

Running head: BEHAVIOURAL ACTIVATION FOR INFORMAL CARERS

Behavioural Activation for Depression in Informal Caregivers: A Systematic Review and Meta-
Analysis of Randomised Controlled Clinical Trials

Sedigheh Zabihi, Frederike K Lemmel, Vasiliki Orgeta*

*Corresponding Author
Dr Vasiliki Orgeta
Associate Professor
University College London
Division of Psychiatry
Faculty of Brain Sciences
6th Floor, Maple House,
149 Tottenham Court Road,
London W1T 7NF
Telephone: 02076799294
Fax: 02076799426
v.orgeta@ucl.ac.uk

Abstract

Background: Carers experience significant physical and psychological burden and are at increased risk of experiencing clinical depression. Although several psychological treatments have been shown to be effective for preventing and treating depression in carers, most are complex, costly, and not easily accessible to family carers. In this paper, we review evidence of effectiveness of Behavioural Activation (BA) for depressive symptoms in informal caregivers and report on its quality.

Methods: We searched MEDLINE, EMBASE, PsycINFO, CINAHL, CENTRAL and Online trial registers for randomised controlled clinical trials of BA for carers.

Results: Twelve trials met inclusion criteria and eleven were included in the meta-analyses. BA reduced depressive symptoms for carers (standardised mean difference (SMD) -0.68; confidence interval (CI) -1.14 to -0.22) at post intervention (4-14 weeks) and in the long term (1 year; SMD -0.99; CI -1.26 to -0.71). BA decreased risk of a diagnosis of major depression (Odds Ratio 0.35; CI 0.19 to 0.67), and reduced negative affect (SMD -0.53; 95% CI -0.83 to -0.23), and caregiver burden (SMD -0.32; CI -0.55 to -0.09) at post-treatment. Quality of evidence was moderate and there was no evidence of publication bias.

Limitations: There was high heterogeneity in the studies included.

Conclusion: BA is effective in reducing depressive symptoms post-treatment and long-term (1 year) and decreases odds of a diagnosis of major depression in informal caregivers. Our review provides further evidence that BA is an effective psychological intervention, which is potentially highly scalable across many settings, populations and cultures (Registration: PROSPERO-CRD42019138860).

Key words: carers; behavioural activation, activity scheduling, pleasant events; meta-analysis; randomised controlled trials;

Declaration of interest

None.

Introduction

It is currently estimated that over 65.7 million people in the USA and 100 million people in Europe are currently providing care to a family member or friend who, due to a physical, mental or chronic illness requires intensive care and support (Embracing Carers, 2017). Given the increase of the ageing population and global dependence, the number of people engaging in informal caregiving is expected to rise (Carers UK, 2015). **In contrast to formal caregivers, informal carers provide some form of unpaid, voluntary and ongoing support and assistance with activities of daily living or instrumental activities of daily living, to an individual with a chronic illness or disability (Roth et al., 2015).** Informal caregiving is burdensome mentally and physically and predisposes carers to increased risk of psychiatric morbidity such as clinical depression (Vitaliano et al., 2003). Although prevalence of major depression in carers varies by care recipient needs and illness, increased risk is consistently higher compared to the general population. Caring for a person living with a diagnosis of dementia is associated with the highest rates of depression, with prevalence rates up to 43% (Waite et al., 2004) followed by caring for people living with cancer and stroke survivors (Geng et al., 2018; Loh et al., 2017).

Several systematic reviews and meta-analyses have shown that psychological treatments are generally effective in reducing depressive symptoms in carers (Sørensen et al., 2002; Yusefu-Udechuku et al., 2015). Cognitive behavioural therapy-based (CBT) interventions alongside psychoeducation appear to be the most effective, although effect sizes vary from 0.27 to 0.51 depending on the type of approach used (Kaddour et al., 2018; Kishita et al., 2018). Despite evidence of clinical effectiveness, many family carers do not access psychological interventions, partly due to high levels of carer burden such as hours spent caregiving, and difficulties with accessing services including psychological treatments (Bank et al., 2006).

Although effective, current CBT-based interventions for family carers have several limitations. For example, they are generally a complex set of approaches requiring a highly specialised set of skills for both therapists and individuals in order to be effective, and are associated with high costs of training and delivery, limiting their access in many settings (Richards et al., 2016). Provision of simple therefore, easily implemented and cost-effective psychological treatments for carers may close the treatment gap and potentially reach a higher proportion of carers, **especially in settings** where there is paucity of qualified therapists **such as in low-income countries** (Hollon et al., 2002; Kohn et al., 2004). Informal carers are an important part of the social care sector, and given well-recognised evidence of the negative effects of caring on carer mental health, access to effective prevention and treatment strategies is an important public health priority.

Recent evidence suggests that Behavioural activation (BA) is as effective as CBT for depression in adults and can be delivered without the need of costly and highly trained professionals (Richards et al., 2016). BA is a psychological intervention that aims to engage individuals with healthy resources of positive reinforcement and improve mood (Lewinsohn et al 1980; Jacobson et al 1996). Originally developed to treat depression, BA emphasizes on structured attempts to support individuals identify and engage in activities that are reinforcing and consistent with their long-term goals (Hopko et al., 2003). Given its simplicity and lower cost therefore BA may be an effective, accessible and highly sustainable intervention for family carers across diverse settings and cultures.

Further evidence on the effectiveness of BA in diverse populations will also contribute towards recent NICE recommendations of increasing evidence base of this approach (NICE, 2010). In this review, our aim was to establish the treatment effect of BA for depression in informal caregivers by reviewing worldwide evidence, report on its quality and assess whether study parameters modified the treatment effect.

Methods

Search strategy

We searched all terms related to RCT, caregiving and BA in 8 databases: EMBASE, MEDLINE, PsycINFO, CINAHL, CENTRAL (Cochrane Central Register of Controlled Trials), clinicaltrials.gov, European registers and specialised databases of psychological treatments of depression (www.evidencebasedpsychotherapies.org) up to December 2018 (see Figure 1, Appendix for search terms used). We also looked at reference lists of all included papers and systematic reviews in the area.

Trial eligibility criteria

Inclusion criteria were: a) RCTs of BA versus treatment as usual (or any other treatment), in b) informal carers, d) reporting on depression or any other outcome of psychological distress. We defined BA as a psychotherapeutic approach aimed at increasing engagement in enjoyable and meaningful activities (often associated with pleasure and mastery) through structured activity scheduling and monitoring of mood (association of mood and activities), and/or other behavioural strategies such as relaxation or hierarchical construction of goals (Dimidjian et al., 2011). Given that BA is a relatively recent term describing this approach, we also included studies of behavioural therapy or behavioural management as long as activity scheduling and mood monitoring in relation to activities were the key elements of the intervention. We also tested whether publication bias was present.

