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Cognitive-Behavioral Interventions to Reduce Suicide Behavior

A Systematic Review and Meta-Analysis

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Suicide behavior is a serious clinical problem worldwide, and understanding ways of reducing it is a priority. A systematic review and meta-analysis were carried out to investigate whether Cognitive-behavioral therapies (CBTs) would reduce suicide behavior. From 123 potential articles, 28 studies met the entry criteria. Overall, there was a highly significant effect for CBT in reducing suicide behavior. Subgroup analysis indicates a significant treatment effect for adult samples (but not adolescent), for individual treatments (but not group), and for CBT when compared to minimal treatment or treatment as usual (but not when compared to another active treatment). There was evidence for treatment effects, albeit reduced, over the medium term. Although these results appear optimistic in advocating the use of CBT in ameliorating suicidal thoughts, plans, and behaviors, evidence of a publication bias tempers such optimism.

Keywords: *psychological therapy; suicidal behavior; CBT*

Suicide and suicide behavior are serious public health issues. Suicide is among the 10 leading causes of death in most countries, and for every suicide, it is estimated that there are more than 30 nonfatal episodes of self-harm (Gelder, Mayou, & Cowen, 2001). World Health Organization figures for 1999 indicate suicide rates of 11.8 per 100,000 for males and 3.3 per 100,000 for females, with global rates having increased over the last five decades. A U.K. survey in 2002 indicated that 4.4% of respondents reported that they had ever attempted suicide (Office for National Statistics, 2005).

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Kuo, Gallo, and Tien (2001) reported an incidence of 419.9 per 100,000 for suicide ideation and attempts in adults in the United States. Suicidal ideation is a common problem, with studies indicating a 1-year prevalence rate of between 2.3% and 5.6% of the adult population and a lifetime prevalence of 13% to 15% (Kerkof & Arensman, 2001). In an epidemiological survey of a community sample in the United States, 13.5% of the sample (respondents were between the ages of 15 and 54) reported lifetime suicidal ideation; 3.9%, a suicidal plan; and 4.6%, suicide attempts (Kessler, Borges, & Walters, 1999). The transition from ideation to suicide plan occurred in 34% and from plan to attempt in 72%, and 26% proceeded from ideation to an unplanned attempt. There is considerable variation in completed and attempted suicide when variables such as gender and age, as well countries and cultures, are factored in (Kerkof & Arensman, 2001).

Suicide behavior is associated with mental illness. Rates of suicide behavior vary among different diagnostic groups. In depression, there is an estimated 10.8% mortality rate from suicide (Wulsin, Vaillant, & Wells, 1999). Personality disorder is diagnosed in a third to a half of people who commit suicide (Foster, Gillespie, & McClelland, 1997). Suicide risk in schizophrenia is high; between nearly 5% and 10% of sufferers will eventually kill themselves, often near to illness onset (Caldwell & Gottesman, 1990; Palmer, Pankratz, & Bostwick, 2005). Suicidal ideation and suicide attempts are common, with as many as half of all patients with schizophrenia experiencing suicidal ideation at any point in time or having a history of attempts (Fenton, 2000; Fenton, McGlashan, Victor, & Blyler, 1997; Nieto, Vieta, Gasto, Vallejo, & Cirera, 1992; Tarrier, Barrowclough, Andrews, & Gregg, 2004). Similar or even higher rates have been reported for those with bipolar disorder (Chen & Dilsaver, 1996; Goodwin & Jamison, 1990).

It has always been a basic tenet of cognitive-behavioral therapy (CBT) that the efficacy and effectiveness of psychological treatments require rigorous evaluation. This tenet and the resulting evidence base have set CBT aside from other psychotherapies (Tarrier, 2002). The current focus on evidenced-based medicine is welcomed, within certain caveats, as a drive to improve clinical practice (Salkovskis, 2002; Sanderson, 2003). Randomized controlled trials are the established scientific method to minimize bias in evaluating treatment efficacy. For instance, design features such as randomization and blinding (masking) diminish bias although they do not guarantee freedom from it. Meta-analysis is a systematic approach to identifying, appraising, synthesizing, and combining the results of relevant studies to arrive at conclusions about a body of research and provide a secondary analysis of trial data that, owing to size and scale, allow conclusions to be made that would not be possible from the individual clinical trials (Rosenthal & Dimatteo, 2001; Stroup et al., 2007;

Thacker, 1988). Studies are typically included or excluded on the basis of preset criteria. However, there may still be considerable variation in the quality of the trial methodology even within the included studies. Investigating medical trials, Moher et al. (1998) found that trials with poorer-quality masking of allocation of treatments were associated with an increased estimate of benefit of 34% in a variety of different treatments in circulatory and digestive disease, mental health, obstetrics, and childbirth. This replicated a similar earlier finding of Schulz, Chalmers, Hayes, and Altman (1995), who reported 30% to 40% exaggerated estimates of treatment efficacy with inadequate concealment of randomization and assessment. Tarrier and Wykes (2004) found a significant negative correlation between the effect size in trials of CBT in the treatment of schizophrenia and scores on a measure of the quality of trial methodology, namely, the Clinical Trials Assessment Measure (CTAM). This consistent finding of an association with estimates of treatment benefit and clinical trial methodology emphasizes that it is important to take into account a quality of methodology measure, given that it will be an indicator of potential bias.

The aim of this article is to systematically review studies that evaluated a CBT or a treatment that contains cognitive-behavioral methods as a substantial part of that treatment, in an attempt to reduce suicide behavior. As such, it is aimed to complement more general recent systematic reviews on suicide prevention (Mann et al., 2005) and psychosocial interventions following self-harm (Crawford, Thomas, Khan, & Kulinskaya, 2007). We define *suicide behavior* as including completed suicides, suicide attempts, suicide intent and/or plans, and suicide ideation. We acknowledge that there is a considerable difference between thinking about suicide and a successfully completed suicide. However, we maintain that it is helpful to consider that suicide behavior lies on a continuum from ideation, through intent and planning, to action. Although not everyone will progress along this continuum, many will do so. Furthermore, suicide ideation in itself is undesirable and distressing and, therefore, a legitimate target for treatment. There is also the practical issue that completed suicide, although not uncommon, remains sufficiently infrequent to limit its usefulness as an outcome measure in treatment trials in spite of its obvious importance. Even in meta-analyses, there may be insufficient statistical power to distinguish treatment effects on completed suicide (Crawford et al., 2007). We have therefore chosen to investigate studies that had suicide behavior in any of its manifestations, proximal or distal to completed suicide, as a target for treatment. The general hypothesis to be tested was that CBT would significantly reduce suicide thoughts and behaviors in the experimental groups as compared to control groups (including waiting-list controls; treatment as usual [TAU]; or other treatments, such as supportive counseling). Furthermore, we investigated whether CBT would

have an immediate effect (i.e., within 3 months of treatment) and a more long-term effect (i.e., between 6 and 24 months after treatment).

Method

Search Strategy

The PsychInfo and Web of Science databases were searched for articles reporting clinical trials from 1980 using the following index items via Boolean search criteria: "suicide & therapy & cognitive OR behavioral*"; "CBT & suicide"; "CBT & self-harm"; "CBT & suicidal behavior"; "suicide & intervention"; "suicide & therapy." In addition, reference lists were examined for further articles, and hand searches were made in the most relevant journals (e.g., *American Journal of Psychiatry*, *Archives of General Psychiatry*, *Behavioural and Cognitive Psychotherapy*, *Behaviour Research and Therapy*, *Behavior Therapy*, *British Journal of Psychiatry*, *Psychological Medicine*, *Suicide and Life-Threatening Behavior*).

