via referral from GPs or mental health practitioners (Craske et al., 2011; Draper et al., 2008; Mewton et al., 2012; Sunderland et al., 2012; Zou et al., 2012). Sample size ranged from 3 (Draper et al., 2008) to 1,004 (Craske et al., 2011). Most studies used one or more self-report measures to assess anxiety. Most studies included a measure that specifically assessed GAD, such as the Generalized Anxiety Disorder Inventory-7 (GAD-7) (Dear et al., 2011; Mewton et al., 2012; Sunderland et al., 2012; Zou et al., 2012); and the Penn State Worry Questionnaire (PSWQ) (Dear et al., 2011; Draper et al., 2008).

Five studies evaluated GAD-specific internet-delivered cognitive-behavioral therapy (iCBT) interventions (Craske et al., 2011; Draper et al., 2008; Klein et al., 2011; Mewton et al., 2012; Sunderland et al., 2012). Two studies looked at transdiagnostic internet-delivered CBT programs: one for anxiety disorders (Zou et al., 2012), and one for comorbid anxiety and depression (Dear et al., 2011). Carlbring et al. (2011) evaluated a tailored internet-delivered CBT approach where clients are assigned 6–10 out of a possible 16 modules for anxiety disorders based on their specific diagnosis or diagnoses. The final study evaluated a transdiagnostic internet-based mindfulness treatment for the anxiety disorders. The intervention programs in the studies ranged from 5 modules over 8 weeks to 12 modules over 12 weeks. In line with best practice, most studies included support from a practitioner, by telephone, e-mail or instant messaging. Outcomes from across the studies are positive for the clinical benefit of internet-delivered interventions for GAD.

### 6.4 Quality assessment

Regarding the methodological quality of the studies, they can be considered robust. See Fig. 2. Risk of bias graph.

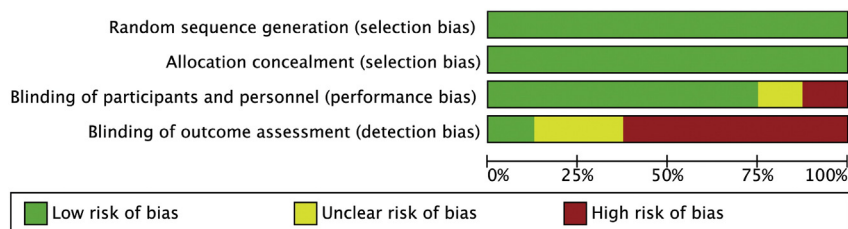


Fig. 2. Risk of bias graph.

### 6.5 Meta-analysis results: effects of internet-delivered interventions

Results from the meta-analysis are shown in Table 2. Sample sizes for the individual analyses ranged from 66 to 344 in the treatment conditions. There were statistically significant improvements for internet-delivered interventions compared to waiting-list controls on self-reported GAD symptoms ( $d = -0.91$ ; CI: 1.25–0.56;  $n = 8$ ) and pathological worry ( $d = -0.74$ ; CI: 0.96–0.52;  $n = 10$ ), both yielding what can be considered large effects (Cohen, 1988). Similar statistically significant large effects can be noted for the active treatments compared to waiting-list controls for comorbid anxiety ( $d = -0.57$ ), depression ( $d = -0.63$ ), distress ( $d = -0.91$ ), disability ( $d = -0.77$ ), and quality of life ( $d = 0.38$ ). Figs. 3 and 4 display forest plots for the primary outcome variables of GAD and Worry. Figs. 5 and 6 display funnel plots for these variables. The funnel plot for Worry (Fig. 6) is relatively symmetrical suggesting no clear publication bias. However GAD (Fig. 5) is somewhat asymmetrical suggesting some publication bias.