Data extraction and risk of bias

After excluding irrelevant titles and studies, two reviewers (SZ, FKL) independently screened studies meeting the inclusion criteria, extracted data and assessed study quality. Disagreements were resolved through discussion with the third reviewer (VO). We used the Cochrane Handbook for Systematic Reviews of Interventions approach, to assess risk of bias (selection bias - random sequence generation and allocation concealment), performance bias

(blinding of participants and personnel, detection bias - blinding of outcome assessment), and attrition and reporting bias. We used a random-effects model to represent overall estimate effects. We measured heterogeneity using the I^2 statistic. We used Review Manager (Revman) 5 for Windows for all meta-analyses (Cochrane Collaboration, Oxford UK; www.cc-ims.net/RevMan) and the GRADE approach to assess quality of evidence. We additionally investigated publication bias and performed several sensitivity analyses to examine effects of several parameters.

Results

We identified 9898 references through database searching and 22 additional potentially relevant references via other sources (see Figure 1 for study flow chart). After removal of duplications and clearly irrelevant articles, we retrieved 184 full text records. Of these, 143 were excluded at this stage as not relevant, leaving 41 full text references to be fully assessed for eligibility. Of these, 27 studies were excluded (see Appendix Table 1 for Excluded studies). A total of 14 studies met inclusion criteria of which 11 contributed to the **primary and secondary** meta-analyses (See Table 1 for Characteristics of main studies including description of elements of BA interventions; **one study is ongoing; Mausback 2018**).

Description of studies

We were able to pool data from twelve studies. There were nine studies reporting on effectiveness of BA on carers of people with dementia, one on carers of older people living with physical or mental illness, and two studies, which did not specify care recipient diagnosis. The main intervention in all twelve studies was BA. Six studies compared BA with enhanced support, including general psychoeducation approaches, whilst the remaining studies compared BA to treatment as usual.

Primary outcomes

Depressive symptoms and depression diagnosis

Meta-analysis of effects of BA on depressive symptoms showed that results significantly favoured BA in reducing carer depressive symptoms at post-treatment (8 studies, 815 participants, standardised mean difference (SMD) -0.68; 95% Confidence Interval (CI) -1.14 to -0.22; efficacy at 4-14 weeks); there was high heterogeneity between studies ($I^2=89\%$) (see Figure 2). One study (Gallagher-Thompson et al., 2003) contributed two independent comparisons. BA was favoured compared to control in the long-term (1 year) reduction of depressive symptoms (2 studies, 235 participants, SMD -0.99; 95% CI -1.26 to -0.71, efficacy at 1 year, $I^2=92\%$; see Figure 3). BA was associated with a decreased risk of depression diagnosis in comparison to control at post-treatment (3 studies, 854 participants, Odds Ratio (OR) 0.35, 95% CI 0.19 to 0.67, efficacy at 3-12 months); with moderate heterogeneity between studies ($I^2=48\%$, Figure 4).

Secondary outcomes

Negative affect and caregiver burden

BA significantly reduced negative affect for carers (3 studies, 183 participants, SMD -0.53; 95% CI -0.83 to -0.23, 6-14 weeks, $I^2=0\%$), and caregiver burden at post treatment compared to control (3 studies, 340 participants, SMD -0.32; 95% CI -0.55 to -0.09, 5-10 weeks, $I^2=10\%$).

Risk of bias, publication bias and overall quality of evidence

Bias was detected predominantly in the domains of allocation concealment, blinding of outcome assessments, incomplete outcome data and selective reporting (for detailed ratings of risk of bias see Figure 5). Using the GRADE approach, the overall quality of evidence of effectiveness of BA for depressive symptoms was rated as moderate. We assessed publication bias via a funnel plot (see Figure 6) which appeared to be approximately symmetrical, indicating no association between standardised effect size and standard errors of effects, which was confirmed by the Egger's test ($t=-1.73$, $P=0.51$).

Sensitivity analyses

We considered whether quality of studies moderated the size of the treatment effect by conducting a meta-analysis only on high quality studies as judged by the Cochrane risk of bias tool. Only four studies ($n = 454$) were qualified to be included in the analysis. Results showed that BA was still significantly associated with a reduction of depressive symptoms (SMD -0.42; 95% CI -0.77 to -0.06, $I^2 = 72\%$), but heterogeneity was reduced. We conducted further analyses to control for type of control comparison group. Six studies ($n = 572$) compared BA to treatment as usual as opposed to enhanced psychosocial support; (SMD -0.46; 95% CI -0.91 to 0, $I^2 = 84\%$). In this analysis, both heterogeneity and size of treatment effect were reduced.

Comparison of BA to other psychological treatments

One study (Au et al., 2015) investigated the efficacy of BA for depressive symptoms compared to structured psychoeducation for dementia caregivers, which incorporated some elements of BA (32); BA was superior to psycho-education at post-treatment (SMD -0.74; 95% CI -1.16 to -0.32; 8 weeks). This study was not included in the meta-analysis.

Discussion

Main findings

In this review, we tried to establish an accurate estimate of the effectiveness of BA for caregiving populations. We evaluated the quantity and quality of the available evidence to date and assessed the effect of presence of publication bias. Our results show that BA appears to show efficacy for improving depressive symptoms for informal carers. We found that BA was effective in reducing depressive symptoms both at post-treatment (SMD = -0.68) and at long-term follow-up (1 year) (SMD = -0.99). BA was associated with a decreased risk of a diagnosis of clinical depression at post-treatment indicating that it may be an important preventative strategy. **BA was associated with better outcomes across domains by**

additionally protecting carers from high levels of negative affect and caregiver burden. Our results therefore support and strengthen the evidence base of BA as an effective treatment for depression.

An important strength of our review is that we were able to investigate effects of BA long-term (1 year) given that maintenance of post treatment effects of an intervention is an important clinical goal. This is significant within the caregiving context, as caregiving responsibilities last many years, gradually increasing over time, exerting a negative effect on carers' mental health, which can extend beyond the end of the caregiving role (Lacey et al., 2018; Lee and Gramotnev, 2007). Although we do not know what are the treatment mechanisms that may be responsible for the observed effects, we have been able to identify the characteristics and key components of BA across studies to date. For example, increasing meaningful and enjoyable activity may be a key treatment mechanism of BA interventions in line with hypotheses that caregiving affects carers' psychological health through time constraints limiting access to social networks and leisure activities (Pearlin et al., 1990; Stansfeld et al., 2014).

