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A meta-analysis of cognitive therapy for worry in generalized anxiety disorder

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HIGHLIGHTS

- Cognitive therapy was found to be effective in reducing worry when compared with non-therapy controls.
- The magnitude of effects was greater than previously found.
- There was weaker evidence that cognitive therapy was superior to alternative non-CT therapies.
- 57% of participants were classed as recovered following cognitive therapy.

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ABSTRACT

We report a meta- and primary data-analysis investigating the efficacy of cognitive therapy (CT) for pathological worry in adults with GAD that includes an analysis of primary data not reported in previous meta-analyses. Eligible studies included those whose participants met the criteria for a diagnosis of GAD and those that used the PSWQ as an outcome measure. All eligible studies used a randomized controlled design. Analyses included a random-effects meta-analysis of between-study effect sizes and hierarchical linear models of both within study change over time and primary recovery data. The results show that CT was effective in reducing pathological worry when compared with non-therapy controls ($d = 1.81$), and gains were largely maintained at follow-up. The magnitude of effects reported was larger than previously found, suggesting an increased efficacy of newer forms of CT. However, we found weaker evidence to suggest that CT for pathological worry was superior to non-CT treatment controls ($d = 0.63$). Analysis of primary recovery data revealed that 57% of participants were classed as recovered at 12 months following CT, and CT had significantly better recovery rates than all other comparison treatments at post-treatment and 12-month follow-up. These findings support the increasing efficacy of CT as a treatment for GAD. However, CT interventions still need further refinement to help a greater proportion of sufferers achieve recovery.

Contents

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1. Introduction

GAD is one of the most common anxiety disorders seen in primary care with a current prevalence rate of between 3.7% and 8%, and a 12-month prevalence rate of 10.3% (Holaway, Rodebaugh, & Heimberg, 2006). It is a pervasive condition with sufferers often reporting a duration of longer than 20 years; relapse rates are also high at over 50% (Holaway et al., 2006). GAD is characterized by excessive anxiety and pathological worrying, and is often comorbid with major depression (Davey, 2008a; DSM-IV-TR, 2000; Stein & Heimberg, 2004). Excessive anxiety and worry (apprehensive expectation) is the definitive feature of GAD and must be present in about 2 or more domains of activities and occur on more days than not for 6 months or more for its diagnosis (DSM-IV-TR, 2000). Worrying in GAD is also perceived as difficult to control and is associated with emotional discomfort (Davey, 2006; DSM-IV-TR, 2000; Holaway et al., 2006). Consequently, interventions such as cognitive therapy (CT), which target these key debilitating features of GAD and reduce worrying to within the normative range, are regarded as clinically important and need to be identified (Covin, Ouimet, Seeds, & Dozois, 2008; Waters & Craske, 2005).

1.1. Cognitive therapy (CT) for GAD

Arguably, CT describes a class of psychotherapeutic approaches that include cognitive methods, often accompanied with associated behavioral techniques, to modify maladaptive cognitions (i.e. thoughts, beliefs and images) that are considered to maintain psychopathologies, with current CT approaches tracing their roots to the pioneering work of Aaron Beck (e.g. Beck, 1976). We focus on CT in this article rather than on the wider and more heterogeneous category of cognitive–behavioral therapy (CBT), which also includes behavioral therapies not aimed at necessarily changing cognitions. Furthermore, we adopt an inclusive definition of CT, considering it to encompass any psychotherapeutic approach that is founded on a theory in which cognitions play an important role and that includes at least some techniques aimed at modifying these cognitions or the client's/patient's relationship to them. Note that, by this definition, CT can also include behavioral techniques (e.g. activity scheduling in Beck's CT for depression), but does not include therapies that solely comprise behavioral techniques (e.g. applied relaxation administered on its own).

CT is one of the most widely evaluated and utilized forms of psychological treatment for GAD (Davey, 2008b) and has been recorded as an empirically supported intervention for the disorder (Chambless & Ollendick, 2001; NICE, 2011). However actual recovery rates, such as those found by Fisher (2006) of between 36% and 50%, imply that CT/CBT interventions are still limited in their efficacy (Borkovec & Ruscio, 2001; Fisher, 2006). Additionally, when the efficacy of CT for GAD has been compared to its efficacy in treating other anxiety disorders, outcomes have been modest (Brown, Barlow, & Liebowitz, 1994).

A number of cognitive models and CT approaches specifically designed to understand and ameliorate excessive worrying have emerged since GAD was recognized as independent in the *DSM-III-R* (APA, 1987). Each of these models attempts to capture important aspects of the beliefs, attitudes and thought patterns associated with pathological worrying in GAD, but they differ by placing emphasis on different cognitive determinants of worrying in GAD. Most of these approaches have evolved out of specific theories of the causes of pathological worrying, and have developed interventions designed to target key features of pathological worrying as detailed in these theoretical approaches.

First, the cognitive avoidance model developed by Borkovec and Costello (1993) proposes that worry operates as a form of avoidance – especially avoidance of emotional processing – and is maintained in part, through positive beliefs about worrying (Borkovec, Ray, & Stober, 1998; Koerner & Dugas, 2006; Sibrava & Borkovec, 2006). The therapy protocol derived from the model by Borkovec et al. comprises a variety of components including the identification of and exposure to those cues that are perceived as threatening and routinely avoided, training to respond to anxiety with relaxation techniques, and cognitive restructuring (Borkovec, 2006; Borkovec, Newman, Pincus, & Lytle, 2002). Based on the theory that relationship difficulties and failure to process uncomfortable emotions may be contributing to the maintenance of worry, components that address these factors have recently been added (Borkovec, 2006; Newman, Castonguay, Borkovec, Fisher, & Nordberg, 2008; Newman et al., 2011). In addition, Newman and Llera (2011) have extended an avoidance view of pathological worry in GAD by arguing that worry does not necessarily act to avoid negative emotional experiences per se, but through a negative contrast effect acts to avoid further increases in negative affect to future threats and challenges (Llera & Newman, 2010). This research has given rise to a number of new interventions designed to target avoidance of emotion in GAD and which are currently at various stages of testing. These include interventions addressing interpersonal and emotional processing (Newman et al., 2008), mindfulness-based CT for GAD (Roemer, Orsillo, & Salters-Pedneault, 2008), and emotion-regulation therapy for GAD (Mennin, 2006).

Secondly, one explanatory construct that has received theoretical support in seeking to establish why some individuals experience excessive worry and anxiety, is intolerance of uncertainty (IU). Individuals who experience high IU consider the possibility of a negative event occurring as unacceptable and threatening, irrespective of the actual probability that the event will occur (Carleton, Norton, & Asmundson, 2007) and IU can be defined as "a dispositional characteristic that results from a set of negative beliefs about uncertainty and its implications" (Dugas & Robichaud, 2007, p. 24). Essentially, the 'not knowing' about the outcome of a potential threat is a worry trigger (Birrell, Meares, Wilkinson, & Freeston, 2011) and it is IU that is believed to exacerbate the initial "what if?" questioning style exhibited in pathological worrying in GAD (Dugas, Gagnon, Ladouceur, & Freeston, 1998). CT derived from this model emphasizes countering IU by applying problem-solving techniques to those worries that can be addressed, reevaluating positive beliefs about worry, recognizing the role of intolerance of uncertainty in worry and encouraging behavioral exposure to uncertainty-inducing situations, and using imaginal exposure to deal with core fears, (Dugas et al., 1998; Dugas et al., 2010; Robichaud & Dugas, 2006).

Finally, the metacognitive model of worry developed by Wells (1995, 2010) and colleagues also tackles worrying directly and is unique in its inclusion of both positive and negative metacognitions in its explanation of pathological worry (Wells, 2006, 2010). According to this account the negative appraisal of worry (meta-worry) and negative beliefs about worry are both central to the development of pathological worrying in GAD (Wells, 1999). The derived intervention, called metacognitive therapy, is a form of CT that focuses on modifying these metacognitive beliefs and reducing the use of worry. This consequently helps clients to re-evaluate and develop new and adaptive metacognitive beliefs about worrying (Wells, 2006).