There was high heterogeneity observed for GAD ( $I^2 = 77\%$ ) and depression ( $I^2 = 68\%$ ), moderate heterogeneity observed for worry ( $I^2 = 46\%$ ), and distress ( $I^2 = 39\%$ ), for the other variables the observed heterogeneity was not significant. Given the moderate to high heterogeneity observed for some variables it would suggest significant variance in the distribution of the effect sizes reported. However, with the removal of the psychodynamic studies (Andersson et al., 2012; Johansson et al., 2013) the results indicate a reduction in heterogeneity and an increase in effect of the two main constructs, namely generalized anxiety symptoms ( $I^2 = 49\%$ ;  $d = 1.19$ ) and worry ( $I^2 = 17\%$ ;  $d = 0.87$ ). There was statistically significant variation for GAD, worry, and depression, however, changing from a random to fixed-effects model had little impact on effect sizes, suggesting that heterogeneity for these variables was not problematic.

Three studies (Johansson et al., 2013; Newby et al., 2013; Titov et al., 2011) included participants with depression and anxiety disorders, however, with the exclusion of these subjects with depression and anxiety, the effect size for depression remained the same  $d = -0.63$  ( $-1.03, -0.91$ ).

Sub-group analyses were conducted to compare studies which were GAD specific to studies which were transdiagnostic (specifically transdiagnostic or included comorbid depression or other anxiety disorder). For GAD subjects, effect sizes were similar for GAD-specific ( $d = -0.81$ ; CI:  $-1.27, -0.35$ ,  $n = 4$ ,  $p < .001$ ) and transdiagnostic ( $d = -0.91$ ; CI:  $-1.25, -0.56$ ,  $n = 4$ ,  $p < .001$ ). The difference between these subgroups was not statistically significant:  $\chi^2 = 0.34$ ,  $df = 1$ ,  $p > .05$ . For worry the effect sizes were also similar for GAD-specific ( $d = -0.68$ ; CI:  $-0.97, -0.38$ ,  $n = 5$ ,  $p < .001$ ) and transdiagnostic ( $d = -0.77$ ; CI:  $-1.12, -0.42$ ,  $n = 4$ ). The difference between these subgroups was not statistically significant:  $\chi^2 = 0.16$ ,  $df = 1$ ,  $p > .05$ .

## 7. Discussion

The paper sought to establish whether the published studies on internet-delivered treatment for GAD, comparing active treatment interventions with a waiting-list control, were efficacious. The meta-analysis results demonstrate significant post-treatment gains on a number of measures for internet-delivered interventions for generalized

**Table 2**

Results from the meta-analysis.

| Variable                     | Studies included             | Number participants treatment (control) | Heterogeneity $I^2$ , $Q$             | Standardized mean difference (upper, lower) | Overall effect          |
|------------------------------|------------------------------|-----------------------------------------|---------------------------------------|---------------------------------------------|-------------------------|
| GAD <sup>i</sup>             | n = 8 <sup>a</sup>           | 321 (249)                               | 77%: $\chi^2 = 42.68$ , $p < 0.00001$ | −0.91 (−1.25, −0.56)                        | $z = 5.10$ , $p < .001$ |
| Worry <sup>j</sup>           | n = 10 <sup>b, c, d, o</sup> | 342 (257)                               | 46%: $\chi^2 = 23.90$ , $p = 0.03$    | −0.74 (−0.96, −0.52)                        | $z = 6.59$ , $p < .001$ |
| Anxiety <sup>k</sup>         | n = 3 <sup>i</sup>           | 92 (76)                                 | 1%: $\chi^2 = 3.02$ , $p = 0.39$      | −0.57 (−0.86, −0.27)                        | $z = 3.81$ , $p < .001$ |
| Depression <sup>l</sup>      | n = 10 <sup>e</sup>          | 344 (270)                               | 66%: $\chi^2 = 38.36$ , $p = 0.0003$  | −0.63 (−0.90, −0.35)                        | $z = 4.44$ , $p < .001$ |
| Distress <sup>m</sup>        | n = 4 <sup>f</sup>           | 173 (133)                               | 39%: $\chi^2 = 6.54$ , $p = 0.16$     | −0.91 (−1.20, −0.61)                        | $z = 6.01$ , $p < .001$ |
| Disability <sup>n</sup>      | n = 5 <sup>g</sup>           | 209 (152)                               | 0%: $\chi^2 = 4.7$ , $p = 0.58$       | −0.77 (−0.97, −0.57)                        | $z = 7.63$ , $p < .001$ |
| Quality of life <sup>o</sup> | n = 2 <sup>h</sup>           | 87 (70)                                 | 0%: $\chi^2 = 1.07$ , $p = 0.77$      | 0.38 (0.08, 0.67)                           | $z = 2.51$ , $p < .01$  |