Inclusion Criteria

Studies were included if they were published in a refereed journal and if they included a treatment group that consisted of a form of cognitive, behavioral, or CBT or a substantial component of cognitive-behavioral, cognitive, or behavioral methods in the treatment; a control group as a comparison (such as TAU, no treatment, wait list, or another form of treatment); and any kind of self-harm or suicide behavior as an outcome measure.

Exclusion Criteria

Studies were excluded if they were case studies, clinical descriptions, reviews or discussion articles; if they did not include a control group (e.g., just pre- and posttreatment measures in an intervention group); if they were published before 1980; or if they were not published in English.

Evaluation of Trial Methodology: The CTAM

The CTAM was designed for assessing the quality of trials of psychological treatments in mental health (Tarrier & Wykes, 2004). Relevant design and methodological features were extracted from the CONSORT guidelines (Moher, Schultz, & Altman, 2001), a review of 25 trial assessment scales (Moher et al., 1995), and expert opinion. Individual features were differentially

weighted based on previous data on methodological characteristics that can influence outcome (e.g., Chalmers et al., 1981; Jadad et al., 1996; Juni, Altman, & Eggar, 2001; Juni, Witschi, Bloch, & Eggar, 1999; Kazdin & Bass, 1989; Marshall et al., 2000; Moher et al., 1998; Sterne et al., 2002). The resulting list had 15 items grouped into six areas of trial design: sample size and recruitment method, allocation to treatment, assessment of outcome, control groups, description of treatments, and data analysis. The CTAM showed good blind interrater agreement (.96), adequate internal consistency (Cronbach's alpha = .69), and excellent concurrent validity with three other scales devised for the generic assessment quality of trials (S. A. Brown, 1991; Chalmers et al., 1981; Jadad et al., 1996). The correlations of the scales with the CTAM scores were as follows: CTAM and Jadad et al. (1996), rho = .97, $p < .001$; CTAM and Chalmers et al. (1981), rho = .93, $p < .001$; CTAM and Brown (1991), rho = .79, $p < .001$. The CTAM has been used to assess clinical trials of CBT in schizophrenia (Tarrier & Wykes, 2004; Wykes, Steel, Everitt, & Tarrier, 2007) and the use of virtual reality in mental health treatments (Gregg & Tarrier, 2007). We have used the CTAM to assess the methodological quality of the studies included in the meta-analysis.

Statistical Analysis

A fully random effects model was used for all analyses because there was considerable heterogeneity in the variables of interest (Borenstein, Hedges, & Rothstein, 2007; Egger, Smith, & Phillips, 1997). Major sources of variability included the outcome measures, the type of cognitive therapy employed, the mode of delivery of the treatment, the number of sessions and/or hours of therapy, the age of the samples, and the focus of the study (suicide, self-harm, depression). Although the effects of CBT on suicide were examined within these subgroups separately, the studies comprising those subgroups were still diverse.

Hedge's *g* was used as the measure of effect size in all analyses because this measure controls for small sample sizes (Borenstein, 2006; Hedges & Olkin, 1985). In all cases, the effect sizes were negative because a positive outcome of therapy is denoted by less hopelessness and fewer suicidal thoughts and behaviors. In addition, 95% confidence intervals (CI) were calculated. Analyses were conducted with comprehensive Meta Analysis, Version 2.2.034 (Borenstein, Hedges, Higgins, & Rothstein, 2005).

Period of Analyses

Analysis was carried out on data reported at the end of treatment, defined as within 3 months of the termination of the treatment program. In studies that

included an intensive treatment program followed by a booster session, the termination of treatment was defined as being at the end of the intensive program. In other words, if a 12-month treatment program was in place, then the closest point available for the relevant measures to the ending time of treatment was included (i.e., Linehan, Armstrong, Suarez, Allmon, & Heard, 1991; Linehan et al., 2006; van den Bosch, Koeter, Stijnen, Verheul, & van den Brink, 2005; Verheul et al., 2003). Similarly, if treatment was an intensive 2-week in-house program, then measures closest to the ending of treatment and within 3 months of its ending were taken (e.g., Katz, Cox, Gunasekara, & Miller, 2004; Liberman & Eckman, 1981). The outcome variable that was most proximal to suicidal behaviors was used at this point. However, it should be noted that this included suicidal attempts, behaviors, plans, and thoughts (sometimes in composite form) together with hopelessness and satisfaction with life measures. Assessment after 3 months posttreatment was regarded as follow-up, and separate analyses were performed on follow-up data where studies reported these data solely or in addition to outcomes within 3 months of treatment termination.

Results

From the initial online search, 8,435 articles were identified. Of these, 123 were categorized as having suicide or self-harm as a target for treatment, and 8,312 were excluded because they failed to meet this criterion. From these 123 articles, 28 satisfied the inclusion criteria, through examination of the title and abstracts. In cases where there was any doubt, the complete article was read by all three coauthors, and a consensus decision reached. No further studies were identified by hand search. Studies were excluded because they were any of the following: case studies (n = 9); descriptive or discussion articles (n = 21); reviews (n = 14); follow-up articles of original studies (n = 2); secondary articles of original studies (n = 4); studies not involving CBT interventions (n = 13); studies where suicide behavior or a related construct was not the outcome (n = 2); studies that were not controlled (n = 29); and studies not in English (n = 1).

Study Characteristics

The studies and their characteristics are described in Table 1. The evaluation through clinical trials of CBT to reduce or prevent suicide behavior is a relatively recent phenomenon, with 18 of the 28 studies having been published since 2000, 8 studies in the 1990s, and 2 from the 1980s.

Table 1
Studies Included in the Meta-Analysis

Study	*N*	Problem Treated	Treatment vs. Comparison Group	Estimated Hour of Therapy / Number of Sessions	Most Proximal Outcome Variable to Successful Suicide	CTAM (Quality) Score	Data Type
G. K. Brown et al. (2005)	120	Suicide attempt	CBT vs. enhanced TAU	8.92 / 8.92	Suicide ideation	71	Cohort event data
Donaldson et al. (2005)[a]	39	Suicide attempt	Skills based vs. supportive counseling	11.66 / 7	Suicide ideation	51	*M*, *SD*, pre- and posttest
Evans et al. (1999)	34	DSH, personality disturbance	MACT vs. TAU	4.66 / 2.7	Suicide attempt, plan, potential, probable	56	Cohort event data
Katz et al. (2004)[a]	62	Suicide attempt, ideation	DBT vs. TAU	20 / 14	Suicide ideation	27	*M*, *SD*, pre- and posttest
Klingman and Hochdorf (1993)[a]	237	N/A: Students aged 12.5–13.5	CBT vs. none	10 / 12	Suicide attempt, plan, potential, probable	61	*M*, *SD*, pre- and posttest
Koons et al. (2001)	20	DSH/BPD	DBT vs. TAU	69.3 / 48	Suicide attempt, plan, potential, probable	66	*M*, *SD*, pre- and posttest
Lerner and Clum (1990)	18	Suicidal ideation	Problem solving vs. supportive counseling	15 / 10	Suicide ideation	52	*M*, *SD*, pre- and posttest
Liberman and Eckman (1981)	24	Suicide attempt	Behavior therapy package vs. insight-oriented therapy	32 / 8	Suicide attempt, plan, potential, probable	41	Cohort event and nonevent data
Linehan et al. (1991)	44	BPD, suicidal	DBT vs. TAU	182 / 104	Suicide ideation	48	Cohort event data
Linehan et al. (1999)[b]	28	BPD and drug dependency	DBT vs. TAU	156 / 104	Suicide attempt, plan, potential, probable	41	Independent group analysis, sample size, and *p*