The emphasis in each of these prevalent models of worry in GAD is different, but it is likely that an effective model of the development and maintenance of excessive worrying will include much of what is suggested by each of these models. In the meantime, CT interventions for chronic worry in GAD have tended to be developed in relative isolation from each other and focused on addressing the cognitive factors central to individual worry theories.

1.2. Previous meta-analyses of GAD

Several meta-analyses have been conducted since GAD was first recognized as an independent disorder in 1987. In the past ten years there have been five meta-analyses that have looked at CT and CBT outcome studies for GAD. The earliest two of these Borkovec and Ruscio (2001) and Westen and Morrison (2001) found that CT and CBT were effective at reducing anxiety at post-treatment. In addition, Borkovec and Ruscio (2001) found that CT produced greater reductions in anxiety in comparison to placebo and non-CT treatments; was superior to no-therapy controls; was more effective if it included behavioral components; and produced post-treatment gains that were maintained over time. Conversely, Westen and Morrison (2001) did not find evidence to support the long-term efficacy of CBT (Borkovec & Ruscio, 2001). However, Aikens, Hazlett-Stevens, and Craske (2001) have criticized Westen and Morrison (2001) for their reliance on measures that do not capture change in pathological worry, and have argued that their conclusions are flawed as a result.

The importance of including a measure of the key diagnostic feature of GAD as an index of outcome when assessing the efficacy of CT or CBT has more recently been reflected in meta-analyses (Fisher, 2006; Gould, Safren, O' Neill Washington, & Otto, 2004). Both Fisher (2006) and Gould et al. (2004) have argued that the Penn State Worry Questionnaire (PSWQ) needs to be utilized if true symptom change in GAD is to be accurately assessed (Fisher, 2006; Gould et al., 2004; Startup & Erickson, 2006). Thus, in their meta-analyses both, Fisher (2006) and Gould et al. (2004) used multiple measures of anxiety, including the PSWQ. As in previous meta-analyses, Gould et al. (2004) found CBT to be significantly more effective than control groups in reducing symptoms of anxiety. Fisher (2006) looked at clinically significant change and found that although CT with behavioral components had higher rates of recovery at post-treatment and at follow-up compared to both applied relaxation and CT without behavioral elements, there was a high proportion of patients who do not achieve recovery. Therefore, the efficacy of CT in treating GAD is still limited (Fisher, 2006).

Covin et al. (2008) extend arguments for the inclusion of the PSWQ when assessing the efficacy of treatments for GAD by arguing for the sole use of the PSWQ to index outcome. They contend that analyses which average effects across multiple measures of anxiety dilute symptom change captured in pathological worry, which, they stress, is a separate construct from general anxiety or worry (Covin et al., 2008). Their 2008 meta-analysis, which is the most recent analysis to look specifically at CT for GAD, reflects previous findings: CT was more effective than no-treatment or placebo controls, while gains made were maintained over time. Interestingly, the results indicated that older adults do not respond as well to treatment. Comparisons to normative data found mean PSWQ scores at post-treatment and at follow-up to be considerably outside the clinical range for pathological worry.

Finally, two recent reviews of the effectiveness of CT across anxiety disorders report findings consistent with previous meta-analyses. Norton and Price (2007) found that CT for GAD was superior compared to no-treatment or placebo. Similar results were found by Stewart and Chambless (2009) who uniquely looked at the efficacy of CBT for anxiety disorders in clinical practice.

1.3. The current meta-analysis

As in the recent meta-analysis by Covin et al. (2008), the current meta-analysis focuses on the effect of CT on worry in the context of GAD. We decided not to widen the focus to also include anxiety and quality of life because (1) worry and anxiety have been shown to be different constructs with independent sources of variance (Davey, Hampton, Farrell, & Davidson, 1992), (2) from a theoretical standpoint being precise about the outcome variable should be of more help to those who wish to further develop theory, and (3) similarly from a clinical perspective precision is valuable, because CT clients are encouraged to develop specific goals, which for GAD are most likely to relate to reductions in worry, and therapists need to know which interventions are effective at addressing such goals.

The current meta-analysis has five unique features: (1) It extends Covin et al.'s analysis by comparing CT to non-CT treatments to assess the effectiveness of CT relative to other active treatments. (2) Although previous analyses have compared worry outcomes to normative data, this meta-analysis uses normative data from 2006 for comparisons (Startup & Erickson, 2006). These are the most recent normative data available for the English version of the PSWQ making them more relevant and reliable than was previously possible given that this represents an update of the normative data reported by Molina and Borkovec (1994). (3) The current review is the first meta-analysis that specifically examines the efficacy of CT for GAD to include data published since 2005. This represents a significant gap considering the burgeoning of interest in more specific CT interventions for GAD and has meant that the present review included nine additional studies since the meta-analyses carried out by Covin et al. (2008) and Fisher (2006). (4) We are the first to include an analysis that looks at the effects of different forms of CT over time using multilevel modeling. (5) Finally, we collected raw data from most of the studies that enabled us to do a unique analysis of predictors of recovery.

Specifically, the present analysis was carried out to investigate the efficacy of CT for pathological worry in adults with GAD, using a meta-analysis of pre–post data, a multilevel analysis of longitudinal

data, and an analysis of recovery rates using raw data. Based on the findings of previous analyses it was expected that in comparison to no-treatment controls CT would be significantly more effective at reducing symptoms of pathological worry, while based on findings from individual studies it was expected that CT would be moderately more effective than non-CT treatments, such as applied relaxation delivered on its own. It was hypothesized that these effects would be maintained over time and that comparison to normative data would show those treated with CT to be well outside the clinical range at post-treatment and at follow-up.

CT comprises a range of interventions and CT for GAD is no exception. When considering the latter, arguably three broad types of CT emerge: (1) forms of CT that primarily seek to change the content of cognitions thought to maintain GAD, for example, positive and negative beliefs about worry or cognitions relating to uncertainty, (2) 'third wave' interventions, such as mindfulness-based cognitive therapy, that aim to help people to develop a more accepting relationship with cognitions and other aspects of experience, and (3) therapies that combine CT with substantive components from other forms of therapy, including components from emotion-focused and interpersonal therapies, and motivational interviewing. In principle, it would be preferable to further divide these categories into more specific forms of CT (e.g. meta-cognitive therapy), given the clinical and theoretical value of precision, discussed above. However, the current number of studies in the literature prevents further, statistically meaningful sub-division.

2. Method

2.1. Identification and selection of studies

2.1.1. Literature search

Studies for inclusion in the current meta-analysis were located in a number of ways. Firstly, the databases PsychInfo, Web of Science, and Medline were searched for English language studies using keywords considered relevant, with the final search conducted in April 2010. Search terms included combinations of the following: *GAD, generalised anxiety disorder, generalized anxiety disorder, anxiety, cognitive, therapy, treatment, CBT, cognitive behavioral therapy, cognitive behavioural therapy, outcome, and efficacy.* These searches produced 804 articles, of which the abstracts of 90 were examined. Secondly, the reference lists of previous meta-analyses and retrieved articles were scanned for relevant studies. Finally, email addresses of published researchers from retrieved papers were compiled and 52 researchers were emailed and invited to send any unpublished data fitting the inclusion criteria. This invitation provided three papers: two of which were at the time under review (Newman et al., 2011; van der Heiden, Muris, & van der Molen, 2012) and one published in May 2010 (Wells et al., 2010).

2.1.2. Exclusion and inclusion criteria

Following these searches, studies were excluded on the basis of the following criteria: (a) treatments such as bibliotherapy, telephone, or computer-administered treatment, although important treatments, were considered too distinct to be meaningfully compared to face-to-face therapies, and were therefore excluded; (b) studies were excluded if subsamples of the data utilized represented data already included in the meta-analysis; and (c) studies which did not have the required statistics necessary for analysis (sample sizes, means and standard deviations for treatment and control groups) were excluded; four studies were excluded on this basis.