<sup>a</sup> Andersson et al. (2012), Johansson et al. (2013), Johnston et al. (2011), Newby et al. (2013), Paxling et al. (2011), Robinson et al. (2010), Titov et al. (2009), Titov et al. (2011).<sup>b</sup> Andersson et al. (2012), Bell et al. (2012), Berger et al. (2013), Johnston et al. (2011), Newby et al. (2013), Paxling et al. (2011), Robinson et al. (2010), Titov et al. (2009), Titov et al. (2010), Titov et al. (2011).<sup>c</sup> Berger et al. (2013), Johnston et al. (2011), Titov et al. (2010), Titov et al. (2011).<sup>d</sup> Johnston et al. (2011), Titov et al. (2010), Titov et al. (2011).<sup>e</sup> Andersson et al. (2012), Berger et al. (2013), Johansson et al. (2013), Johnston et al. (2011), Newby et al. (2013), Paxling et al. (2011), Robinson et al. (2010), Titov et al. (2009), Titov et al. (2011).<sup>f</sup> Newby et al. (2013), Robinson et al. (2010), Titov et al. (2009), Titov et al. (2011).<sup>g</sup> Johnston et al. (2011), Newby et al. (2013), Robinson et al. (2010), Titov et al. (2009), et al. (2011).<sup>h</sup> Anderson et al. (2012), Paxling et al. (2011).<sup>i</sup> Andersson et al. (2012), Bell et al. (2012), Paxling et al. (2011).<sup>j</sup> GAD-IV, Generalized Anxiety Disorder Question 7 Item Version, Generalized Anxiety Disorder Questionnaire IV.<sup>k</sup> Penn State Worry Questionnaire.<sup>l</sup> Beck Anxiety Inventory.<sup>m</sup> Patient Health Questionnaire 9 Item Version, Beck Depression Inventory II.<sup>n</sup> Kessler Distress Scale.<sup>o</sup> Sheehan Disability Scale, WHO Disability Assessment Schedule version 2.<sup>o</sup> Quality of Life Inventory.

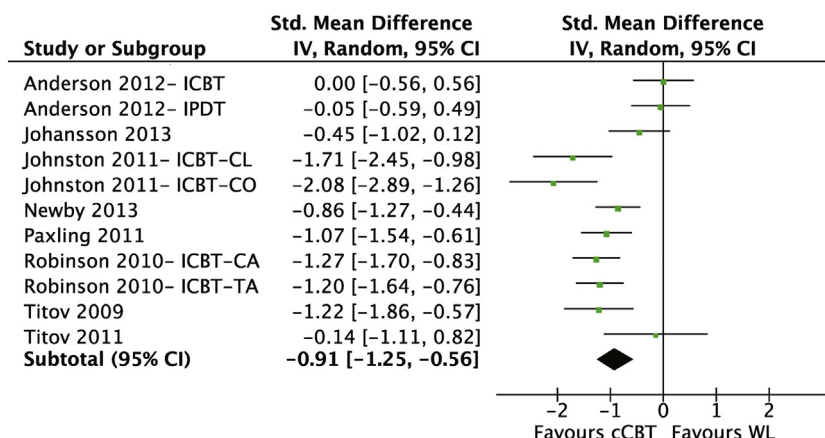
anxiety disorder in comparison to waiting-list. Specifically, regarding GAD symptoms a significant post-treatment effect was found for participants both across the studies included and the various interventions, compared to the waiting-list control participants. A similar picture is revealed for pathological worry, a central construct in generalized anxiety disorder, where participants in the active treatment yielded a large post-treatment effect compared to the outcomes from the participants in the waiting-list.