(continued)

Table 1 (continued)

Study	*N*	Problem Treated	Treatment vs. Comparison Group	Estimated Hour of Therapy / Number of Sessions	Most Proximal Outcome Variable to Successful Suicide	CTAM (Quality) Score	Data Type
Linehan et al. (2006)	101	BPD, suicidal behaviors	DBT vs. community treatment	89 / 65	Suicide attempt, plan, potential, probable	88	*M*, *SD*, pre- and posttest
March et al. (2004)[a]	439	Depression	Fluoxetine alone vs. CBT alone vs. fluoxetine and CBT vs. placebo	13.75 / 11	Suicide ideation	79	*M*, *SD*, pre- and posttest
McLeavy et al. (1994)	39	Self-poisoning	Interpersonal problem solving vs. brief problem-solving-oriented approach	5.3 / 5.3	Hopelessness	62	*M* change scores, plus *SD*
Nordentoft et al. (2002)[b]	341	First-episode psychosis	Integrated treatment vs. TAU	58 / 39	Suicide attempt, plan, potential, probable	53	Cohort event data
Nordentoft et al. (2005)[b]	401	Suicide attempts, ideation	Problem solving vs TAU	42 / 14	Suicide attempt, plan, potential, probable	43	Cohort event data
Patsiokas and Clum (1985)	15	Suicide attempt	CBT vs. individual therapy	10 / 10	Suicide ideation	48	*M*, *SD*, pre- and posttest
Power et al. (2003)	42	First-episode psychosis	TAU and LifeSPAN therapy vs. TAU	10 / 10	Hopelessness	58	Independent group analysis, sample size, and *p*
Raj et al. (2001)	40	DSH	CBT vs. TAU	10 / 12	Suicide ideation	61	*M* change scores plus *SD*
Rathus and Miller (2002)[a]	111	Suicidal with BPD features	DBT vs. TAU	28 / 24	Suicide attempt, plan, potential, probable	47	Cohort event data
Rhee et al. (2005)	55	Suicidal ideation	Solution-focused brief therapy vs. common factors therapy vs. waiting list	8 / 8	Satisfaction with life	54	*M*, *SD*, pre- and posttest

Rudd et al. (1996)	264	Suicidal ideation	Problem solving, skill develop. vs. TAU	126 / 36	Suicide attempt, plan, potential, probable	55	*M*, *SD*, pre- and posttest
Salkovskis et al. (1990)	20	Suicide attempt	CBT vs. TAU	5 / 5	Suicide attempt, plan, potential, probable	38	Cohort event data
Tarrier at al., (2006)	278	Schizophrenia and suicidal behavior	CBT vs. supportive counseling vs. TAU	17.5 / 19	Suicide attempt, plan, potential, probable	89	Independent group analysis with *M* and *SD*
Tyrer et al. (2003)[b]	480	DSH	MACT vs. TAU	7 / 7	Suicide attempt, plan, potential, probable	69	Cohort event data
van den Bosch et al. (2005)	58	BPD	DBT vs. TAU	177.6 / 104	Suicide attempt, plan, potential, probable	65	*M*, *SD*, pre- and posttest
Verhuel et al. (2003)	58	DSH, BPD	DBT vs. TAU	190.6 / 104	Suicide attempt, plan, potential, probable	60	Cohort event data
Weinberg et al. (2006)	30	DSH, BPD	MACT vs. TAU	3.15 / 6	Suicide attempt, plan, potential, probable	47	*M*, *SD*, pre- and posttest
Wood et al. (2001)[a]	63	DSH	Group therapy vs. TAU	12.25 / 11.5	Suicide ideation	59	*M*, *SD*, pre- and posttest

Note: BPD = borderline personality disorder; CBT = cognitive-behavioral therapy; CTAM = Clinical Trials Assessment Measure; DBT = dialectic behavior therapy; DSH = deliberate self-harm; MACT = manual assisted cognitive-behavioral therapy; TAU = treatment as usual.

a. Study involved adolescent participants.

b. Study was follow-up only.

Location and sample. Of the 28 studies, 14 were carried out in the United States; 5 in the United Kingdom; 2 in both Holland and Denmark; and 1 each in Australia, Canada, India, Ireland, and Israel.

Study populations. The age of the treated samples showed some variation and can be broadly divided into studies that described their samples as *adolescent* (n = 7) and *adult* (n = 21). However, this categorization was blurred because one study described the sample as *older adolescent* and gave an age range of 18 to 24 years, whereas the lower range for *adult* samples could be between 15 and 18. So there was some potential overlap between study populations described as adolescent or adult. In the analysis, we have utilized the description of the sample used in the original report.

The studies targeted different diagnostic groups, with 14 studies stating psychosis as an exclusion criterion and 3 studies including only recent onset or first-episode schizophrenia or psychosis. Eight studies included only personality disorder, mainly borderline.

Treatments

There was considerable variation in what was included as treatment and how treatment was delivered.

Length of treatment. The mean duration of treatment was 19.52 weeks (SD = 24.77),[1] with a median of 10 weeks (range = 1–104). Six interventions were 12 months or longer and included dialectic behavior therapy (DBT), which in its standardized format is of 12 months' duration. However, the majority of interventions (n = 20) were brief, being of 6 months or less.

It was possible to estimate hours of treatment for all 28 studies, although the accuracy of this estimate depended on the information provided. Studies including intensive therapy over days rather than weeks and those involving group therapy tended not to specify hours. The mean number of hours of therapy was 40.99 (SD = 56.74), and the median was 12.25 (range = 3.15–190.6).

Number of treatment sessions. It was possible to estimate the number of sessions in all studies, although in some cases, the estimates were more precise than others. For instance, five studies had inpatient, intensive, or continual treatment; two studies had an undetermined number of sessions with open access. Three studies included some type of less intensive maintenance treatment or booster sessions. One of these consisted of open access "long-term groups." Whether measured in duration of treatment or number of sessions,

the majority of interventions were brief, with DBT being the exception, which, as mentioned, has as its standard format weekly individual and group treatments over 12 months. The mean number of sessions was 25.01 (*SD* = 30.72) and median was 11 (range = 2.7–104.0).

Nature of treatment. There was enormous variability across the studies in what methods and treatment techniques were used and in how they were delivered. All the studies were selected because the interventions were solely CBT or included CBT as a significant component. Broad arrays of techniques were described in the different studies in varying levels of detail. Some studies described clear and standardized programs of treatment in considerable detail and for which treatment manuals and, in some cases, training procedures were available. In other studies, an intervention had been developed for a particular project. Despite the apparent diversity, there was undoubtedly considerable overlap in what was done therapeutically at the macrotherapeutic (strategic) and microtherapeutic (process mechanisms) levels.

The most frequently used standardized treatment program was DBT. This is described as

> a manualized treatment that combines treatment strategies from behavioral, cognitive, and supportive psychotherapies. . . . It includes concomitant weekly individual and group therapy that is conducted for one year. Individual DBT applies directive, problem oriented techniques (including behavioral skill training, contingency management, cognitive modification, and exposure to emotional cues) that are balanced with supportive techniques, such as reflection, empathy, and acceptance. . . . The emphasis is on teaching patients how to manage emotional trauma rather than reducing or taking them out of crisis. . . . Group therapy met once each week for two and a half hours and followed a psychoeducational format. Behavioral skills in three main areas were taught as follows: 1) interpersonal skills, 2) distress tolerance/reality acceptance skills, and 3) emotional regulation. (Linehan, Armstrong, Suarez, Allmon, & Heard, 1991, p. 1061)

Four studies used this standardized version of DBT. A further four studies used a modified version of DBT. In three studies, the version of DBT was shortened to 6 months, 3 months, or a 2-week intensive inpatient program for adolescents.[2] A further study included aspects of DBT in a hybrid[3] intervention that included problem solving and psychodynamic psychotherapy.