Within these limits, studies were included if they met the following inclusion criteria: (1) Studies were required to have included only those participants who met the criteria for a diagnosis of GAD outlined by the *DSM* since GAD was recognized as an independent disorder; that is in the *DSM-III-R*, *DSM-IV*, or *DSM-IV-TR*. This was to avoid samples being heterogeneous in terms of disorder, and to ensure that the main feature of GAD, namely chronic worry, was present in all participants. (2) Given the well documented evidence showing that CT for older GAD patients is less efficacious than for younger adults (Covin et al., 2008; Stanley, Beck, & Glassco, 1996; Stanley et al., 2003; Wetherell, Gatz, & Craske, 2003), only studies in which the majority of participants were between 18–65 years of age were included in order to avoid, as far as possible, samples being heterogeneous in terms of systematic differences in disorder chronicity and treatment type (Covin et al., 2008). This allows the results of the current meta-analysis to be more comparable to previous research on the effectiveness of CT for an adult population. (3) Given that our focus was on the effect of CT on worry in the context of GAD, only studies that contained a specific measure of worry were included; in practice this limited studies to those that employed the PSWQ, since no other measures that solely focused on worry were used to evaluate outcome. (4) To be included studies needed to examine the efficacy of CT, where CT was defined as any treatment which used cognitive techniques either in combination with, or without, behavioral or other techniques. For example mindfulness-based cognitive therapy (MBCT) was included in this definition, but not applied relaxation (AR). (5) Finally, to ensure that high quality data were included in the meta-analysis, only studies that used a randomized controlled design were selected (Barker, Pistrang, & Elliott, 2002). However two studies (Craigie, Rees, Marsh, & Nathan, 2008; Roemer & Orsillo, 2007) not contained in the initial meta-analysis, as they did not meet this latter criterion, were included in a subsequent, longitudinal analysis of follow-up data, since they contained such data.

2.1.3. Studies included

Applying these inclusion criteria resulted in the identification of 15 studies (plus two additional studies in the within-group analysis). This figure represents an additional nine studies in the meta-analysis, and an additional 12 in the within-group analysis, since the analyses by Covin et al. (2008). Participants' ages ranged from 18 to 65 in 15 out of 17 studies. One study (Westra, Arkowitz, & Dozois, 2009) allowed for the inclusion of participants over the age of 16; however data provided by the author confirmed that no participants were under 18 and only one participant was over 65. A second study (Wells et al., 2010) included two participants over the age of 65; however as this represented only 10% of the total sample the study was included. Table 1 provides a summary of sample characteristics.

2.2. Data analysis

The current analysis involved (1) a meta-analysis of between-group effect sizes (ESs) of PSWQ scores at post-treatment; (2) an analysis of longitudinal follow-up data for PSWQ scores; and (3) an analysis of raw data using 'recovery' as an outcome variable.

2.2.1. Between-group meta-analysis

Following recommendations by Lipsey and Wilson (2001) concerning the mixing of inappropriate groups in comparisons, it was decided to carry out two separate analyses in response to the different types of control conditions (non-therapy control, non-CT treatment control, and CT control) used in studies. As such, ESs corresponded to the standardized difference on PSWQ scores between those who received a target CT treatment and those in a particular control condition. Non-therapy controls comprised wait-list and no intervention control groups. Non-CT treatment controls comprised active therapies that did not meet our definition of CT; for example applied relaxation taught on its own. Finally, some studies included more than one recognized CT experimental condition. However, using multiple ESs from the same study can lead to certain studies influencing the overall population ESs disproportionately (Brewin, Kleiner, Vasterling, & Field, 2007; Lipsey & Wilson, 2001). Consequently, where more than one treatment condition included cognitive

Table 1
Summary of sample characteristics for studies included in the between, and within-group, analysis.

Sample characteristics	Composite data	
	Meta-analysis ($k=15$)	Within-group analysis ($k=17$)
n (overall)	785	824
n (CT)	503	542
Mean age (years)	39.07	39.17
Sex (% female)	71%	71%
Dropout rate (overall)	12%	13%
Dropout rate (CT)	10%	11%
Mean length of CT in hours	16.01	16.19
Comorbidity %	66%[a]	67%[b]
Mean GAD severity rating	5.64[c]	5.62[d]
Mean duration of GAD (years)	17.23[e]	16.52[f]

[a] Based on 9 studies (which included this data).
[b] Based on 10 studies.
[c] Based on 9 studies.
[d] Based on 11 studies.
[e] Based on 9 studies.
[f] Based on 10 studies.

components, the CT condition identified in the study as the experimental condition was treated as the target CT intervention and the CT comparison condition was labeled as a 'CT control group' (see Table 2 for details); as above, the ES corresponded to the standardized difference on PSWQ scores between the target and control groups.

Fifteen studies were included in the between-group analysis with a total of 19 ESs. When ESs were disaggregated according to type of control condition, each study contributed only one ES to each meta-analysis, with four studies contributing two ESs: one to each meta-analysis. Cohen's *d* (Cohen, 1988) was used to measure ESs for all analyses.[1] ESs were corrected for the known small bias that *d* has in small samples using the adjustment, *J*, described by Hedges (1981). To fit with convention ES signs were reversed, as recommended by Lipsey and Wilson (2001), such that a positive sign indicates that a treatment group did better. Forest plots depicting ESs and their 95% confidence intervals were constructed for each analysis. To check for publication bias funnel plots were produced and to see what difference the inclusion of 'missing' studies would make to the overall population effect size estimate a sensitivity analysis using methods proposed by Vevea and Woods (2005) was conducted. Most of the analyses were conducted using the *metafor* package for R (R Development Core Team, 2010; Viechtbauer, 2010); the publication bias analysis was conducted using Vevea and Woods' R code that accompanies Field and Gillett (2010). Real social science data have been shown to contain variability in effect sizes as the norm, which indicates variable population parameters (Field, 2003, 2005; Field & Gillett, 2010; Hunter & Schmidt, 2000). For this reason, and so that the results can be generalized beyond the studies included in the meta-analysis (Hedges & Vevea, 1998), a random-effects meta-analysis was used. A mixed model was used for moderator analyses. These models were decided on following recommendations by Lipsey and Wilson (2001) and Field and Gillett (2010). Moderator analyses were done using type of control group (CT, non-CT treatment, or non-therapy) as a categorical predictor and mean age as a continuous variable.

[1] E.g., (Mean PSWQ CT post-therapy − Mean PSWQ control post-therapy)/control post-therapy PSWQ standard deviation.

2.2.2. Longitudinal analysis

Within-group ESs for all CT conditions (including comparison CT conditions) were calculated only to examine the efficacy of CT in reducing pathological worry at post-treatment and over time. Follow-up data were included for all studies that provided these data, except one; follow-up data from Borkovec and Costello (1993) was not reported because a proportion of participants received additional therapy following CT that may have influenced follow-up outcome scores. As before, ES signs were reversed to fit with convention. ESs depicting the difference to control participants at baseline, post-therapy, and 6, 12 and 24 month post therapy were calculated as: (Mean control PSWQ pre-therapy − Mean CT PSWQ at time x)/pre-therapy control PSWQ *SD*. As such, each effect was expressed as the mean in the treatment group relative to control group PSWQ levels and variance pre-treatment. The comparison to pre-treatment controls is both pragmatic (most studies did not report follow-up data for control groups) and sensible (treatment itself is likely to affect PSWQ variation so the baseline *SD* is a sensible value to standardize the effect size).

To allow for comparisons between different forms of CT, the CT group was divided into three subgroups: (1) the 'CT subgroup', which comprised forms of CT that primarily seek to change the

Table 2
Effect sizes (*d*) in the between groups analysis $k=19$.