The effect generated from our meta-analysis is in line with evidence of CBT-based interventions for carers (Kaddour et al., 2018; Kishita et al., 2018), and data on the effectiveness of BA in the general population (Dimidjian et al., 2011). However, given that, evidence remains moderate and the majority of studies had small sample sizes, further studies are required to increase our confidence on the estimate of the treatment effect. In order to assist with interpretation of reported treatment effects we investigated the effect of quality of evidence and parameters such as type of control comparison group. We found that these parameters generally resulted in overestimation of the treatment effect similar to previous meta-analyses in the literature (Ekers et al., 2018).

Average duration of intervention delivery was 9 weeks and format of intervention varied from telephone activity scheduling, self-help materials, to group and individual sessions, suggesting that BA may be highly adaptable. Similar to previous research we found a comparable effect size across delivery modes (Ekers et al., 2018). The evidence base so far comes from several countries and different ethnic groups of carers, which is encouraging in terms of acceptability of BA across many cultures and settings. However as with previous reviews of BA (Orgeta et al., 2017) treatment protocols utilised to some extent different strategies. All studies meeting our inclusion criteria had activity scheduling as their primary treatment component and to a greater or lesser degree included additional strategies such as structured mood monitoring, relaxation techniques, and general psychoeducation about dementia and/or responding to problem behaviours of the care recipient.

In most studies BA was delivered by psychology graduates (i.e. BSc graduates) which were trained and supervised by a senior clinician. Some studies reported that a combination of psychology graduates and several allied health professionals delivered the sessions, such as social workers, nurses, or occupational therapists (i.e. MSc level clinicians). Only in three out of the thirteen studies BA was delivered by a senior clinician with professional training in psychological therapy. This is in line with research supporting the effectiveness of BA delivered by junior mental health professionals, which may potentially increase its implementation and access to populations at high risk of depression, making this psychological intervention more cost-effective than CBT (Richards et al., 2016).

BA for example may become a more widely chosen psychological intervention compared to standard therapies such as CBT, due to its potential to be more available via cost-effective means such as being delivered via the Internet (Huguet et al., 2018), reducing waiting time to access specialists (Hazell et al., 2017). As hypothesized and shown in previous RCTs, BA can be offered by non-specialists in various settings and formats reflecting the diversity of the

approach, which may be particularly important in terms of accessibility for family carers. BA has been additionally described as a therapeutic model that can be modified according to individual needs, personal values and circumstances making this approach suitable for population-specific adaptations (Mir et al., 2015).

Quality of evidence

Risk of bias was unclear for multiple domains in some studies, with information sometimes insufficient to determine risk of bias. Most of the studies had uncertainties on the areas of random sequence generation, allocation concealment and blinding of participants. Based on GRADE recommendations, we judged the quality of the evidence as moderate. Although there was no evidence of publication bias, small studies may have affected the estimate of the effect.

Implications for practice and research

We did not find any studies reporting on cost-effectiveness and adaptability of BA and how it can be best implemented in clinical practice to benefit the growing number of informal caregivers. For example, BA interventions may assist carers in facilitating and maintaining important health behaviours that will benefit both their physical and mental well-being. Exploring the key treatment mechanisms by which BA improves depression and reduces psychological distress will be important for understanding how outcome change takes place. This will inform the design and development of interventions that are more targeted, addressing needs of specific caregiving populations, and those at higher risk of physical and psychiatric morbidity. Given that most of the evidence to date is in dementia caregivers future large-scale studies are needed to confirm clinical efficacy and cost-effectiveness in caregivers providing informal care to people with other chronic health conditions by incorporating economic outcomes.

Strengths and limitations

This is the first meta-analysis of BA interventions for preventing and treating depression in informal carers, providing valuable knowledge about potential mental health promotion strategies **for this group**. This review followed guidelines set out by the Cochrane Collaboration. We used a thorough and sensitive strategy to identify studies. Two reviewers independently performed selection of studies, data extraction and assessment of risk of bias. Given the small number of studies however, we were unable to conduct meta-regression analyses and examine the effect of informal carer characteristics, such as age, relationship to care recipient, and diagnostic status. We were unable to investigate effects of BA longer than 1 year and although our search was systematic, searching many databases and ongoing trials, we may have still missed studies.

There was evidence of high heterogeneity amongst studies despite controlling for several factors such as quality of evidence and comparison control conditions. Although all of the studies evaluated interventions that incorporated key components of BA such as pleasant activity scheduling, in some studies additional strategies were offered such as psychoeducation and management of disease specific behavioural and psychological symptoms. This may have added to heterogeneity of results, limiting conclusions of treatment mechanisms responsible for the reduction of depressive symptoms. Most studies evaluated effectiveness of BA for carers of people with dementia so therefore our findings may not be generalised to all **caregiving groups**. We were unable to examine the effectiveness of BA in comparison to CBT-based approaches (Lins et al., 2014).

Conclusion

We found that BA was effective in reducing depressive symptoms both at post-treatment and **at long-term follow-up (1 year)**, and decreased risk of diagnosis of clinical depression for carers. BA interventions reduced the experience of negative affect, and subjective caregiver burden indicating that these interventions may benefit carers across general and carer-specific

psychological distress. Given the small number of studies and presence of bias, our results should be interpreted with caution as the size of the treatment effect remains uncertain.

Future large-scale studies are necessary to confirm clinical effectiveness and cost-effectiveness of this approach for the increasing number of informal caregivers worldwide.

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Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