Participants in all cases had a DSM diagnosis of GAD prior to treatment and robust and usual post-treatment measures for GAD and pathological worry were employed to assess outcomes (GAD, GAD-Q-IV and PSWQ). With this in mind, the data from the meta-analysis supports the efficacy of internet-delivered treatments for generalized anxiety disorder compared to waiting-list controls. The large effect size reported is similar to the post-treatment outcome from face-to-face studies of GAD where a waiting-list control groups were also used. For instance, Cuijpers et al. (2014) report a post-treatment outcome based on 38 comparisons (from 28 studies) of  $d = 0.84$ .

The evidence from our analysis supports the efficacy of internet-based disorder-specific (4 studies) and transdiagnostic treatment protocols (7 studies) and those that use CBT-based treatment protocols (9

studies). The evidence is limited for psychodynamic therapy, indeed one of the studies (Andersson et al., 2012) had a rather unexpected improvement in the waiting list.

Although the current meta-analysis did not include a comparison with face-to-face CBT studies, it is encouraging to note that outcomes for pathological worry in patients with GAD could possibly be similar to what has been reported in the face-to-face CBT literature. The evidence supports CBT as a highly effective treatment on symptoms of pathological worry associated with generalized anxiety disorder (Covin et al., 2008). Hanrahan et al. (2013) analyzed studies that sought to address this primary symptom of GAD and therefore those that included the PSWQ as a primary outcome measure. The study of cognitive therapy versus a waiting-list control reported a large post-treatment effect size  $d = 1.81$  (Hanrahan et al., 2013). In comparison, the present meta-analysis shows a smaller effect for pathological worry as measured by PSWQ ( $d = -0.74$ ) across the studies and for CBT-based interventions only ( $d = 0.87$ ); however these effects can be considered large (Cohen, 1988). It is important to bear in mind that the face-to-face studies are likely to have higher GAD symptom presence and lower levels of initial symptom heterogeneity; both of which Cohen's  $d$  is sensitive to. Similarly, the recent paper by Cuijpers et al. (2014), based on 20 studies

**Fig. 3.** Forest plot: GAD.



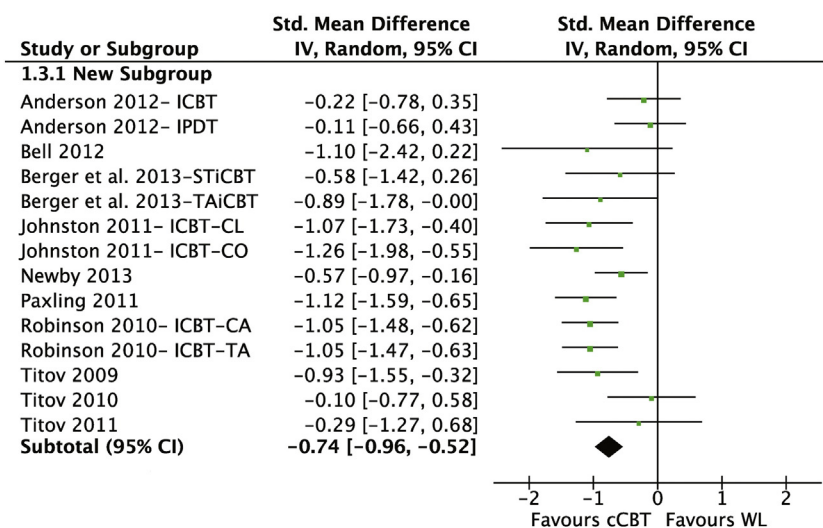


Fig. 4. Forest plot: Worry.

reported a post-treatment vs. control group effect size of  $d = 0.95$  for pathological worry. It seems that face-to-face may have a stronger impact on pathological worry, although this may be confounded by the fact that many face-to-face interventions actually take more distressed people so they have more space to improve.