Study ID	Study	ES ID	CT treatment	Control type	Control	N	*d*
1	van der Heiden et al. (2012)	1[a]	MCT	Non-therapy	WL	81	1.42
		2	MCT	CT	IUT	121	0.68
2	Newman et al. (2011)	3	CT/IEP	CT	CT-SL	83	−0.17
3	Wells et al. (2010)	4	MCT	Non-CT	AR	20	2.57
4	Dugas et al. (2010)	5[a]	IUT	Non-therapy	WL	43	0.82
		6	IUT	Non-CT	AR	45	0.13
5	Westra et al. (2009)	7	MI-CT	CT	NPT-CT	76	0.45
6	Leichsenring et al. (2009)	8	CT_1	Non-CT	STPP	57	0.31
7	Roemer et al. (2008)	9[a]	ABBT	Non-therapy	WL	31	2.44
8	Rezvan et al. (2008)	10[a]	CT-IT	Non-therapy	NI	24	3.22
		11	CT-IT	CT	CT_2	24	−0.08
9	Zinbarg, Lee, and Yoon (2007)	12[a]	CT_3	Non-therapy	WL	18	2.25
10	Gosselin, Ladouceur, Morin, Dugas, and Baillargeon (2006)	13	CT_4	Non-CT	NST+	53	0.89
11	Dugas et al. (2003)	14[a]	Group CT-IU	Non-therapy	WL	52	1.23
12	Borkovec et al. (2002)	15	CT-SCD	CT	CT_5	46	0.27
13	Ladouceur et al. (2000)	16[a]	IUT	Non-therapy	WL	26	2.22
14	Öst and Breitholtz (2000)	17	CT_5	Non-CT	AR	33	0.31
15	Borkovec and Costello (1993)	18	CT_6	Non-CT	ND	37	0.83
		19	CT_6	Non-CT	AR	37	0.26

Note: MCT = metacognitive therapy; IUT = intolerance of uncertainty therapy; CT/IEP = CT and interpersonal and emotional processing therapy; CT-SL = CT and supportive listening; MI-CT = motivational interview and CT; NPT-CT = CT, pre-treatment; ABBT = acceptance-based behavior therapy; CT-IT = CT and interpersonal therapy; CT_1 = manualized CT; CT_2 = CT with behavioral components including applied relaxation; CT_3 = CT based on MAW package; CT_4 = CT and medication tapering; CT_5 = CT based on the cognitive theory of generalized anxiety (Beck, Emery, & Greenberg, 1985); CT_6 = CT developed by Borkovec and Costello (1993); CT-SCD = CT and applied relaxation combined with self-control desensitization; WL = wait-list; AR = applied relaxation; STPP = manualized short-term psychodynamic psychotherapy; NI = no intervention; NST+ = non-specific treatment and medication tapering; ND = non-directive therapy.
[a] Indicates effect sizes calculated using a non-therapy control comparison.

content of cognitions thought to maintain GAD, for example, positive and negative beliefs about worry, and cognitions relating to uncertainty; (2) the '3W subgroup', which comprised 'third-wave' forms of CT, such as mindfulness-based cognitive therapy, that aim to help people to develop a more accepting relationship with cognitions and other aspects of experience; and (3) the 'CT+ subgroup', which comprised interventions that combine CT with substantive components from other forms of therapy, such as combining CT with motivational interviewing. Further details can be found in Table 4. Finer sub-divisions were not made because the number of studies in each group would not have been statistically meaningful.

Although some studies had follow-up data at 24 months, this was not the case for all types of treatment, so only time points up to 12 months were included in the analysis. One of the problems with assimilating data from repeated time points is that time points are correlated, and therefore legitimate effects would be confounded with effects due to other factors such as placebo effects, shared factors, and the passage of time (Covin et al., 2008; Westen & Morrison, 2001). This can lead to an over-estimation of actual effects and makes results difficult to interpret (Westen & Morrison, 2001). Therefore, unlike previous attempts at this kind of analysis, we employed multilevel modeling and explicitly modeled between study variability in overall effects by including intercepts as a random effect, and also correlations between time points (by using a first order autoregressive covariance structure—see Field, Miles, & Field, 2012, for a relatively non-technical description). The model was built up hierarchically beginning with just the intercept, intercepts were then included as a random effect (to see if overall effects varied across studies), then time (post-intervention, 6 months, 12 months) was added as a fixed effect, then a first order autoregressive covariance structure was added for effects over time (which assumes that effects closer in time are more strongly correlated), then linear and quadratic effects of time were added, followed by the type of treatment as a fixed effect (as described above), and finally the interaction of treatment type with time was added. Each model was fitted using maximum likelihood estimation and compared using the change in the log-likelihood. The models were fitted using the lme() function in R (Bates & Maechler, 2010; R Development Core Team, 2010).

2.2.3. Analysis of clinical significance (recovery)

The raw data from studies included in the present meta-analysis were used to carry out an analysis of clinical significance. Authors with papers included in the present meta-analysis were contacted and invited to provide scores on the PSWQ for participants included in these studies, at pre, post, and follow-up testing moments for all treatment conditions. Of the 17 studies included in the meta-analysis, the raw data from 12 studies were made available by authors for inclusion in the further analysis (for studies included in this analysis see Table 4).

Raw recovery data from the 12 studies were analyzed using a multilevel model based on the binomial distribution implemented in R using the lmer() function. Multilevel models are a useful way to analyze clinical data from multiple cites because it is possible to model the fact that data within studies will be more correlated than data from different studies. In addition, this type of analysis does not require a balanced data set to estimate parameters (Field & Wright, 2011).

The individual and the source of the data (i.e., the study) were treated as random effects within the model. The outcome was whether the client was classified as recovered (yes or no), and the fixed effect predictors were the type of treatment (non-therapy control, non-CT treatment control, CT control, and CT) and time (post-treatment, 6 month follow-up, and 12 month follow-up). Recovery was determined using Fisher's (2006) standardized criteria for recovery on the PSWQ (reliable change index≥7, cut-off point≤47 for functional distribution) using criterion (c) from Jacobson and colleagues' (Jacobson, Follette, & Revenstorf, 1984; Jacobson & Truax, 1991) methods for determining a cut-off point. The general analysis was as follows: fit a baseline model in which intercepts were allowed to vary across studies and individuals (this models differences in overall recovery rates across clients and studies); add fixed effects to the model; add a term allowing the slope for treatment to vary across studies (this parameter models the variability in treatment effects across studies); and finally add a term allowing for the effect of treatment over time (i.e. the slope of the growth curve) to vary across individuals.

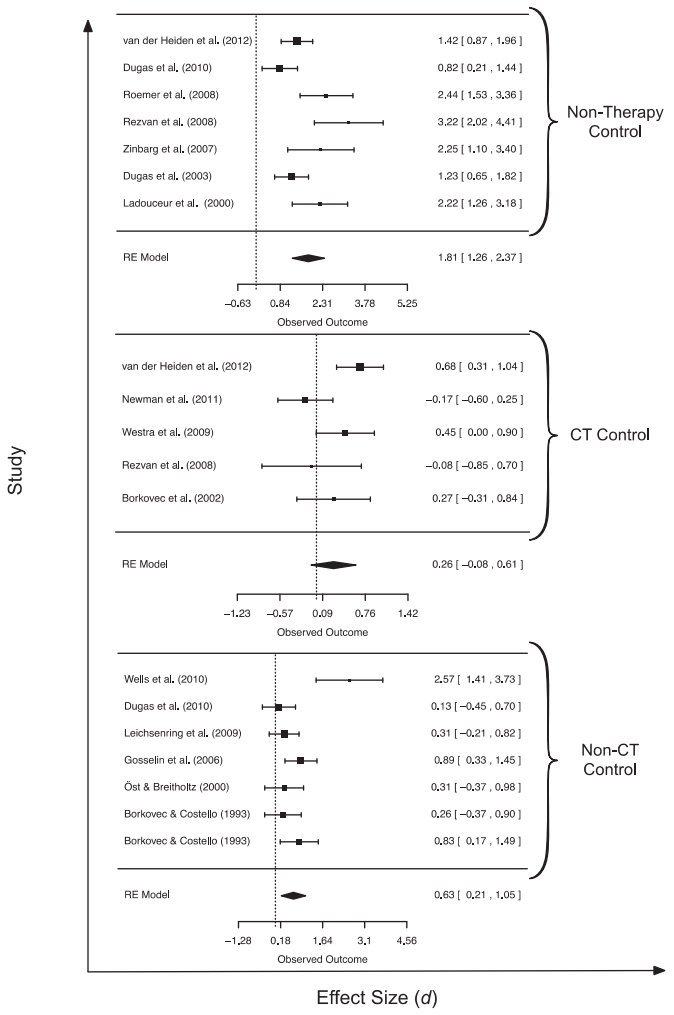

Fig. 1. Forest plots of effect sizes and 95% confidence intervals for the three between-group meta-analyses.