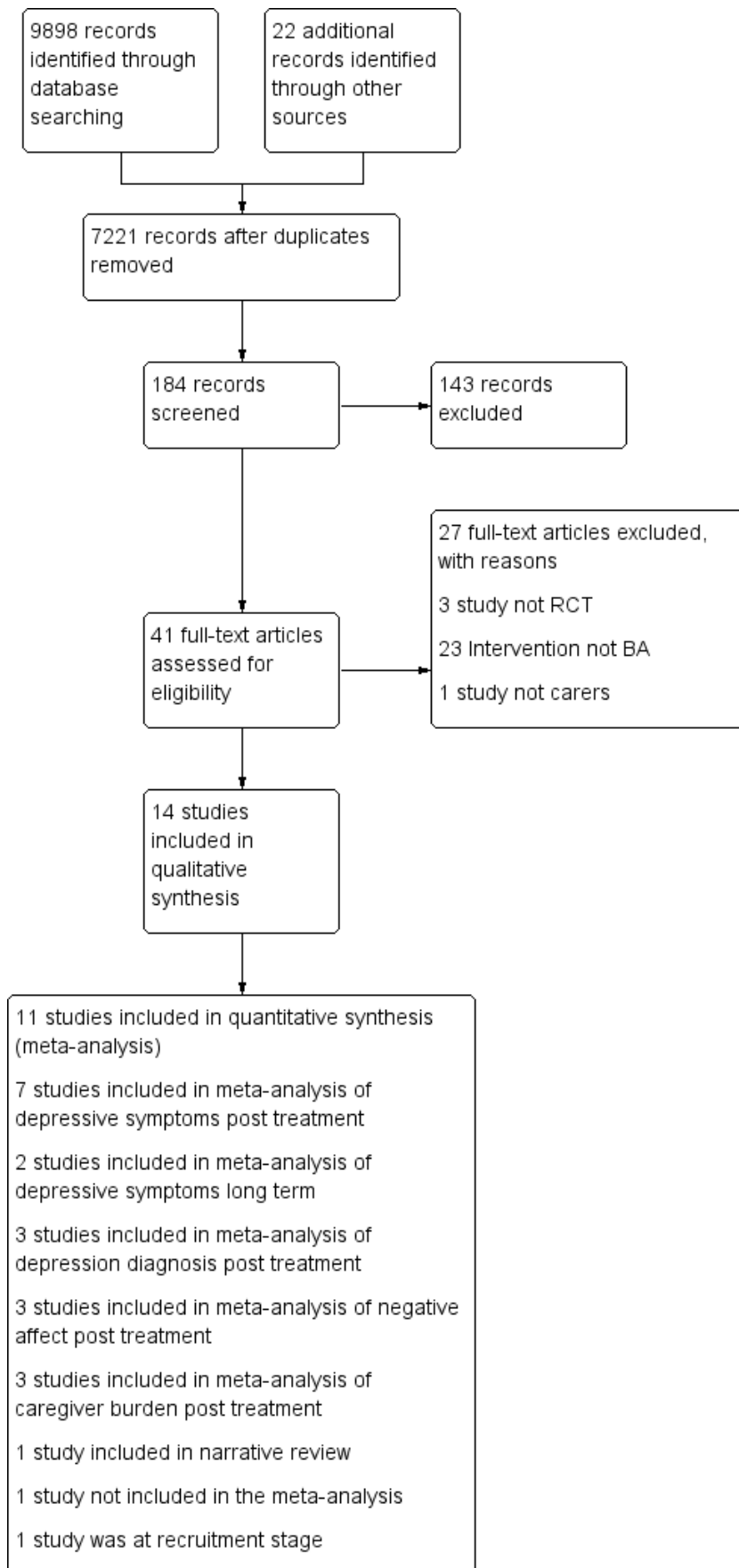


Figure 1. Study flow chart

Table 1. Characteristics of included studies

Study	Sample	Measures	Intervention	Outcome Data Time points
Au et al. 2014 Hong Kong	N=60 Inclusion criteria: •Primary full-time caregiver for at least 6 months •Aged \geq 25 •No sign of severe intellectual deficit, suicidal ideation or psychotic disorder	Primary outcomes 1. Depression (CES-D) 2. Self-efficacy (SE)	TAPES (Telephone-Assisted Pleasant-Event Scheduling) 1. Introduction to BA 2. Pleasant Event Scheduling (PES) 3. Accessing social and psychological services 4. Learning adaptive coping skills (Details of interventionists not provided) Duration: 4 weeks of telephone calls (6 calls in total) Control: TAU (standard care with regular psychiatric follow-up for the care recipient and support from social workers upon request)	1 month post intervention
Au et al. 2015 Hong Kong	N=93 Inclusion criteria: • Aged \geq 25 • Providing care to someone with a diagnosis of AD for at least 3 months	Primary outcomes: 1. Depressive symptoms (CES-D)	Behavioural activation (4 weeks of PsyED through phone at first) 1. Activity monitoring 2. Activity scheduling 3. Reinforcing or modifying pleasant events and communication based on feedback or self-evaluation 4. Activity rescheduling/revision based on changes after modification Delivered by senior citizens trained as paraprofessionals (with background in nursing or management) Duration: 4 weeks Control: 4 weeks of enhanced structured PsyED for dementia caregivers 1. Information about dementia and its effect on caregivers 2. Information about stress and how to be aware of it 3. Learning about pleasant event scheduling	1. Post-intervention (4 weeks) 2. Follow-up (8 weeks)

<p>Belle et al. 2006</p> <p>USA</p>	<p>N= 642</p> <p>Inclusion criteria:</p> <ul style="list-style-type: none"> • Hispanic or Latino, White or Caucasian, Black or African-American caring for someone with a diagnosis of AD or related disorders • Aged ≥ 21 • Living with the care recipient • Caring ≥ 4 hours a day for ≥ 6 months • Reporting distress associated with caregiving 	<p>Primary outcomes</p> <ol style="list-style-type: none"> 1. Depression (CES-D) 2. Caregiver burden (ZBI) 3. Self-Care (one-item) 4. Social support (one-item) 5. Problem behaviours (RMBPC) <p>Secondary outcomes</p> <ol style="list-style-type: none"> 1. Prevalence of clinical depression (CES-D) 2. Institutional placement of care recipient 	<p>4. Teaching of different types of communication with family members</p> <p>Multicomponent BA</p> <ol style="list-style-type: none"> 1. Providing information on PES, caregiving and stress, self-care, preventive health practices, dementia and managing behaviours 2. Teaching and practicing Pleasant Events (PE) strategies 3. Mood management 4. Relaxation and healthy behaviours to enhance communication 5. Establishing schedule of PE 6. Problem solving 7. Additional telephone support <p>Delivered by trained interventionists (BSc graduates; probably in psychology, social work or related discipline)</p> <p>Duration: 6 months</p> <p>Control: Educational materials (basic information about dementia and AD, caregiving, safety, community resources), 2 brief telephone check-ins at 3 and 5 months</p>	<p>6 month follow-up</p>
<p>Coon et al. 2003</p> <p>USA</p>	<p>N= 169</p> <p>Inclusion criteria:</p> <ul style="list-style-type: none"> • Female • Aged ≥ 50 • Caring for someone with a diagnosis of dementia • No evidence of psychosis, alcoholism, suicidal risk or bipolar disorder • Not currently on psychotropic medication 	<p>Primary outcomes</p> <ol style="list-style-type: none"> 1. State Anger (STAXI) 2. Hostility (MAACL) 3. Depressed mood (MAACL) 4. Coping strategies (WCCL-R) 5. Self-efficacy (SE) 	<p>Mood and PES management</p> <ol style="list-style-type: none"> 1. Introduction to the relationship between mood and PE 2. Developing self-monitoring techniques 3. Development of individualised lists of everyday pleasant activities <p>Delivered by clinical psychologists, clinical interns, advanced level graduate students and master's level clinicians</p> <p>Duration: 12 weeks</p>	<p>12 weeks</p>