A further three studies used manual assisted cognitive-behavioral therapy (MACT), which is described as incorporating elements of DBT, Beck's cognitive therapy, and bibliotherapy (Weinberg, Gunderson, Hennen, & Cutter,

2006). If these studies are considered to use aspects of DBT, then a total of 12 studies could be considered as using standard, modified, or aspects of DBT. Of the 8 studies using solely standard or modified DBT, 6 treated women suffering from borderline personality disorder, for which this treatment was originally designed. The remaining 2 DBT studies were modified for use with suicidal adolescents.

A number of studies ($n = 14$) included some aspect of problem-solving training. In four studies, problem solving was the sole treatment component; in one of these, problem solving focused on interpersonal behavior. Three studies had problem solving as the major component of treatment, and a further seven studies, including the three MACT studies, included problem solving as a treatment component.

Nine studies described cognitive therapy or cognitive restructuring as a major treatment component. This could have been in an established format such as Beck's cognitive therapy for depression, or it could have specifically focused on suicide behavior or its antecedents—for example, "Cognitive therapy aimed at vulnerability factors, including hopelessness, poor problem solving, impaired impulse control, treatment non-compliance and social isolation, and relapse prevention" (G. K. Brown et al., 2005, p. 564). Three studies described using training in adaptive coping strategies or skills, usually to manage affect regulation or suicide behavior. Two studies included social skills training and improving social competencies as a major part of the intervention.

In four studies, the treatment could be described as *indirect* in that reduction of suicide behavior was not the prime aim of treatment, although treatment was aimed to reduce factors that were associated with increased risk of suicide behavior, such as in cases where the reduction of psychotic symptoms in schizophrenic patients (Nordentoft et al., 2002;[4] Tarrier et al., 2006) or that of substance abuse in borderline personality disorder (Linehan et al., 1999) was the main treatment goal. In two studies, reduction in distress (Klingman & Hochdorf, 1993) or depression (March & the Treatment for Adolescents With Depression Study Team, 2004) was the main focus.

Five studies described involving parents or families in treatment. This could be from highly structured family behavior therapy (e.g., Liberman & Eckman, 1981) to a small number of parent-only sessions (e.g., March & the Treatment for Adolescents With Depression Study Team, 2004) to including parents in groups if appropriate (e.g., Rathus & Miller, 2002).[5]

The structure of treatment showed considerable variation, although in the majority of studies, treatment was delivered on an outpatient, sessional basis. Four studies reported intensive, structured inpatient or day hospital treatments

of 10 to 14 days. One study provided brief solution-focused treatment over the telephone, with no face-to-face contact at all (Rhee, Merbaum, Strube, & Self, 2005). One study provided a school-based treatment program over 12 weeks (Klingman & Hochdorf, 1993) and another, an integrated mental health service of assertive community treatment, antipsychotic medication, psychoeducation family treatment, individual family sessions, family groups, and social skills training delivered over 2 years (Nordentoft et al., 2002). Three studies evaluated a treatment program based on a self-help manual version of CBT (i.e., MACT) that consisted of brief contact with a therapist (up to six or seven sessions), determined through a method developed by Schmidt and Davidson (2004).

Treatment was described as being delivered by a range of professions with varying levels of professional training and experience. Clinical psychologists, psychologists, psychiatrists, social workers, specialist nurses, nurses, and school counselors were all described as providing treatment, and in some studies, the therapists were in training or were relatively junior. Seven studies explicitly stated that the therapists received regular and frequent supervision during the study. Studies also varied greatly in the number of therapists used, with a range of 1 to 41; to some extent, this depended on the size and funding of the study. The majority indicated that patients were seen in hospitals or clinics, but at least two studies did provide home treatment.

Variation in the Quality of Trial Methodology

Scores on the CTAM varied, with a mean of 55.72 (SD = 15.00) and a median of 55 (range = 27–89). The association (Spearman's correlation coefficient)[6] between the CTAM and study effect size was positive and significant (r = .387, $p < .05$, two-tailed). The more negative Hedge's g, the greater the effect size; hence, the correlation indicated that larger effect sizes were associated with poorer study quality.

Results of the Meta-Analysis

Of these 28 studies, 4 provided follow-up data only (Linehan et al., 1999; Nordentoft et al., 2002; Nordentoft et al., 2005; Tyrer et al., 2003), leaving 24 studies. It should be noted that the analysis used 25 data points because Klingman and Hochdorf (1993) provided separate data for subgroups of males and females but not data for the entire sample.

Thirteen studies[7] provided data such that means and standard deviations could be used to calculate the effect size pre- and posttreatment for both the

patient and the control groups. Mean change scores, with the standard deviation of the difference in each group, were available for two studies. Cohort event data were available for six studies, and cohort event and nonevent data were available for one study. Independent group analysis with the sample size and *p* value was used for one study, and independent group analysis with the means and standard deviations was used for one study (for the type of data used in the analyses, refer to Table 1).

There were four types of outcome measure—namely, Satisfaction With Life Scale ($n = 1$, adult); hopelessness ($n = 2$, adult); suicidal ideation ($n = 8, 9$ data points); and suicidal attempts or plans, probability of suicide, and suicide threats ($n = 12$ studies, 13 data points). Some studies provided data for more than one outcome measure. For the current analysis, the most proximal measure to a suicide attempt was taken (documented in Table 1).

Table 2 presents the effect sizes for the 25 studies that provided end-of-treatment data and the six subanalyses (age group, comparison group, study focus, outcome measure, therapy type, and therapy mode). Figure 1 shows a forest plot of the effect sizes of these 25 studies.

As can be seen from Table 2 and Figure 1, cognitive therapy had an overall positive effect on the outcome variables (combined Hedge's $g = –0.59$, $z = –5.26$, $p < .0001$, 95% CI = –0.811 to –0.371).

Adults Versus Adolescents: 0–3 Months After Treatment Completion

Seven data points (from six studies, given the subgroups of Klingman and Hochdorf, 1993) were conduced with adolescents, and 18 data points were available for adults (see Table 2). The definitions of *adult* and *adolescent* were defined by the articles rather than any consistent age cutoffs for adolescents and adults.

The effect size for the 18 studies based on adults was highly significant (combined Hedge's $g = –0.775$, $z = –5.497$, $p < .0001$, 95% CI = –1.051 to –0.498). The effect size for the data points based on an adolescent sample was not significant, however (combined Hedge's $g = –0.260$, $z = –1.355$, $p = .175$, 95% CI = –0.635 to 0.116).