3. Results

3.1. Between-group analysis

Table 2 depicts all studies included in the between-group analysis, effect size ID, treatment types, control types, sample sizes and ESs. The population effect size estimate for CT compared to controls ($k=19$) was large, $\hat{d}=0.93$ (CI_{95}: 0.59, 1.27), and had a highly significant associated z score ($z=5.39$, $p<.0001$). Heterogeneity was significant ($Q(18)=100.69$, $p<.0001$) indicating significant variance in the distribution of ESs ($\tau^2=0.44$, $I^2=82.12\%$). A moderator analysis was carried out, which revealed that type of control group was a significant predictor, $b=-0.56$ (-0.92, -0.19), $Q(1)=8.97$, $p=.0027$ and reduced the effect size variability ($\tau^2=0.33$). In light of this moderator effect, separate analyses were conducted for the three types of control group.

3.1.1. CT compared to non-therapy controls

This analysis included the studies from Table 2 for which control type is non-therapy. The effect sizes are shown in the forest plot in Fig. 1 (top). Exploratory data analysis did not reveal any outliers. The population effect size estimate for CT compared to non-therapy controls ($k = 7$) was large, $\hat{d} = 1.81$ (CI_{95}: 1.26, 2.37), and highly significant ($z = 6.37$, $p < .0001$). Heterogeneity was significant ($\tau^2 = 0.38$, $Q(6) = 21.12$, $p = .0017$) indicating significant variance in the distribution of ESs.

3.1.2. CT compared to CT controls

This analysis included the studies from Table 2 for which control type is CT. The effect sizes are shown in the forest plot in Fig. 1 (middle). The population effect size estimate for CT compared to CT-therapy controls ($k = 5$) was small, $\hat{d} = 0.26$ (CI_{95}: −0.08, 0.61), and non-significant ($z = 1.49$, $p = .137$). Heterogeneity was significant ($\tau^2 = 0.09$, $Q(4) = 10.14$, $p = .038$) indicating significant variance in the distribution of ESs.

3.1.3. CT compared to non-CT treatment controls

This analysis included the studies from Table 2 for which control type is non-CT treatment. The effect sizes are shown in the forest plot in Fig. 1 (bottom). The population effect size estimate for CT compared to non-CT treatment controls ($k = 7$) was medium, $\hat{d} = 0.63$ (CI_{95}: 0.21, 1.05), and was significant ($z = 2.91$, $p = .0036$). Heterogeneity was significant ($\tau^2 = 0.21$, $Q(6) = 18.06$, $p = .006$) indicating significant variance in the distribution of ESs.

Exploratory data analysis revealed one outlier from Wells et al. (2010). This outlying study had a large raw effect size compared to the mean ($d = 2.57$, $v = .35$), which could be explained by the small sample of this study, where for each condition $n = 10$. Other possible reasons include the quality of treatments, or researcher allegiance. Without this study, the population effect size estimate for CT compared to non-CT treatment controls ($k = 6$) was reduced, $\hat{d} = 0.45$ (CI_{95}: 0.19, 0.71), but still significant ($z = 3.40$, $p < .001$). Heterogeneity became non-significant ($\tau^2 = 0.01$, $Q(5) = 5.69$, $p = .338$).

3.1.4. Moderator analyses

A meta-regression was carried out to explore whether mean age and length of CT were significant predictors of ES. Mean age was almost a significant predictor of effect sizes when a non-therapy, $Q(1) = 3.49$, $p = .06$, and non-CT treatment, $Q(1) = 3.84$, $p = .05$ (including Wells, but $Q(1) = 2.01$, $p = .157$, excluding the Wells study), control was used with older participants showing lower ESs, but not when a CT control was used, $Q(1) = 0.33$, $p = .57$.

Hours of CT were not a significant predictor of effect sizes, when a non-therapy, $Q(1) = 0.10$, $p = .747$, a CT, $Q(1) = 3.09$, $p = .08$, or non-CT treatment, $Q(1) = 0.81$, $p = .37$ (with Wells included), $Q(1) = 0.09$, $p = .77$ (without), control group was used.

3.1.5. Between-group data sensitivity analysis

Fig. 2 shows the funnel plots broken down by control group. Asymmetry in the plot representing ESs for the non-therapy control comparison indicated missing studies with low precision and negative effect sizes. Similarly, as you would expect with so few studies, funnel plots were highly asymmetric for the other two types of control group. As such, it is highly likely that the results have some publication bias. To quantify the likely effect of publication bias, a sensitivity analysis based on Vevea and Woods (205) was conducted which adjusts the population effect size estimate for moderate and severe one- and two-tailed selection bias. Table 3 shows the results of correcting for these forms of publication bias on the overall population effect size estimate, and the population effect size estimates for the analyses separated by the type of control group. In all cases correcting for publication bias, reduces the population effect size estimates (as you would expect). However, even correcting for severe forms of publication bias has relatively trivial effects on the

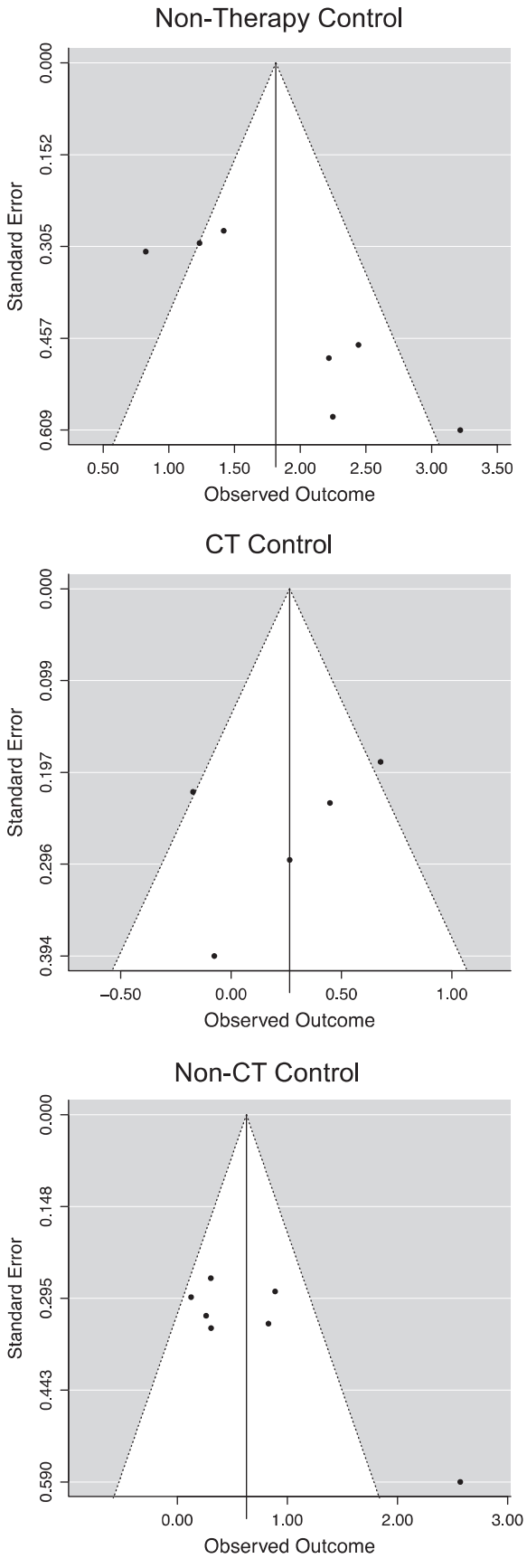

Fig. 2. Funnel plots of effect sizes for the three between-group meta-analyses.

Table 3
Population effect size estimates ($\hat{d}$) corrected for various forms of publication bias.