	<ul style="list-style-type: none"> • No signs of severe cognitive impairment (MMSE \geq 25) 		<p>Control: Waiting-list (brief telephone calls to maintain interest in the study)</p>	
<p>Gallagher-Thompson et al. 2000</p> <p>USA</p>	<p>N= 213</p> <p>Inclusion criteria:</p> <ul style="list-style-type: none"> • Providing care to an adult aged \geq60 who is physically and/or mentally limited in self-care abilities 	<p>Primary outcomes</p> <ol style="list-style-type: none"> 1. Depressive syndromes (SADS) 2. Coping (IC) 3. Burden (CTCL) 4. Perceived stress (PSS) 	<p>Increasing Life satisfaction</p> <ol style="list-style-type: none"> 1. Monitoring of daily mood and rate of engagement in PE 2. Developing a self-change plan to increase at least one PE 3. Review of barriers of PE 4. Learning to reward oneself to maintain the new activity schedule <p>Delivered by mental health professionals & advanced graduate students</p> <p>Duration: 10 weeks</p> <p>Control: Waiting-list group receiving minimal contact</p>	<p>10 weeks</p>
<p>Gallagher-Thompson et al. 2003*</p> <p>USA</p>	<p>N= 213</p> <p>Inclusion criteria:</p> <ul style="list-style-type: none"> • Female • Aged \geq21 • Care recipient has a formal diagnosis of dementia or MMSE \leq 23 • Providing \geq4 hours of care • Relative experiencing impairment in at least 1 or 2 instrumental activities of daily living (IADL) or one activity of daily living (ADL) • Caring for at least 6 months 	<p>Primary outcomes</p> <ol style="list-style-type: none"> 1. Caregiver depression (CES-D) 2. Coping (RWCCCL) 3. Social support (ISSB) 4. Caregiver bother (RMBPS) 	<p>Psychoeducation based on the Coping with Caregiving Class (CWC) program</p> <ol style="list-style-type: none"> 1. Introduction to relaxation, behaviour appraisal and communication 2. Monitoring of mood and activities 3. Developing a PEA schedule to do small, everyday pleasant activities 4. Setting and learning self-change goals and rewarding oneself 5. Relaxation techniques <p>Delivered by trained interventionists including graduate psychologists, social workers or other allied health professionals</p> <p>Duration: 18 weeks</p> <p>Control: Enhanced support group (caregiver support groups in the community)</p>	<p>3 month follow-up</p>

Gant, Steffen & Lauderdale 2007	<p>N= 32</p> <p>Inclusion criteria:</p> <ul style="list-style-type: none"> •Male •Aged 30-85 •Caring for someone with dementia •No alcohol abuse, serious suicidal ideation, or history of suicidal attempt •Reporting moderate distress following 2 or more care recipient behaviours 	<p>Primary outcomes</p> <ol style="list-style-type: none"> 1. Upset and annoyance (RMBPC) 2. Self-efficacy (SE) 3. Positive and negative affect (PANAS) 4. Target Complaints Interview (TCI) 	<p>BA</p> <ol style="list-style-type: none"> 1. Introduction to BA 2. Behavioural activation scheduling and rationale 3. Relaxation techniques 4. Psychoeducation on AD (10 session video series, workbook from the Dementia Caregiving Skills Program) 5. Reducing problem behaviours through behavioural management skills <p>Delivered by trained coaches (clinical geropsychologists, MSc gerontology students)</p> <p>Duration: 12 weeks</p> <p>Control: Education and check-in-calls (information about dementia and suggestions for dealing with caregiving challenges, 7 bi-weekly phone calls for checking on safety and usage of information booklets)</p>	<p>Post-intervention (12 weeks)</p>
Gonyea et al. 2006	<p>N=80</p> <p>Inclusion criteria:</p> <ul style="list-style-type: none"> •Providing care for a minimum of 4 hours weekly •Care recipient has AD (MMSE\geq10), and at least 1 neuropsychiatric symptom 	<p>Primary outcomes</p> <ol style="list-style-type: none"> 1. Caregiver distress (NPI) 2. Global caregiver burden (ZBI) 3. Severity of neuropsychiatric symptoms (NPI) 	<p>Group-based BA</p> <ol style="list-style-type: none"> 1. Psychoeducation about BA 2. Behavioural management 3. PES 4. Relaxation techniques 5. Psychoeducation about AD 6. Review of PES every week <p>Delivered by trained therapists (further details not provided)</p> <p>Duration: 5 weeks</p> <p>Control: General psychoeducation (general information on aging and AD, home safety, techniques for improved communication and support)</p>	<p>1 week post-intervention</p>

<p>Losada, Marquez-Gonzalez & Romero-Moreno 2011</p> <p>Spain</p>	<p>N= 170</p> <p>Inclusion Criteria:</p> <ul style="list-style-type: none"> •Caring for someone with a diagnosis of AD or other dementia •Providing more than one hour of care daily •Caring for longer than 3 months 	<p>Primary outcomes</p> <ol style="list-style-type: none"> 1. Dysfunctional thoughts about caregiving (DTCQ) 2. Frequency of leisure activities (LTS) 3. Depression (CES-D) 	<p>Group based BA</p> <ol style="list-style-type: none"> 1. Psychoeducation about key CBT concepts 2. Pleasant Activity Scheduling and weekly review 3. Review of barriers to activities 4. Learning CBT techniques 5. Homework assignment of BA <p>Delivered by a graduate psychologist & an occupational therapist</p> <p>Duration: 12 weeks</p>	<p>3 months</p>
<p>Moore et al. 2013</p> <p>USA</p>	<p>N= 100</p> <p>Inclusion criteria:</p> <ul style="list-style-type: none"> •Aged ≥ 55 •Caring for someone with AD or other dementia •Not receiving beta-blocking/anticoagulant medications •Not having severe hypertension, diagnosis of a terminal illness •Have not received behavioural or cognitive psychotherapy recently 	<p>Primary outcomes</p> <ol style="list-style-type: none"> 1. D-dimer 2. Interleukin-6 3. Depressive symptoms (CES-D) <p>Secondary outcomes</p> <ol style="list-style-type: none"> 1. Positive and negative affect (PANAS) 	<p>Pleasant Events Program (PEP)</p> <ol style="list-style-type: none"> 1. Introduction to PE and BA rationale 2. Recognizing negative moods and creating a healthy environment 3. Measuring life goals and identifying activities <p>Delivered by Master's level clinicians</p> <p>Duration: 6 weeks</p> <p>Control: Information and support (resource manual on problem-solving, communication, and management of problem behaviours)</p>	<ol style="list-style-type: none"> 1. Post-intervention (6 weeks) 2. 1 year follow up