Comparison Group: 0–3 Months After Treatment Completion

The comparison or control groups used by the 24 studies (25 data points) were classified as follows: placebo, waiting-list control, no treatment ($n = 5$);

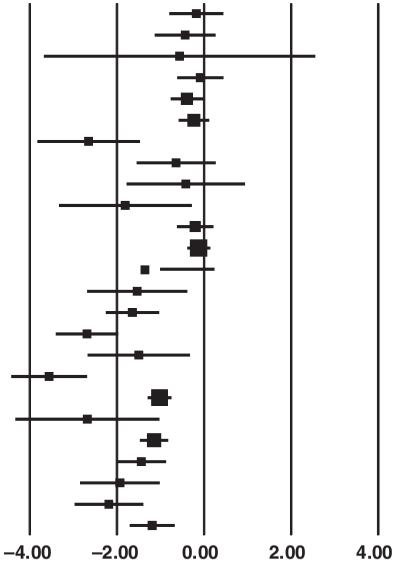
Table 2
Effect Size (Hedge's *g*), Confidence Intervals, and *z* Scores Overall and for Six Subgroup Analyses

		Effect Size and 95% Confidence Interval						Test of Null (Two-Tailed)	
		Data Points	Point Estimate	*SE*	Variance	Lower limit	Upper limit	*z*	*p*
All studies		25	–0.591	0.112	0.013	–0.811	–0.371	–5.265	.000
Age group	Adolescents	7	–0.260	0.192	0.037	–0.635	0.116	–1.355	.175
	Adult	18	–0.775	0.141	0.020	–1.051	–0.498	–5.497	.000
Comparison group	Placebo, WLC, or nothing	5	–0.808	0.239	0.057	–1.276	–0.341	–3.389	.001
	TAU	14	–0.594	0.166	0.028	–0.920	–0.269	–3.574	.000
	Therapy	6	–0.412	0.254	0.065	–0.910	0.087	–1.619	.105
Study focus	Direct	21	–0.712	0.130	0.017	–0.967	–0.457	–5.469	.000
	Indirect	4	–0.228	0.228	0.052	–0.674	0.219	–1.000	.318
Outcome measure	Hopelessness	2	–0.530	0.330	0.109	–1.177	0.116	–1.608	.108
	Satisfaction with life scale	1	–2.585	0.561	0.315	–3.685	–1.484	–4.604	.000
	Suicide ideation	9	–0.390	0.155	0.024	–0.693	–0.087	–2.522	.012
	Suicide, attempt, plan, potential, problem	13	–0.574	0.145	0.021	–0.858	–0.290	–3.957	.000
Therapy type	CBT	18	–0.562	0.132	0.018	–0.822	–0.302	–4.244	.000
	DBT	7	–0.697	0.228	0.052	–1.143	–0.250	–3.057	.002
Therapy mode	Group	5	–0.263	0.186	0.035	–0.628	0.102	–1.410	.159
	Individual	11	–0.576	0.155	0.024	–0.881	–0.271	–3.704	.000
	Individual plus family	2	–0.212	0.325	0.106	–0.849	0.425	–0.652	.514
	Individual plus group	6	–0.790	0.228	0.052	–1.237	–0.343	–3.466	.001
	Telephone plus group	1	–2.585	0.561	0.314	–3.684	–1.486	–4.610	.000

Note: The fully random effects model was used for all analyses. CBT = cognitive-behavioral therapy; DBT = dialectic behavior therapy; TAU = treatment as usual; WLC = waiting-list control.

Figure 1
Random Effects Meta-Analysis of Cognitive-Behavioral Therapy in the Reduction of Suicide Behavior, 0–3 Months After Therapy Cessation

Study name	Hedges's g	Lower limit	Upper limit	Z–Value	p–Value
Brown et al., 2005	−0.178	−0.795	0.438	−0.567	0.571
Donaldson et al., 2005	−0.432	−1.127	0.262	−1.220	0.223
Evans et al., 1999	−0.562	−3.672	2.547	−0.354	0.723
Katz et al., 2004	−0.084	−0.615	0.446	−0.311	0.755
Klingman and Hochdorf, 1993	−0.391	−0.762	−0.019	−2.061	0.039
Klingman and Hochdorf, 1993	−0.233	−0.583	0.117	−1.306	0.192
Koons et al., 2001	−2.650	−3.825	−1.476	−4.423	0.000
Lerner and Clum, 1990	−0.641	−1.545	0.264	−1.389	0.165
Liberman and Eckman, 1981	−0.420	−1.776	0.937	−0.606	0.544
Linehan et al., 1991	−1.807	−3.329	−0.285	−2.327	0.020
Linehan et al., 2006	−0.204	−0.620	0.212	−0.960	0.337
March et al., 2004	−0.122	−0.384	0.139	−0.916	0.360
McLeavey et al., 1994	−0.385	−1.006	0.236	−1.217	0.224
Patsiokas and Clum, 1985	−0.564	−1.710	0.583	−0.964	0.335
Power et al., 2003	−0.673	−1.283	−0.062	−2.159	0.031
Raj et al., 2001	−1.717	−2.432	−1.003	−4.710	0.000
Rathus and Miller, 2002	−0.526	−1.698	0.646	−0.880	0.379
Rhee et al., 2005	−2.585	−3.453	−1.716	−5.834	0.000
Rudd et al., 1996	−0.050	−0.322	0.221	−0.364	0.716
Salkovskis et al., 1990	−1.707	−3.359	−0.056	−2.026	0.043
Tarrier et al., 2006	−0.177	−0.500	0.147	−1.070	0.285
van den Bosch et al., 2005	−0.468	−1.033	0.097	−1.624	0.104
Verheul et al., 2003	−0.959	−1.871	−0.047	−2.061	0.039
Weinberg et al., 2001	−1.213	−2.001	−0.425	−3.018	0.003
Wood et al., 2001	−0.219	−0.733	0.295	−0.836	0.403



TAU, including enhanced TAU ($n = 14$); another form of treatment, including supportive counseling and nondirective discussion of suicide ($n = 6$). Table 1 indicates the treatment and comparison groups. It should be noted that the control group of one study (Raj et al., 2001) was given the option of coming to therapy; because this was not a systematic application of treatment, it was classified as *no treatment*. For this initial analysis, where any study had used two comparison groups, for instance, TAU and supportive counseling, the comparison group that involved the least treatment was included, in this case, TAU. March and the Treatment for Adolescents With Depression Study Team (2004) included both a drug-only treatment (fluoxetine) and a combined drug-and-CBT treatment limb, as well as CBT alone and placebo groups. For the purposes of this review, data from only the CBT-alone group and placebo group have been included to avoid confusion of psychological and pharmacological treatments.

The no-treatment and TAU subgroups were highly significant, as expected (combined Hedge's $g = –0.808$, $z = –3.389$, $p < .001$, 95% CI = –1.276 to –0.341 for no treatment; combined Hedge's $g = –0.594$, $z = –3.574$, $p < .0001$, 95% CI = –0.92 to –0.269 for TAU). However, the effect size for studies comparing CBT to another form of therapy was not significant (combined Hedge's $g = –0.412$, $z = –1.619$, $p = 0.105$, 95% CI = –0.910 to 0.087).

Four studies (March & the Treatment for Adolescents With Depression Study Team, 2004;[8] Patsiokas & Clum, 1985; Rhee et al., 2005; Tarrier et al., 2006) had comparisons with additional groups of 'treated' controls. When the analysis was run again with these further comparison groups the overall analysis remained highly significant (combined Hedge's $g = –0.560$, $z = –5.058$, $p < 0.0001$, 95% CI = –0.777 to -0.343), as was the analysis comparing CBT with another therapy (combined Hedge's $g = –0.452$, $z = –2.351$, $p < 0.02$, 95% CI = –0.828 to –0.075).

Direct or Indirect: 0–3 Months After Treatment Completion

Of the 25 data points (24 studies), 16 ($n = 3$, with adolescents) were primarily interested in investigating treatment effects on suicidal thoughts or behaviors; 5 ($n = 1$, with adolescents) focused on deliberate self-harm, 2 on distress (both with adolescents), 1 on schizophrenia, and 1 on depression (with adolescents). A focus on deliberate self-harm and suicidal thoughts and/or behaviors was classified as *direct* ($n = 21$), the remainder as *indirect* ($n = 4$). The effect size was significant for the direct subgroup (combined Hedge's $g = –0.712$, $z = –5.469$, $p < .0001$, 95% CI = –0.967 to –0.457) but

not for the indirect subgroup (combined Hedge's $g = -0.228$, $z = -1.000$, *ns*, 95% CI = –0.674 to 0.219).