### 7.1 Comorbid depression

It is not unusual to find depression as a significant comorbidity with generalized anxiety disorder (Kessler et al., 2005b). The present study found a significant positive shift in depression symptoms from pre- to post-treatment in comparison to waiting-list controls  $d = 0.63$ . This effect is similar to that found for various psychological treatments for depression in general (Cuijpers et al., 2011); for instance, an analysis of 215 comparisons based on 147 studies for the psychological treatment for depression vs. a control group found an overall effect of  $d = 0.66$ , and similar to the present analysis heterogeneity was moderate to high. More particularly, based on 94 comparisons from 75 studies of cognitive-behavioral therapy for depression in adults vs. a control group yielded an effect size of  $g = 0.71$  (Cuijpers et al., 2013). Interestingly, in both of these meta-analyses when the authors adjusted for publication bias, effects returned decreased to  $d = 0.53$  and  $g = 0.53$  respectively. Another recent meta-analysis for psychological treatments for GAD, that included a small number ( $n = 5$ ) of internet-delivered treatments demonstrated an effect size of  $g = 0.71$  for depression

post-treatment compared to a control group (Cuijpers et al., 2014). It would seem that in addition to psychotherapy (face-to-face and internet-delivered) having a positive impact on symptoms of generalized anxiety disorder it also has a significant positive impact on comorbid depression that may have existed in relation to primary symptoms. Additionally, impact on depression was not confounded by studies that had mixed anxiety and depression participants.

### 7.2 Psychological distress and quality of life

The current study was able to analyze the results of the Kessler-10 (K-10) measure (Kessler et al., 2003) from 4 studies and demonstrated a significant improvement ( $d = -0.91$ ) in post-treatment distress in comparison to the waiting-list controls. Anxiety, generalized anxiety disorder, as with all mental health difficulties can cause significant distress to persons and therefore realizing a significant reduction in comorbid distress is a positive result for internet-delivered treatments.

More particularly, generalized anxiety disorder can cause serious disability in one's life. The Sheehan Disability Scale (Sheehan, 1983) was employed by five of the CBT-based studies in the current meta-analysis and demonstrates significant post-treatment effects ( $d = -0.77$ ). The results on a quality of life measure used by 2 studies also confirmed a positive and significant post-treatment effect ( $d = 0.38$ ) in the current study. These findings are important given the deleterious effects that GAD can have on peoples general functioning and well-being (Wittchen, 2002).

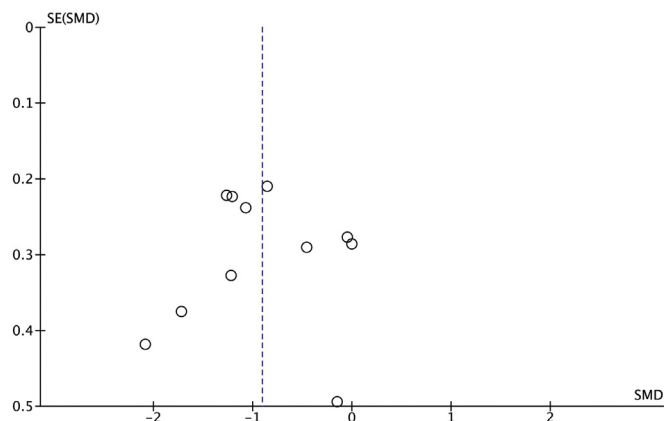


Fig. 5. Funnel plot: GAD.