Analysis	Original estimate $\hat{d}$	One-tailed		Two-tailed	
		Moderate	Severe	Moderate	Severe
Overall	0.93	0.82	0.56	0.91	0.86
Non-therapy control	1.81	1.77	1.73	1.78	1.74
CT control	0.26	0.19	−0.77	0.24	0.20
Non-treatment control	0.63	0.55	0.47	0.59	0.57

population effect size estimates and certainly would not change our broad interpretations of them. These findings give us confidence that the estimated population effect sizes have not been severely inflated by unpublished studies not in the meta-analysis. The one exception was for the CT control group correcting for severe one-tailed publication bias, where this dramatically changed the size and direction of the population estimate. It is worth remembering that this correction is adjusting for severe publication bias, but nevertheless we should be aware that the effects in the CT control group would be affected by a specific pattern of severe publication bias.

3.2. Within-group analysis

Table 4 and Fig. 3 present within-group ESs for CT therapies at pre-therapy and at follow-up periods for all studies that included these data. Remember that positive effect sizes reflect *lower* PSWQ relative to control participants pre-therapy. For this analysis we planned to divide the CT group into CT, CT+ and 3W subgroups, as described earlier. However, of the few studies using 3W therapies only one had sufficient data, therefore, this analysis could compare only the CT and CT+ subgroups. Fig. 3 shows the pattern of results: pre-therapy effect sizes are close to zero (i.e. no difference between treatment and control groups), but post-therapy and at all subsequent time points effect sizes are positive and maintained at around a 2–3 standard deviation difference between treatment and control groups.

Overall effect sizes did not vary over studies, $\chi^2(1) = 2.14$, $p = 0.144$. There was a highly significant effect of effect sizes increasing over time, $\chi^2(1) = 28.66$, $p < .001$. The first-order autoregressive covariance structure did not significantly improve the fit of the model, $\chi^2(1) = 0.80$, $p = .372$, but was retained. The final model is summarized in Table 5. There were both significant linear and quadratic trends of time (see Table 5). There was no significant main effect of the type of treatment, or of the interaction between treatment type and time. Looking at Fig. 3, the significant quadratic trend unambiguously shows that both CT and CT+ subgroups show an initial improvement in PSWQ scores and that this improvement is maintained over time. Although CT+ treatments lead to a greater improvement, this is not significant (although it is worth remembering that only 3 studies used CT+). Table 4 also shows the model parameters when Wells et al. (2010) is excluded (this study was in the CT subgroup and had very large effect sizes). Excluding this study did make the differences between CT and CT+ subgroups more apparent (the model parameters increased for the crucial quadratic trend × intervention interaction, but they were still not significantly different to zero ($p = .163$)).

3.3. Recovery: raw data analysis

For this analysis, the CT, CT+ and 3W subgroups were collapsed together again into the CT group. Table 6 shows the number of individuals classified as recovered for each type of treatment at each time point across all of the studies. These frequencies seem to suggest that the percentage of recovered individuals is higher in the CT group especially compared to the non-CT treatment and non-therapy controls, and most notably at 12 month follow-up.

In the multilevel analysis the treatment fixed factor was dummy coded to compare all groups against the CT group (in keeping with our main hypotheses), and the time variable was treated as a continuous variable (i.e., a growth curve). The baseline model (random intercepts across studies as the only predictor), BIC = 1607.00, LL = −792.64, was a significantly worse fit of the data compared to the model including

Table 4
Effect sizes (d) in the within groups analysis at post-treatment and follow-up, $k = 17$. Note that follow-up effect sizes are calculated relative to post-treatment scores.

Study	CT sub-group	d at pre-treatment	d at post-treatment	d at 6 months	d at 12 months	d at 24 months
van der Heiden et al. (2012)[a]	CT	−0.25	1.76	1.70	–	–
Newman et al. (2011)[a]	CT+	0.05	2.03	2.12	2.01	2.25
Wells et al. (2010)[a]	CT	1.04	5.33	5.04	5.51	–
Dugas et al. (2010)	CT	−0.54	0.93			
Westra et al. (2009)[a]	CT+	−0.08	3.68	3.09	3.18	–
Leichsenring et al. (2009)	CT	−0.55	1.07	1.01	–	–
Craigie et al. (2008)[a, b]	3W	–	–	–	–	–
Roemer et al. (2008)[a]	3W	1.63	4.62	5.57	6.01	–
Rezvan et al. (2008)[a]	CT+	−0.08	2.56	–	3.02	–
Roemer and Orsillo (2007)[a, b]	3W	–	–	–	–	–
Zinbarg et al. (2007)[a]	CT	0.20	3.14	–	–	–
Gosselin et al. (2006)[a]	CT	−0.45	1.42	1.59	1.78	–
Dugas et al. (2003)	CT	−0.05	1.85	2.40	2.61	2.67
Borkovec et al. (2002)[a]	CT	0.22	2.36	2.52	2.63	2.36
Ladouceur et al.(2000)	CT	0.86	1.77	1.63	1.71	–
Öst and Breitholtz (2000)	CT	0.26	0.54	–	0.60	–
Borkovec and Costello (1993)[a]	CT	0.23	2.77	–	–	–

Note: 'CT' = forms of CT that primarily seek to change the content of cognitions thought to maintain GAD, for example, positive and negative beliefs about worry, and cognitions relating to uncertainty; '3W' = 'third-wave' forms of CT, such as mindfulness-based cognitive therapy, that aim to help people to develop a more accepting relationship with cognitions and other aspects of experience; 'CT+' = interventions that combine CT with substantive components from other forms of therapy, such as combining CT with motivational interviewing.

[a] Indicates studies included in the analysis of clinical significance.

[b] Indicates non-RCT studies; not included in between groups analysis.

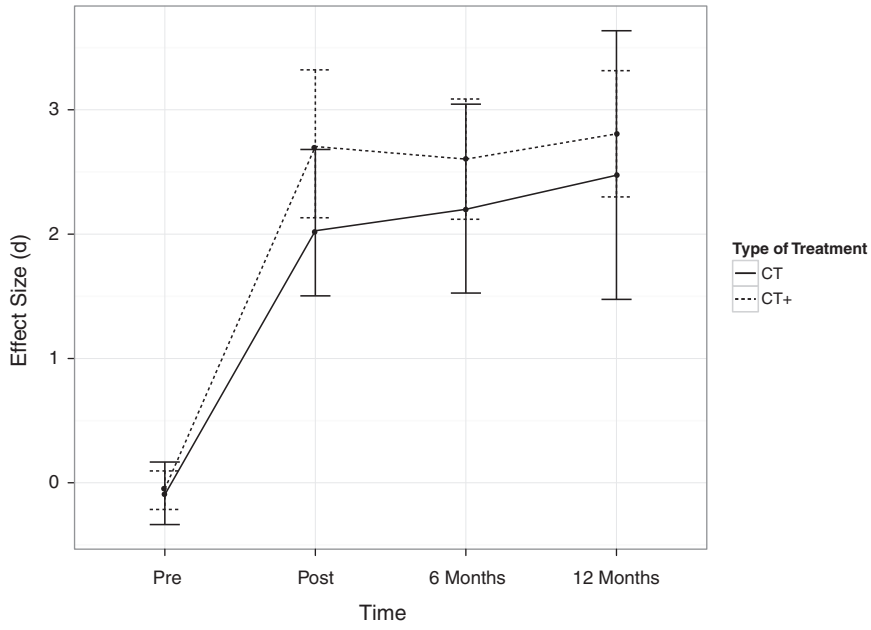

Fig. 3. Line graph showing the in effect sizes (therapy vs. control) for the change from baseline for different types of treatment at post-intervention and 6- and 12-month follow-up.

fixed effects (i.e. treatment, time and the treatment × time interaction), BIC = 1583.30, LL = −755.50, $\chi^2(7) = 74.27$, $p < .001$. In addition, allowing treatment effects to vary across studies did not significantly improve the fit of the model, BIC = 1641.7, LL = −748.56, $\chi^2(10) = 13.88$, $p = .179$, implying that recovery rates were comparable across studies. Given this non-significance, we did not retain this term but reverted back to the previous model (i.e., including random intercepts across studies and fixed effects only) and added a term that allowed the effect of time to vary across individuals. This term models individual differences in the effect of treatment over time by allowing the slope of the growth curve across the three time points to vary by individuals. Adding this term significantly improved the fit of the model, BIC = 1578.9, LL = −742.45, $\chi^2(3) = 26.10$, $p < .001$.