Outcome Measures: 0–3 Months After Treatment Completion

There were four types of outcome measure—namely, Satisfaction With Life Scale ($n = 1$, adult); hopelessness ($n = 2$, adult); suicidal ideation ($n = 8$, 9 data points: adults = 5, adolescents = 4); and suicidal attempts or plans, probability of suicide, and suicide threats ($n = 12$, 13 data points: adults = 10, adolescents = 2 studies, 3 data points). The effect sizes with all subgroups, apart from those using the hopelessness measure, were significant (see Table 2).

One difficulty with this analysis was the inclusion of only one or two studies in the Satisfaction With Life Scale and hopelessness subgroups. It should be remembered that for the initial analysis, the measure that was most proximal to suicidal acts was taken for each study. It was not possible to consider every outcome measure used in one overall analysis, because the same study would have been included multiple times, which would have violated the independence assumption.

It is also possible to categorize studies according to the available outcome measures and to consider each category separately and independently from any other category of outcome measure. Hence, hopelessness was reanalyzed, with independent measures contributing to the analysis in each case. Eleven studies used a measure of hopelessness (irrespective of any other outcome measure reported), one of which was a follow-up only, leaving 10 studies with data sampled within 3 months of therapy ending. One study contained multiple comparison groups; hence, the comparison with the control group was used. The effect size was highly significant (combined Hedge's $g = -0.543$, $z = -4.220$, $p < .0001$, 95% CI = –0.795 to –0.291).[9]

Type of Therapy: 0–3 Months After Treatment Completion

Studies were included in the meta-analysis if they used a form of CBT. Although there were numerous subtypes of CBT, a broad classification could be made with respect to whether the treatment involved DBT close to its conventional format ($n = 7$) or CBT ($n = 18$). This was important because DBT often involves 12 months of treatment, which includes weekly individual and group sessions, with additional telephone support. Hence, it might have been supposed that studies based on this form, duration, and intensity of

treatment would favorably bias the result. However, the effect sizes for CBT and DBT were robust and comparable (respectively, combined Hedge's $g = –0.562$, $z = –4.244$, $p < .0001$, 95% CI = –0.825 to –0.302; combined Hedge's $g = –0.697$, $z = –3.057$, $p < .0001$, 95% CI = –1.143 to –0.250).

Mode of Therapy: 0–3 Months After Treatment Completion

Treatment sessions were most often on a one-to-one basis ($n = 11$) and sometimes involved group treatment alongside one-to-one sessions ($n = 6$). Five studies involved group treatment alone; two studies involved individual treatment alongside family work; and one study used telephone contact and group work. There were nonsignificant results for individual treatment together with family treatment (but this involved only 2 data points) and group treatment alone (see Table 2). Individual treatment, as well as individual treatment alongside group treatment, produced strong effect sizes (combined Hedge's $g = –0.576$, $z = –3.74$, $p < .0001$, 95% CI = –0.881 to –0.271 for individual treatment; combined Hedge's $g = –0.790$, $z = –3.466$, $p < .001$, 95% CI = –1.237 to –0.343 for individual treatment together with group treatment).

Meta-Regression to Control for Continuous Covariates

Continuous variables, which could be used as covariates in meta-regression analysis (using the methods-of-moments model), included the quality of the studies as assessed by the CTAM rating scale (as mentioned previously), the number of therapy sessions, and the hours of therapy. For the 25 data points included in this analysis, the descriptive data are as follows: for the CTAM scores, $M = 56.40$ ($SD = 15.45$), $Mdn = 56$ (range = 27–89); the estimated number of sessions, $M = 26.22$ ($SD = 32.61$), $Mdn = 11$ (range = 2.7–104.0); and the estimated hours of therapy, $M = 42.79$ ($SD = 60.47$), $Mdn = 12.25$ (range = 3.15–190.60).

When CTAM scores were regressed onto Hedge's g effect sizes, both the slope and the intercept were significant (see Table 3 and Figure 2). Only the intercept was significant when session number and hours of therapy were predictor variables.

Follow-Up: 6, 12, and 16–24 Months

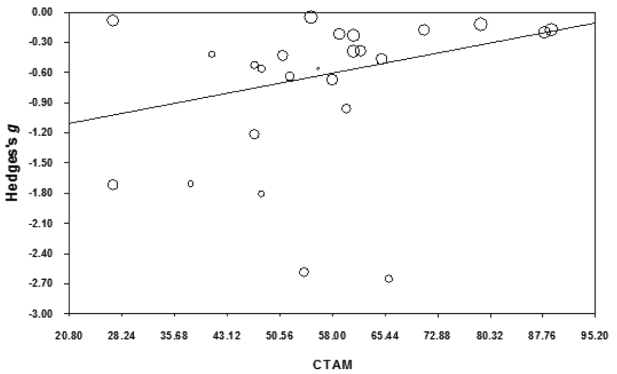
Follow-up data ($n = 20$) were available at 6 months ($n = 7$), 12 months ($n = 6$), and 16–24 months ($n = 7$). It should be noted that the same study

Table 3
Meta-Regression Results for Predictor Variables, 0–3 Months After Therapy Cessation

	Point Estimate	*SE*	Lower Limit	Upper Limit	*z*	*p*
CTAM						
Slope	0.0134	0.007	0.0002	0.0266	1.991	0.046
Intercept	–1.385	0.416	–2.200	–0.569	–3.328	0.0009
No. of therapy sessions						
Slope	0.002	0.0039	0.009	0.006	0.432	0.666
Intercept	–0.554	0.1515	–0.851	–0.257	–3.658	0.00025
Hours of therapy						
Slope	0.00023	0.0021	0.00424	0.00378	–0.1108	0.911
Intercept	–0.590	0.1443	–0.8732	–0.30732	–4.088	0.00004

Note: CTAM = Clinical Trials Assessment Measure.

Figure 2
Meta-Regression Analysis of Clinical Trials Assessment Measure (Quality) and Hedge's *g* (Effect Size) Scores, 0–3 Months After Therapy Cessation



Note: The area of the points are proportional to the study weights.

contributed to these different points, so all 20 could not be analyzed together. Data for 14 independent studies (see Table 4), taking the longest time point, was significant overall (combined Hedge's $g = –0.315$, $z = –3.438$, $p < .001$, 95% CI = –0.494 to –0.135).

Table 4
Studies Included in the Follow-Up Analysis at 6, 12, and 16–24 Months After Therapy Cessation

Study	Comparison Groups	Outcome Measure	Months
Brown et al. (2005)	CT vs. enhanced TAU	Suicide attempts	16–24
Donaldson et al. (2005)[a]	Skills-based CBT vs. supportive counseling	Suicide ideation	16–24
Katz et al. (2004)[a]	DBT vs. TAU	Lifetime parasuicide count	12
Liberman and Eckman (1981)	Behavior therapy vs. insight-oriented therapy	Number of suicidal threats or attempts	16–24
Linehan et al. (2006)	DBT vs. community treatment	Suicide ideation	16–24
Linehan et al. (1999)	DBT vs. TAU	Parasuicide epsiodes	16–24
McLeavey et al. (1994)	Interpersonal problem solving vs. brief problem solving	Hopelessness	6
Nordentoft et al. (2005)	Intervention group vs. comparison	Suicide attempt	12
Nordentoft et al. (2002)	Integrated treatment vs. standard	Suicide attempt	12
Power et al. (2003)	Therapy plus TAU vs. TAU	Hopelessness	6
Rudd et al. (1996)	Treatment vs. control	Suicide probability	16–24
Tarrier et al. (2006)	CBT vs. TAU	Suicidal behavior	16–24
Tyrer et al. (2003)	MACT vs. TAU	Successful suicides	12
Weinberg et al. (2006)	MACT + TAU vs. TAU	Suicide ideation	6

NOTE: CBT = cognitive-behavioral therapy; CT = cognitive therapy; DBT = dialectic behavior therapy; MACT = manual assisted cognitive-behavioral therapy; TAU = treatment as usual.
a. Studies with adolescents.