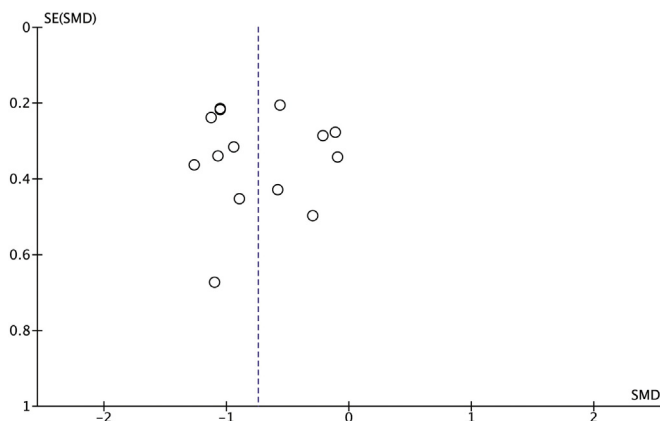


Fig. 6. Funnel plot: Worry.

### 7.3 Limitations

The paper can report a number of potential limitations. First, the number of studies included is not very high. Although in defense, methodologically the studies are of high quality. Second, with the data, we could not perform any long-term follow-up to assess maintenance of gains post-treatment. Third, the main findings and secondary analysis need to be interpreted with caution as the number of study samples are small, particularly, quality of life, disability, and distress. A further limitation is the potential publication bias as demonstrated by the forest plot for GAD. Although we could not complete such a comparison, Cuijpers et al., 2014 showed that self-rated assessments in GAD has lower effect sizes compared to clinician administered instruments. Including studies which had more than one control group in the meta-analysis is not ideal due to shared variance which may have affected results slightly. Lastly, it is generally considered sufficient to establish the efficacy of an intervention against a no-treatment control, but future research could incorporate comparison against a realistic active control to measure further the effects of the intervention for GAD symptoms. In addition, waiting list controls are limited in the period of follow-up meaning that such analysis of the intervention may be overstated. Caution is advised regarding the results as the data is limited and highly heterogeneous, but revealing of what future research might be needed.

### 7.4 Future research

The results are encouraging for the use of internet-delivered treatments for GAD. The pool of published studies is still small by comparison to, for example, studies on depression (Richards & Richardson, 2012), consequently more research in the area would help to build the empirical foundations for the use of internet-delivered interventions for GAD. There is a greater weight of CBT-based protocols than other therapeutic orientations and therefore future research could include greater numbers of investigations employing varying theoretical approaches. The limited number and variety of studies alongside small sample sizes means that there are lots of variables that could not be controlled for which may have a significant impact on outcomes. Future studies could explore these variables of internet-delivered treatments for GAD such as the user experience, supporter function, and the possible active ingredients including the technological tools and features regarding the presentation of content. Also as we were unable to conduct any analysis of maintenance of gains it would be important that studies include follow-up and report on the results. In addition, the data did not permit us to conduct subgroups analysis for type of intervention, support type, dropout and it is recommended that future research might consider these.

## 8. Conclusion

The paper aimed to systematically review and analyze all published studies of internet-delivered treatments for generalized anxiety disorder. Significant post-treatment gains are established for generalized anxiety and symptoms of pathological worry. Results are on a par with face-to-face literature regarding the efficacy of CBT for generalized anxiety disorder. In addition, we observed significant decreases in several comorbid behavioral health difficulties including depression, distress and disability. Lastly, while the results are promising and encouraging for internet-delivered interventions for generalized anxiety disorder further research is needed, especially to establish a more robust empirical foundation for their effects, to examine other theoretical approaches apart from CBT, to learn more about how we can effectively deliver treatment, to examine follow-up for maintenance of gains, and explore in more detail subgroups analysis such as differences in effects for intervention types, support types offered, and retention of participants.

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