<p>Read, Mazzucchelli & Kane 2016</p> <p>Australia</p>	<p>N= 13</p> <p>Inclusion criteria:</p> <ul style="list-style-type: none"> • Being a carer • Not currently experiencing a depressive episode 	<p>Primary outcomes:</p> <ol style="list-style-type: none"> 1. Depression (DASS-21) 2. Anxiety (DASS-21) 3. Stress (DASS-21) 4. Positive wellbeing (WEMWBS) <p>Secondary outcomes:</p> <ol style="list-style-type: none"> 1. Environmental reward (RPI) 2. Valued living (VLQ) 	<p>Behavioural activation (single session)</p> <ol style="list-style-type: none"> 1. Introduction to BA 2. Life-values assessment 3. Activity hierarchies 4. Goal setting 5. Review and modification of goals <p>Delivered by a trained clinical psychology graduate</p> <p>Duration: 1 week</p> <p>Control: Waitlist-list control group</p>	<p>2 weeks</p>
<p>Steffen & Gant 2016</p> <p>USA</p>	<p>N= 66</p> <p>Inclusion criteria:</p> <ul style="list-style-type: none"> •Female gender •Aged ≥ 30 •Carer of patient with a NCD •≥ 2 upsetting care-recipient memory/behaviour problems •3 positive symptoms on the CES-D •No plans for placement in nursing care/hospice •No history of suicide attempts/current ideation •Alcohol use ≤ 2 drinks/day •Receiving primary care 	<p>Primary outcomes</p> <ol style="list-style-type: none"> 1. Depressive symptomatology (BDI-II) 2. Upset following memory and behaviour problems (RMBPC) <p>Secondary outcomes</p> <ol style="list-style-type: none"> 1. Negative Affect (PANAS) 2. State anxiety (MAACL) 3. State hostility (MAACL) 4. Caregiving self-efficacy (SE) 	<p>Behavioural coaching based on BA</p> <ol style="list-style-type: none"> 1. Introduction to BA 2. BA for both the carer and care recipient 3. Management of disruptive behaviours 4. Relaxation techniques during caregiving situations (10 video segments, a workbook, 10 weekly telephone calls, 2 maintenance calls) <p>Delivered by a clinical psychologist & master-trained clinical graduates</p> <p>Duration: 14 weeks</p> <p>Control: TAU (provision of information and support by non-profit agencies)</p>	<ol style="list-style-type: none"> 1. 14 weeks 2. 6 months follow-up
<p>Vasquez et al. 2016</p> <p>Spain</p>	<p>N= 170</p> <p>Inclusion criteria:</p> <ul style="list-style-type: none"> •Female •CES-D score ≥ 16 •No current or past MDD episode or any Axis I disorder 	<p>Primary outcomes</p> <ol style="list-style-type: none"> 1. Incidence of depression (SCID-CV) <p>Secondary outcomes</p>	<p>Brief behavioural intervention based on the model by Lewinsohn et al., (1985)</p> <ol style="list-style-type: none"> 1. Introduction to depression 2. Increasing PES 3. Monitoring mood 4. Preventing depression 5. Changing thoughts 	<ol style="list-style-type: none"> 1. 5 weeks 2. 3 month follow-up 3. 6 month follow-up 4. 12 month follow-up

- Have not received psychological or psychiatric treatment in past 2 months
- No change of residence
- No severe or terminal diagnosis for carer and patient

1. Compliance with treatment
2. Depressive symptoms (CES-D)
3. Emotional distress (GHQ-28)
4. Caregiver burden (ZBI)
5. Participation in pleasant activities (LPAC)
6. Depressive thoughts (ATQ-N)
7. Social contacts (SCR)

6. Increasing interpersonal activities
7. Relaxation techniques

Delivered by trained psychologists
Duration: 5 weeks

Control: TAU (standard care offered locally available)

Notes: CES-D= Centre for Epidemiologic Studies Depression Scale; SE=Revised Scale for Caregiving Self-Efficacy; AD= Alzheimer's disease; PsyED=Psychoeducation; ZBI= Zarit Caregiver Burden Interview; RMBPC= Revised Memory and Behaviour Problem Checklist; MMSE= Mini Mental State Examination; STAXI= State-Trait Anger Expression Inventory; MAACL= Multiple Affect Adjective Checklist; WCCL-R= Ways of Coping Checklist-Revised; SADS= Schedule for Affective Disorders and Schizophrenia; IC= The Indices of Coping; CTCL= Caregiver Task Checklist; PSS= Perceived Stress Scale; RWCCCL= Revised Ways of Coping Checklist; ISSB= Inventory of Socially Supportive Behaviours; PANAS= Positive and Negative Affect Scale; TCI = Target Complaints Interview; NPI= Neuropsychiatric Inventory; DTCQ= Dysfunctional Thoughts about Caregiving Questionnaire; LTS= Leisure Time Satisfaction; DASS-21= Depression Anxiety Stress Scales 21; WEMWBS= Warwick-Edinburgh Mental Well-Being Scale; RPI= Reward Probability Index; VLQ= Valued Living Questionnaire; NCD= Neurocognitive Disorder; BDI= Beck Depression Inventory; MDD= Major Depressive Disorder; SCID-CV= Structured Clinical Interview for DSMIV; GHQ-28= General Health Questionnaire; LPAC= List of Pleasant Activities for Caregiver; ATQ = Automatic Thoughts Questionnaire-Negative; SCR = Social Contacts Registry; * for this study we extracted data from two independent samples.