There were too few studies to subdivide the follow-up studies according to all the categorical subgroups used in the time frame of 0–3 months. However, effect sizes (Hedge's *g*) split according to periods of 6 months, 12 months, and 16–24 months were compared. The most convincing results were for those studies using a 16- to 24-month follow-up period ($n = 7$, combined Hedge's $g = –0.3012$, 95% CI = –0.573 to –2.973, $z = –2.17$, $p < .03$). Only four studies comprised the time frame of 12 months, and results approached significance (combined Hedge's $g = –0.344$, 95% CI = –0.712 to 2.34, $z = –1.84$, $p = .066$). For the three studies sampling outcome measures at 6 months, results were not significant ($z = –1.374$, $p = .17$).

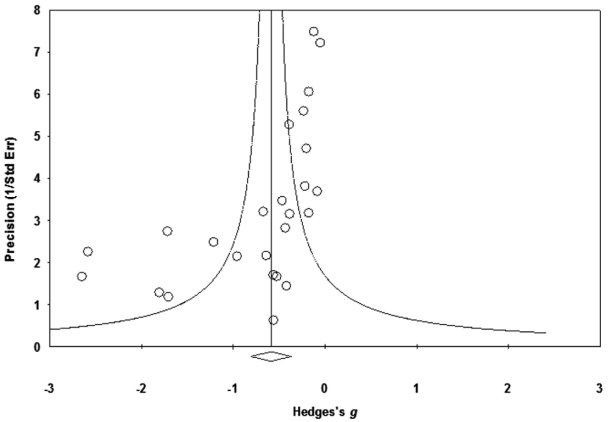
The continuous variables of CTAM quality scores, hours, and number of sessions were used as covariates across all 14 studies. Mean and median CTAM quality scores for the 14 follow-up studies with independent data points were as follows; $M = 56.79$ ($SD = 17.79$) and $Mdn = 54$ (range = 27–89). When entered as a predictor variable in a meta-regression, neither the slope ($z = 0.37$, $p = .71$) nor the intercept ($z = –1.35$, $p = .18$) was significant. The descriptive data for the session number were as follows: $M = 24.52$ ($SD = 28.56$) and $Mdn = 12$ (range = 5.3–104.0); for hours of therapy, $M = 41.93$ ($SD = 48.70$) and $Mdn = 18.75$ (range = 3.15–156.0).[10] The slope was not significant for number of sessions ($z = –0.018$, $p = .99$), but the intercept was significant ($z = –2.33$, $p = .02$). Similarly, the slope was not significant for hours of therapy ($z = –0.018$, $p = .98$), but the intercept was significant ($z = –2.33$, $p = .02$).

Publication Bias of the Main Sample of 25 Data Points

One issue in conducting meta-analyses concerns a publication bias where nonsignificant results do not get published, clearly biasing the available data in favor of treatment effects (Rosenthal & Dimatteo, 2001). The funnel plot of precision plotted against effect size is shown in Figure 3.

If there is no publication bias, then the studies should be dispersed symmetrically, with larger studies clustering around the mean effect size. As can be seen from Figure 3, there appears to be an asymmetry to the left, which implies a publication bias in favor of smaller studies with large negative effect sizes (i.e., showing that CBT reduces suicidal behaviors). Although the calculation of the classic fail-safe sample number showed that for the alpha level to exceed 5%, there would have to be 461 missing studies (Rosenthal & Dimatteo, 2001), which seems to mitigate against publication bias, the Begg and Mazumdar rank correlation, Kendall's tau = –.489, $p < .0001$,[11] and Egger's regression intercept, intercept = –2.403, CI = –3.578 to –1.228; $t(23) = 4.229$, $p < .0001$,[12] were significant.

Figure 3
Funnel Plot of Precision Plotted Against Effect Size, to Illustrate Publication Bias, 0–3 Months After Therapy Cessation



Publication Bias of the Main Sample of 14 Follow-Up Data Points

Unsurprisingly, results were less clear-cut with respect to analysis of publication bias in the follow-up studies, given the reduced sample number. The classic fail-safe sample-number method indicated that 46 additional studies would be needed for the alpha level to exceed 5%. Neither Begg and Mazumdar rank correlation, Kendall's tau = –.187, nor Egger's regression intercept, intercept = –0.4, CI = –2.78 to 1.96; $t(12) = 0.38$, *ns*, were significant.

Discussion

Overall the hypothesis that CBT can reduce suicide behavior in the short term was strongly supported. This highly significant result was in spite of the considerable variability in the populations being treated, the treatments implemented, and the outcomes used. This heterogeneity is a cause for optimism in that CBT can reduce suicide behavior in a variety of circumstances, but it is also a cause for caution in interpreting the results in that many factors may be influential.

To control for and investigate further the wide heterogeneity in studies, we carried out six further subgroup analyses investigating whether any of the following were important: the age of the sample (adult or adolescent); the type of control group in the treatment comparison; the focus of the treatment (directly or indirectly on suicide behavior); the type of outcome measure used; the type of treatment (DBT or general CBT); and the mode of treatment delivery.

CBT appears effective with adult populations but not with adolescents. Although there were possible overlaps in age across studies (i.e., those described as treating *adult* or *adolescent* populations), the tentative conclusion is that when the treated sample is principally adolescent, then suicide behavior is difficult to treat. However, in the current analysis, there was a paucity of studies comprising adolescents, as compared to those involving adults.

CBT does prove effective when compared with minimal treatment or TAU, and interestingly, CBT was still effective when studies using control groups involving active psychological treatments were included in the analysis. This suggests that CBT may have a specific effect, but it is does not mean that other treatments cannot be used to counter suicidal thoughts and behaviors. Indeed, a key question concerns what aspects of therapies are common and effective in helping those who are suicidal and which are specific. A further point to consider is that the number of studies that compared CBT with another active treatment was comparatively low (Donaldson, Spirito, & Esposito-Smythers, 2005; Lerner & Clum, 1990; Liberman & Eckman, 1981; March & the Treatment for Adolescents With Depression Study Team, 2004;[13] McLeavey, Daly, Ludgate, & Murray, 1994; Patsiokas & Clum, 1985; Rhee et al., 2005; Tarrier et al., 2006).

Treatment is effective when directly focused on reducing some aspect of suicide behavior but not when focused on other symptoms (such as depression or distress) with a view to reducing suicide behavior as a secondary effect. Thus, to be effective, specific CBT suicide prevention treatment programs need to be designed, tailored, and implemented to focus on suicidal behavior.

Encouragingly, all measures of suicide behavior show a significant reduction with treatment, although in the two studies in which hopelessness was the most proximal measure, this outcome did not demonstrate a significant reduction. In contrast, when all 10 studies that included a measure of hopelessness were analyzed, there was a very significant reduction in this measure. There does therefore appear to be a reduction across the spectrum of suicide behavior with treatment by CBT. We are very much aware, as stated earlier, that measures of suicide behavior are proxy measures for completed suicide, and we are unable to make substantial conclusions that CBT would reduce

actual suicides. With that acknowledged, there is reasonable but guarded optimism that reductions in hopelessness and suicide ideation and behavior would result in some, albeit an unknown, number of prevented completed suicides. Balanced against this, however, are the results from Crawford and colleagues' recent meta-analysis (2007), which did not find evidence that additional psychosocial interventions following self-harm had a marked effect on the likelihood of subsequent suicide.