Table 7 shows the parameter estimates from the final model. The significance of these parameters suggests a significant main effect of CT compared to the non-therapy control ($p = .024$). However, more interesting is the interaction with time, suggesting that the growth curve for recovery differed significantly between the CT and non-CT treatment control group ($p = .007$). Interestingly, there was no significant effect of CT compared to the non-therapy controls also ($p = .795$). These findings imply that the pattern of recovery over time differed when comparing the CT group to some of the control groups; these patterns warrant further exploration.

To tease apart the effects of the interventions at each time point separate multilevel models were conducted for the data for the three different time points (post-treatment, 6 months and 12 months), including only treatment as a fixed factor. The basic analysis strategy was the same as before except that (obviously) time could not be used as a random effect. As such, intercepts were allowed to vary across studies, then the fixed effect of treatment was added, and then the slope of treatment was allowed to vary across studies. The random effect of treatment did not significantly improve the fit of the model for the post-treatment, $\chi^2(10) = 0.36$, $p = 1$, 6 month, $\chi^2(10) = 2.64$, $p = .989$, or the 12 month analysis, $\chi^2(10) = 7.34$, $p = .693$; therefore, this effect was not retained in any of the models. (These non-significant random effects imply that differences in recovery rates between treatment groups did not vary significantly across studies in the analysis.)

Table 8 shows the parameter estimates for the three separate models. In combination with the recovery percentages in Table 6, a very clear picture emerges from these models: with one exception CT had significantly better recovery rates than all other groups at all time points.[2] The exception was that CT had similar recovery rates to CT controls at 6-month follow-up.

Table 5
Parameter estimates for the hierarchical linear model.

	Estimate	Std. error	*t*	*p*
(Intercept)	1.54	0.292	5.27	.000
Time (linear)	5.66	0.486	11.65	.000
Time (quadratic)	−3.65	0.604	−6.04	.000
Treatment (CT vs. CT+)	0.32	0.630	0.51	.621
Time (linear) × treatment (CT+ vs. CT+)	0.03	0.932	0.03	.973
Time (quad) × treatment (CT+ vs. CT+)	−0.85	1.199	−0.71	.485
Wells et al. (2010) excluded				
(Intercept)	1.26	0.175	7.20	.000
Time (linear)	4.79	0.330	14.52	.000
Time (quadratic)	−3.04	0.427	−7.13	.000
Treatment (CT vs. CT+)	0.58	0.362	1.60	.137
Time (linear) × treatment (CT+ vs. CT+)	0.39	0.600	0.65	.522
Time (quad) × treatment (CT+ vs. CT+)	−1.14	0.794	−1.44	.163

4. Discussion

4.1. Summary of findings

In accordance with predictions made, in the between group analysis adults with GAD showed significantly lower levels of worry immediately

[2] This conclusion might seem odd given that the parameter estimate for CT compared to non-therapy at post-treatment was highly non-significant ($p = .984$). However, this *p* reflects the cell frequency for 'recovered' at this time point in the non-therapy group, which was 0. This incomplete information has massively inflated the standard error associated with the parameter estimate (see Field, 2009); hence it is non-significant. Nothing can be done to remedy this problem other than obtain data for that empty cell; however, the other parameters in the model are unaffected by this problem and you do not need a *p* value to tell you that a recovery rate of 46% is meaningfully better than one of 0%.

Table 6
Frequency, percentage and standardized error of clients recovered at each time point and for each type of treatment.

	Post-treatment		6 month follow-up		12 month follow-up	
Condition	Not recovered	Recovered	Not recovered	Recovered	Not recovered	Recovered
Non-therapy	53	0	13	3	23	4
	100%	0%	81.2%	18.8%	85.2%	14.8%
	3.3	−4.4	1.1	−1.4	2.1	−2.3
Non-CT treatment	56	16	55	16	48	17
	77.8%	22.2%	77.5%	22.5%	73.8%	26.2%
	1.5	−2.0	2.0	−2.4	2.0	−2.2
CT control	105	63	83	61	54	41
	62.5%	37.5%	57.6%	42.4%	56.8%	43.2%
	−0.2	0.3	−0.2	0.3	0.2	−0.2
CT	150	128	120	107	71	94
	54.0%	46.0%	52.9%	47.1%	43.0%	57.0%
	−2.0	2.7	−1.2	1.5	−2.2	2.4

following therapy in the CT group compared to those in non-therapy control group, with the difference representing a large population effect size. There was also evidence to suggest that therapy was more effective in the CT group than the non-CT treatment control group (with a medium effect size). Sensitivity analysis revealed the possibility of publication bias.

Turning to the longitudinal (within-group) analysis, findings supported the predictions: therapy in the CT group was effective at reducing pathological worry at post-treatment and these gains were maintained at follow-up. While no difference was apparent between subgroups of the CT group, there was a trend for the CT + subgroup to show larger effect sizes than CT subgroup, and it's possible that the lack of significance of this trend may be due to the small number of studies in the CT + subgroup. Finally, with respect to the analysis of the recovery data, the CT group (collapsing together the sub-groups CT, CT + and 3W) had significantly better recovery rates than all the control groups at all the time points, with the only exception being that the CT group had a similar recovery rate to the CT control group at 6-month follow-up.

4.2. Discussion of findings

4.2.1. Between-group analysis

The findings from our analysis of the post-treatment PSWQ scores are in keeping with previous meta-analyses in that they provide evidence that CT is a more effective treatment for worry in the context of GAD than non-therapy controls. Our findings also suggest that CT is more effective than the non-CT treatments that were used as comparison/control groups. Hence, unsurprisingly, they support the continued use of CT as a treatment for worry. The magnitude of the effect in the population found in the present study was larger than those found in previous meta-analyses. Given that the current analysis included more recent treatment trials than previous ones, this may reflect recent improvements in treatment design and/or implementation. That said, our effect size (and those in other meta-analyses) might be somewhat of an over-estimate, given the possibility of publication bias revealed by the sensitivity analysis.

The finding that length of treatment was not a significant moderator is consistent with results from Gould et al. (2004), and suggests that the treatment trials were generally providing a sufficient 'dose' of therapy sessions.

4.2.2. Longitudinal analysis

The results of previous meta-analyses are also reflected in our findings since therapy in the CT group significantly reduced worry at post-treatment, and this was largely maintained up to one year following treatment. With the exception of one effect size, pretest–posttest effect sizes indicated that people treated with CT had improved substantially at treatment completion. One possible explanation for the small outcome from Öst and Breitholtz (2000) could be that the quality of CT may not have been as high given that therapists for the CT condition were experienced behavioral, rather than cognitive, therapists.

4.2.3. Raw data analysis (clinical significance)

Clinical services are increasingly interested in the proportion of participants who recover following treatment (e.g. Gyani, Shafran, Layard, & Clark, 2011). Encouragingly, at post-treatment and 12 month follow-up, the CT group showed a higher recovery rate than both of the therapy control groups and the non-therapy controls, which is consistent with the possibility that CT is more effective at promoting recovery than other therapies. Moreover, recovery rates tended to continue to improve following CT. However, there are a number of cautions with regard to this analysis. Firstly, the analysis was based on the sub-sample of

Table 7
Parameter estimates for the hierarchical linear model.

	Estimate	Std. error	*z*	*p*
(Intercept)	−0.727	0.397	−1.83	.067
Treatment: CT vs. non-CT	−0.557	0.744	−0.75	.454
Treatment: CT vs. CT control	−0.271	0.465	−0.58	.561
Treatment: CT vs. non-therapy	−4.853	2.152	−2.26	.024
Time	0.287	0.203	1.41	.159
Treatment × time: CT vs. non-CT	−1.352	0.497	−2.72	.007
Treatment × time: CT vs. CT control	−0.538	0.334	−1.61	.107
Treatment × time: CT vs. non-therapy	−0.278	1.068	−0.26	.795

Table 8
Parameter estimates for the hierarchical linear models run separately for recovery data for the post-treatment, 6 month and 12 month follow-up.