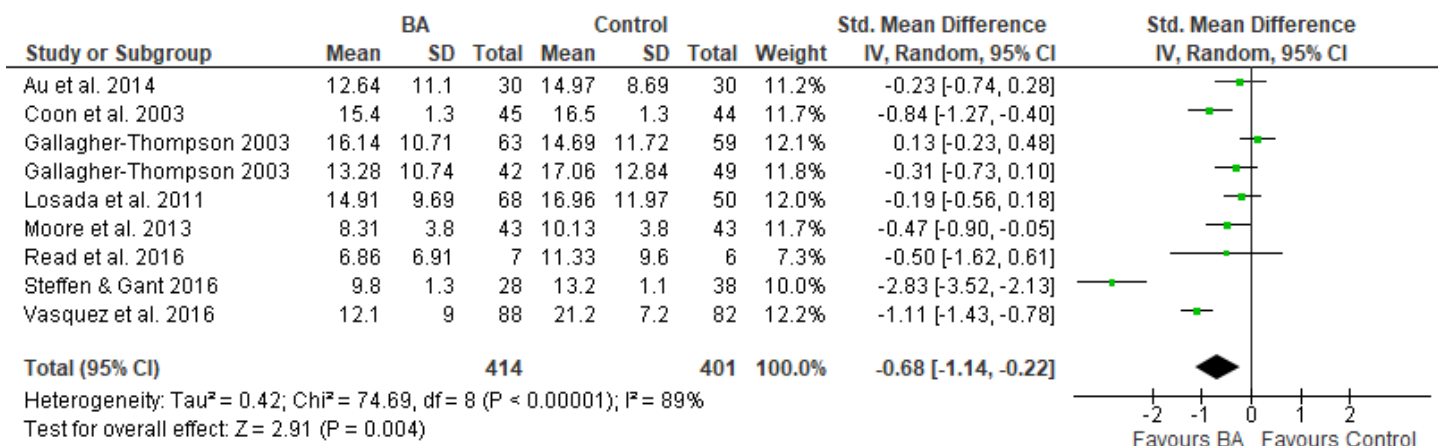


Figure 2. Forest plot of BA versus control group for caregivers. Outcome: Depressive symptoms post-treatment (4-14 weeks)

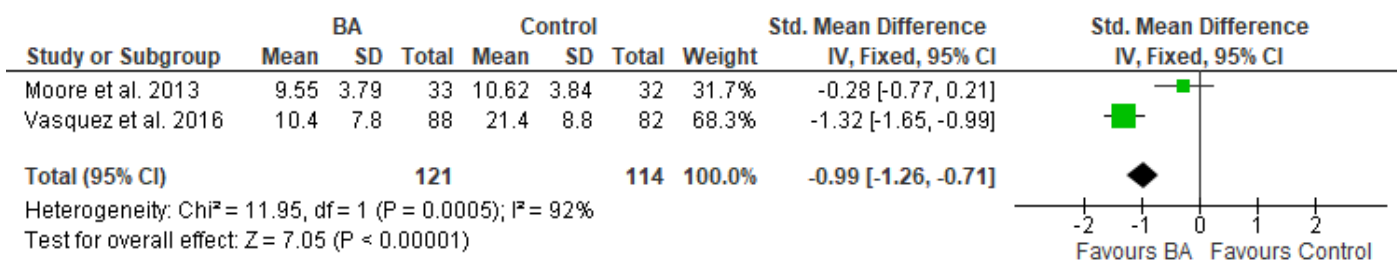


Figure 3. Forest plot of BA versus control group for caregivers. Outcome: Depressive symptoms long-term (1 year)

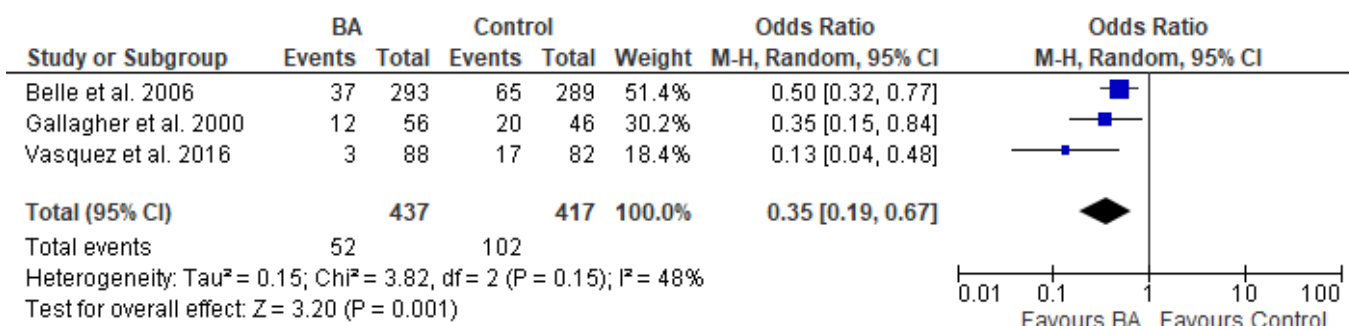


Figure 4. Forest plot of BA versus control group for caregivers. Outcome: Diagnosis of clinical depression post-treatment (3-12 months)