As we have seen, there was enormous variety in what CBTs were delivered and in how and in what configuration they were delivered. The variability was so broad that detailed and multiple subgroup analyses were not feasible. Given the frequency of use of DBT in included studies and in clinical practice in the reduction of suicide behavior and the length and intensity of the actual treatment, we made a broad subgroup analysis to investigate whether DBT or general CBT (not including DBT) had a treatment effect. Both DBT and general CBT demonstrated highly significant effects. Hence, we conducted subgroup analyses on the mode of treatment delivery. In some instances, the number of studies in these subgroups was low, so caution is required in drawing conclusions from these results. Studies in which one-to-one CBT was included show a very significant effect, but studies involving groups alone were not significant. Similarly, subgroup analyses indicate that a combination of individual and group treatment shows a significant effect, whereas a combination of individual and family treatment was not significant.

Furthermore, it was possible to assess the effects of quality (CTAM scores), estimated number of hours of therapy, and estimated sessions of therapy using meta-regression techniques. Even though CTAM scores correlated with effect sizes, indicating that poorer methodology may well lead to overestimates of treatment benefit, and produced a significant slope in the meta-regression, the intercept was still significant, which shows that when CTAM scores are partialed out, the effect sizes still exceed zero to a significant level. Neither estimated sessions nor hours of therapy were significantly associated with these effect sizes, and the intercept was significant in both cases. Hence, it would appear that the efficacy of treatment is not related to the time spent with clients. A clear caveat to such a conclusion is that both the number of therapy sessions and the hours spent were estimated and open to error.

In the main part of this meta-analysis, we focused on whether CBT programs can have an immediate effect on suicide behavior. Clearly, suicide risk can persist over long periods and vary in severity so that a reduction in suicide behavior may occur after treatment but have little importance in signaling a reduction in suicide risk over time. Longitudinal data over an extended period would be required to make conclusions about the long-term

reduction in suicide behavior and risk. Some studies do provide these type of data. For instance, G. K. Brown et al. (2005) documented outcome measures at 1, 3, 6, 12, and 18 months; Liberman and Eckman (1981) provided data points at 2, 6, 24, 36, and 104 weeks; Rudd et al. (1996) provided data at 1, 6, 12, 18, and 24 months; and Tarrier et al. (2006) have outcome measures at 6 weeks, 3 months, and 18 months. Nevertheless, comparisons across studies were difficult because of the lack of standardized follow-up. As a result, we made the decision to divide outcome phases into the measures taken between the completion of treatment (or the completion of the intensive phase of the treatment program) and the subsequent 3 months and those taken at a later point, which would represent the follow-up point (i.e., 6, 12, and 16–24 months). Reference to Table 3 indicates that the follow-up period was between 6 months and 2 years. The results indicate a significant reduction in suicide behavior over this follow-up period, albeit with a reduced effect size. Although caution is required in interpreting these results, there is an indication that a significant, although probably reduced, treatment effect does persist in the short to medium term. Whether there is any long-term effect in reduction of suicide behavior or actual suicides is unknown but is clearly a very important question. In accord with the analysis of the main results up to 3 months after treatment, neither CTAM scores nor number of therapy sessions and hours of therapy compromised the overall results.

A methodological caveat concerns publication bias, wherein studies with a small sample number and large effect size have a disproportionately large influence on the overall effect size. Though difficult to assess, in the current analysis, such a bias appeared to be operating. This conclusion is bolstered by the use of more than one technique to assess publication bias. A clear message is that there is a need for both more studies and larger studies that address the efficacy of CBT (and other therapies) in its effect in directly combating suicidal thoughts and behaviors across diagnostic groups in general and targeted at those who are known to be at particular high risk.

As indicated within the description of the studies, there are numerous other factors that may well exert an influence on outcome, which we have been unable to systematically evaluate but which are important to mention. The duration, frequency, and intensity of treatment are factors that might be important, especially in the maintenance of any treatment effect. Of all the treatment types reviewed, DBT in its conventional form is of longest duration and greatest intensity and, by implication, the most costly. We are unable to say whether the costs and resources required to deliver this treatment result in a concomitant clinical benefit. On a similar resource issue, besides the duration and frequency of treatment, the profession of the clinician delivering

the treatment, his or her seniority, and his or her level of experience and training will also affect cost and, therefore, cost-effectiveness. In our opinion, there is a frequent and an unfortunate trend to recommend that psychological treatments be delivered by the least skilled and most junior staff, mainly on the grounds of cost. Unknown but important to know is whether this is truly cost-effective or whether there is an excessive decrease in clinical benefit resulting from the cheapest option and from what level of skill, training, experience, and supervision is required to effectively and efficiently deliver CBT interventions to reduce suicide behavior.

As far as we are aware, this is the first systematic review and meta-analysis of CBT to reduce suicide behavior and risk. The topic is of high priority given the enormity of the clinical and social problem of suicide. Even though the systematic development of cognitive-behavioral suicide prevention programs is in the early stages, there are reasonable grounds for cautious optimism that progress is in the right direction. Other systematic reviews have been carried out on suicide prevention; for example, Mann et al. (2005) concluded that improving the recognition of depression and its treatment and restricting access to lethal methods reduced suicide rates. They also concluded that "ascertaining which components of suicide prevention programs are effective in reducing rates of suicide and suicide attempt is essential in order to optimize use of limited resources" (p. 2064). We concur with this conclusion and suggest that as far as preventative treatments and interventions are concerned, future research should identify elements within CBT programs that can be delivered in an effective and efficient manner at targeted populations of at-risk individuals. Whether suicide prevention methods can be incorporated into already-existing CBT protocols—for example, the treatment of depression or psychosis—or whether they need to be delivered in parallel or sequentially is currently unknown.

Notes

1. When a range of possible durations were given, the maximum was used in the calculation. One study did not have a fixed duration.

2. In the dialectic behavior therapy (DBT) subgroup analysis, we included only the seven studies that utilized DBT of 6 months or more.

3. A *hybrid treatment* consists of interventions from different schools or orientation other than cognitive-behavioral (such as psychodynamic psychotherapy) or mixes service configuration (such assertive outreach).

4. Note that this study was included only in the follow-up analysis.

5. In the subgroup analyses, we have included only those with a significant family or group component.

6. Clinical Trials Assessment Measure scores were normally distributed; however, Hedge's *g* scores were positively skewed.

7. Fourteen data points were available in this format because Klingman and Hochdorf (1993) provided data for subgroups of boys and girls but not for the entire sample.

8. Note the other comparison, cognitive–behavior therapy plus fluoxetine was not analyzed, because it confounded pharmacology with psychological treatment effects

9. It should be noted that suicide ideation and suicide attempts have already been included as the most proximal measure of suicide in the initial analysis.

10. Clearly, there is a large range and dispersion to this data, which is why the mean and median differ markedly for both the number of therapy sessions and the hours of therapy.

11. High standard errors (small studies) are negatively associated with effect sizes, which for the current data means that the more negative the effect size, the greater the standard error (implying a bias toward small significant studies).

12. The standardized effect size (effect size divided by the standard error) is regressed onto a measure of precision (i.e., the inverse of the standard error). A lack of a publication bias will produce an intercept that passes through the origin. A significant intercept implies a potential publication bias.

13. See note 8.

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