	Estimate	Std. error	*z*	*p*
Post-treatment				
(Intercept)	−0.233	0.266	−0.88	.380
CT vs. non-CT Treatment control	−1.283	0.390	−3.29	.001
CT vs. CT control	−0.614	0.227	−2.709	.007
CT vs. non-therapy control	17.408	903.690	−0.02	.985
6 month follow-up				
(Intercept)	−0.136	0.204	−0.67	.506
CT vs. non-CT treatment control	−1.033	0.362	−2.86	.004
CT vs. CT control	−0.293	0.230	−1.27	.203
CT vs. non-therapy control	−1.342	0.673	−1.99	.046
12 month follow-up				
(Intercept)	0.327	0.226	1.45	.158
CT vs. non-CT Treatment control	−1.285	0.361	−3.56	.000
CT vs. CT control	−0.692	0.284	−2.44	.015
CT vs. non-therapy control	−2.306	0.635	−3.63	.000

papers for which raw data were available, and it may be that significant differences between therapies would not have been observed in the full sample, given the non-significant findings in the between group analysis. Secondly, the highest recovery rate observed following CT was only 57%, meaning that 43% of participants were still in the clinical range. Clearly then, there is substantial room to improve the clinical effectiveness of CT for worry in the context of GAD.

5. Theoretical and clinical implications

The issue of whether CT is in fact superior in treating chronic worry compared to other forms of therapy is a clinically important question given the proven efficacy of some other treatments, for example applied relaxation (AR) (Fisher, 2006). The between group analysis found a significant, medium-sized advantage for the CT group compared to non-CT treatments, and superiority was also observed in the recovery analysis. This supports the use of CT instead of other psychological treatments for worry in the context of GAD. That said, it is not possible to draw detailed conclusions regarding the effectiveness of CT compared to individual non-CT treatments, such as AR, because there were insufficient studies to allow the non-CT treatment control group to be meaningfully sub-divided.

Although a number of studies in the current analyses included comparisons to AR, only one study (Wells et al., 2010) found very substantial differences between these treatments; the effect size was, however, too outlying to be included in the between group analysis. While this large effect size is interesting, given that it may reflect a real superiority for meta-cognitive therapy (MCT) compared to AR, larger scale studies comparing the two are needed before any reliable conclusions can be reached. Nonetheless, some encouraging findings in support of MCT come from the study by van der Heiden et al. (2012), which saw very substantial reductions in pathological worry at post-treatment (see Tables 2 and 3).

The current meta-analysis found a large overall effect size when the efficacy of CT was compared to non-therapy controls ($d = 1.81$). Looking at recent meta-analyses, Gould, Otto, Pollack, & Yap (1997) found an overall ES of CBT for GAD of 0.91 when treatments which combined cognitive and behavioral elements ($n = 8$ treatment groups) were compared to control groups, and similarly Gould et al. (2004) found an overall ES of 0.90 when CBT ($n = 11$ treatment groups) was compared to controls. Borkovec and Ruscio (2001) compared 11 studies involving CBT for GAD and found an overall ES of 1.09 when CBT was compared to wait-list or no treatment controls. Finally, compared to control groups Covin et al. (2008) found an overall ES of CBT for GAD of 1.15 ($n = 7$ treatment groups), and 1.69 for the young adult group when studies were examined separately for younger and older adults. That the overall effect size in the current meta-analysis was found to be larger than was found in previous meta-analyses may possibly have theoretical implications. In explaining their larger effect size Covin et al. (2008) point to differences between changes in chronic worry captured by the PSWQ and smaller changes in anxiety captured by multiple measures in previous meta-analyses. However, this is unlikely to be the only factor influencing the outcome from the present research, given that the overall effect size is greater still than that found by Covin et al. (2008). Another possible explanation, also considered by Covin et al. (2008), is that the inclusion of very recent outcome studies that have investigated the efficacy of newer forms of CT may be influencing the overall effect size. Encouragingly, these newer treatments have some of the largest effect sizes, suggesting that they may be superior in their targeting of pathological worry. This finding has interesting theoretical implications for our understanding of GAD, for although some of these more recent treatments, such as MCT and CT-IU, tackle excessive worry, other recent treatments, such as CT-IT and ABBT, do not explicitly try to modify pathological worry (Davey, 2006; Fisher, 2006). Instead these treatments target either the proposed function of pathological worry, such as avoidance, or the factors associated with GAD, such as difficulties with emotional processing, interpersonal relationships or acceptance (Roemer & Orsillo, 2007). Despite the different foci of these approaches, that each appears to significantly reduce pathological worry suggests that differing models may be describing and addressing aspects of the disorder that are interconnected.

Koerner and Dugas (2006) have made a similar argument in their description of competing cognitive–motivational states. Their model attempts to explain how seemingly opposing processes may simultaneously be involved in the maintenance of pathological worry seen in GAD. Accordingly there may be several pathways to the same pathology, such that a change in one process leads to changes in other processes and characteristics of the disorder.

6. Limitations and recommendations

The results from the present study should be interpreted with caution owing to a number of limitations. First, although the inclusion of seven studies in the comparison of CT to non-therapy controls is comparable to other meta-analyses, this still represents a small number of studies. Small numbers of studies, and hence relatively small overall samples, mean that the likelihood of committing a Type II error is increased (Torgerson, 2003). Additionally, results are weakened due to the increased risk for sampling error, which may confound our findings (Petticrew & Roberts, 2006).

Second, several studies with small sample sizes were included in the present analysis. Future research would benefit from larger sample sizes in order to avoid sampling bias as well as the obscuring of real effects that can result from low power.

Third, although the high quality of the majority of studies in the current meta-analysis must be considered a strength, some studies failed to report key characteristics of their samples, such as GAD chronicity and severity, thereby limiting the possibilities of moderator analyses. In addition, the quality of a minority of studies was not always easy to determine, as information on therapist training (Rezvan, Baghban, Bahrami, & Abedi, 2008) and therapy adherence checks (Öst & Breitholtz, 2000; Rezvan et al., 2008) was not always reported. The reporting of such factors in future studies would benefit this field by allowing for more in-depth analysis of moderator variables, as recommended by Newman (2000).

Fourth, the inclusion of AR in the 'non-CT treatment control' group may mask the size of the advantage of CT approaches over non-CT therapies other than AR. Unfortunately, with the current small number of studies using non-CT treatment controls, it is not possible to examine this hypothesis.

The limitations just described highlight a need for further CT outcome studies for worry in the context of GAD. In particular, studies with larger sample sizes that use an AR comparison group are needed in order to fully ascertain whether, and to what extent, CT is more effective than AR. Such control groups have been particularly lacking in more recent CT efficacy studies, which have been concerned with examining how new versions of CT compare to more traditional CT. While the development of more effective forms of CT is vital, if it is to be considered the treatment of choice for worry in the context of GAD then CT must demonstrate superior efficacy than non-CT treatments, such as AR, which is arguably more cost effective because of the relative ease of delivery and lower clinician training burden.

7. Conclusions

The primary goal of this meta-analysis was to investigate the efficacy of CT for worry in adults with GAD. On the basis of our results it is possible to say with confidence that CT is effective at reducing worry, and that gains are largely maintained at follow-up. The current meta-analysis adds to previous research by including an additional nine studies since the analysis by Covin et al. (2008). Significantly,

the magnitude of the effect in the current analysis was larger when CT was compared to non-therapy controls than has previously been found, possibly providing evidence for the increased efficacy of newer forms of CT. These findings clearly have important clinical implications in that they support the use of CT as a treatment for worry in the context of GAD. Future research is also needed to test for differences between the efficacies of different forms of CT, if more effective forms of treatment are to be found. Finally, the fact that 43% of participants were not classed as recovered at 12 months following CT implies that we have more work to do in order to develop interventions that help a greater proportion of sufferers achieve recovery.

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