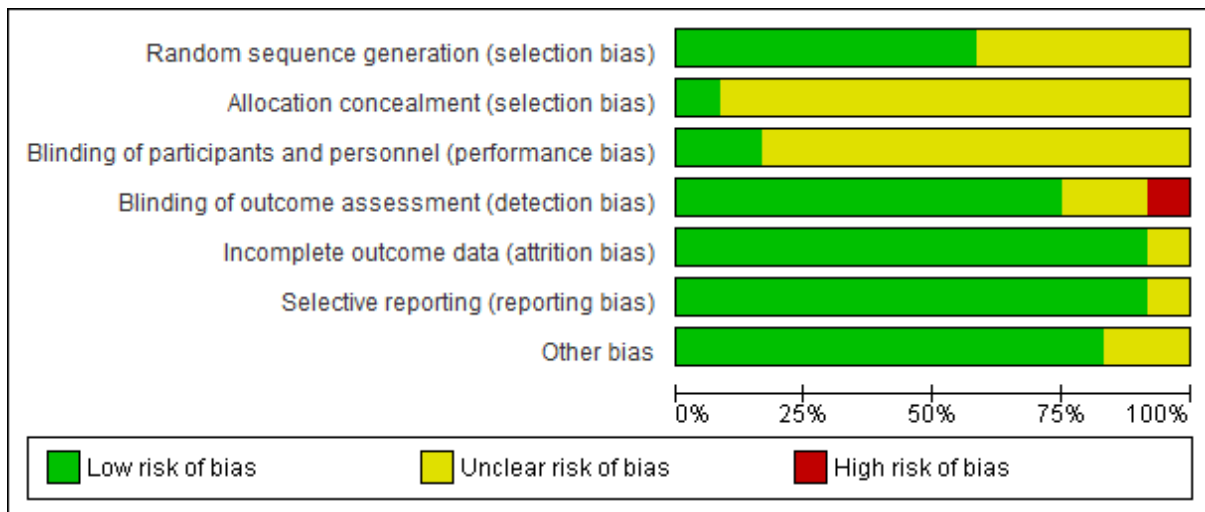


Figure 5. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

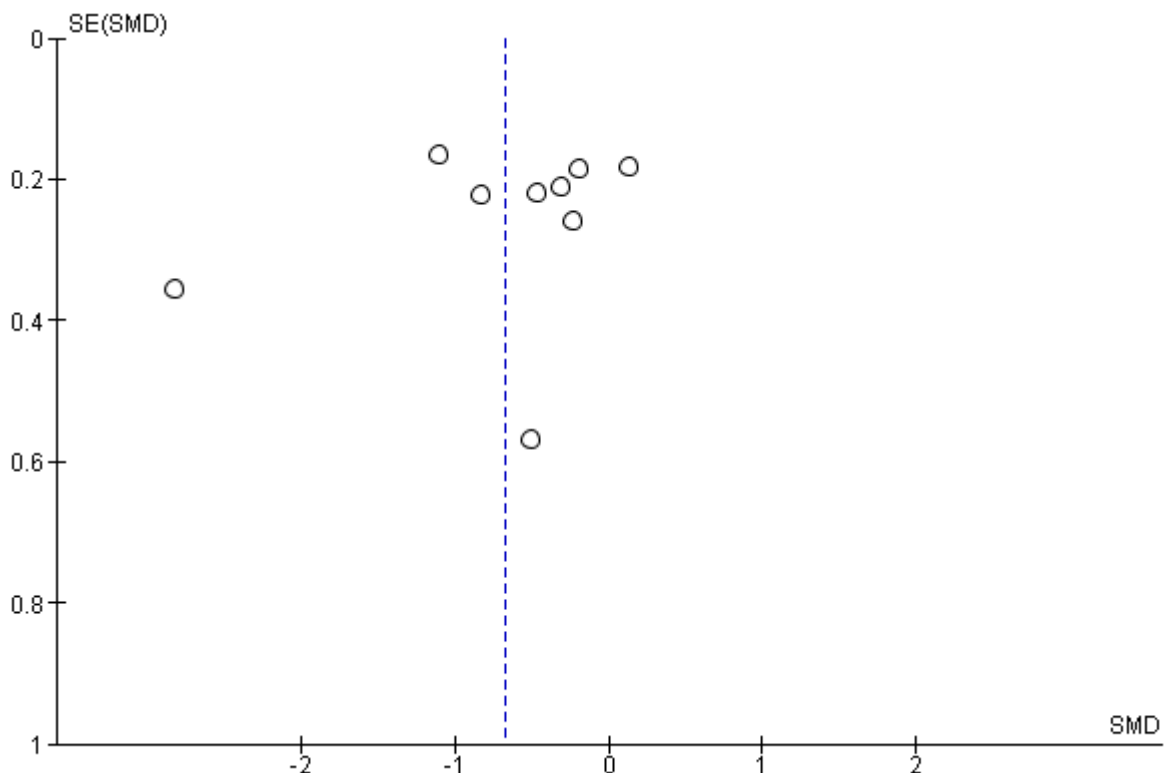


Figure 6. Funnel Plot as indicator of publication bias: BA studies included in meta-analysis for depressive symptoms post-treatment

Highlights

- Results support the efficacy of BA for reducing depressive symptoms in informal caregivers both at post-treatment and **at long-term follow-up (1 year)**
- BA is effective in reducing negative affect and caregiver burden
- High quality studies are needed to improve quality of evidence
- **Given that most of the evidence is in dementia caregiving more research is needed to evaluate the efficacy of BA in caregivers providing informal care to people with other chronic health conditions**

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Figure 1 Search strategy of the review

Table 1. Excluded studies

Study	Reason for Exclusion
1. Borji 2017	RCT of a 10-session group CBT vs. control for caregivers of people living with prostate cancer
2. Burgio 2003	RCT of skills training vs. a minimal support control group for dementia caregivers
3. Cernwall 2017	Long-term (1 year) follow-up RCT of a 10-week internet-based guided self-help CBT intervention plus psychoeducation and coping skills vs a waiting-list control group for parents of children on cancer treatment
4. Chambers 2014	RCT of a single session of self-management vs. 5 sessions of a CBT-based intervention for family carers of people living with cancer
5. Connell 2009	RCT of a telephone-based exercise intervention vs. a control group for dementia caregiving wives
6. de Oliveira 2018	RCT of a tailored activity program vs. psychoeducation for people living with dementia
7. Dowling 2014	RCT of a skill-building intervention teaching skills of gratitude, mindfulness, positive reappraisal, goal setting and altruistic behaviours vs. a control group for family caregivers of people with frontotemporal dementia
8. Dykes 2014	RCT of mindfulness vs. positive psychology practice for mothers of children with disabilities
9. Farran 2007	RCT of a skill building intervention vs. support for dementia caregivers
10. Gallagher-Thompson 1994	RCT of CBT vs. psychodynamic individual psychotherapy for depressed family caregivers
11. Gallagher-Thompson 1995	Case study of grief counselling based on CBT for a family carer of a person living with dementia
12. Gonyea 2016	RCT of a culturally-sensitive CBT intervention vs. psychoeducation for Latino Alzheimer's caregivers
13. Grover 2011	RCT of web-based CBT vs. treatment as usual for carers of people with anorexia nervosa
14. Hoekstra-Weebers 1998	RCT of psychoeducation based on CBT vs. control for parents of paediatric cancer patients
15. Levy 2017	RCT of social learning and CBT vs. education and support for parents of children with functional abdominal pain disorder
16. Ljungman 2018	Feasibility of an individualized face-to-face CBT for parents of children with treated cancer
17. Lopez 2008	RCT of CBT vs. minimal therapist contact for caregivers of elderly dependent relatives
18. McCann 2015	RCT of psychoeducation based on Cognitive therapy (CT) and self-help vs. wait-list control for carers of people with a diagnosis of depression in Thailand
19. Meichsner 2017	Case study of CBT with grief-focused content for 2 caregivers of people with dementia
20. Mosher 2016	Pilot RCT of a 4-session telephone-based symptom management program based on CBT and emotion-focused therapy vs. education or support for carers of people with symptomatic lung cancer
21. Polo-Lopez 2015	RCT of CBT vs. control for relatives of people diagnosed with mental illness
22. Rodriguez-Sanchez 2013	RCT of CBT for managing dysfunctional thoughts about caregiving and self-help techniques vs. control for carers of dependent relatives
23. Secker 2005	RCT of CBT vs. no-treatment control for caregivers of people with Parkinson's disease

24. Schure 2006 RCT of an individual psychoeducational intervention vs. group format for family caregivers of stroke survivors
 25. Schwartz 1998 RCT of brief problem-solving training vs. general health counselling for reducing distress among women with a first-degree relative recently diagnosed with breast cancer
 26. Sveen 2017 RCT of internet-based psychoeducation and self-help vs. waiting-list for parents of children and adolescents with burns
 27. Wilz 2015 RCT of short-term telephone-based CBT vs. no-treatment or attention control for dementia family caregivers
-