Do interventions that include education on dementia progression improve knowledge, mental health and burden of family carers? A systematic review

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Abstract

Background and Aim: The European Association of Palliative Care recommends that family carers need education on the progression of dementia. This systematic review aimed to explore whether interventions incorporating education regarding the progressive nature of dementia increased carers' understanding of dementia and improved mental health and burden.

Method: MEDLINE, PsycINFO and CINAHL were searched to April 2018. Randomised controlled trials with samples of family carers of someone with dementia were eligible. Included interventions involved a component aimed to increase the carer's understanding of the progression of dementia. Outcomes of interest included: knowledge of dementia, depression, burden and pre-death grief.

Results: Searches identified 3221 unique citations of which 11 studies were eligible for review. Interventions ranged from 4-16 sessions of which 1-3 sessions focused on the progression of dementia. *Knowledge*: Two studies evaluated carers' knowledge of dementia. One found no difference between the trial arms immediately after the intervention or three months later. The second found a significant intervention effect at the end of the intervention, but not at three month follow-up. *Depression:* Seven studies evaluated intervention effects on depression. Meta-analysis of three trials showed significant differences in mean follow-up scores favouring intervention

over control. The remaining four studies did not show differences in depression between intervention and control groups. *Burden*: Nine studies evaluated burden and were examined in two meta-analyses (mean scores at follow-up and mean change scores from baseline to follow-up), neither of which found a benefit for intervention over control. Using the GRADE system we judged the quality of evidence to be very low for depression and low for burden, knowledge and pre-death grief, reducing our confidence in any of the effect estimates.
Conclusion: There was not sufficient evidence to support nor refute the effectiveness of education on progression of dementia on carers' knowledge and mental health.

Introduction

Globally, an estimated 46.8 million people have dementia and this figure is expected to almost treble by 2050 (Alzheimer's Disease International, 2015). Deaths due to Alzheimer's disease and other dementias more than doubled between 2000 and 2015 making it the seventh leading cause of death worldwide (World Health Organization, 2017). Most people, particularly in the early stages of dementia, live at home (Wimo, Jonsson, Bond, Prince, & Winblad, 2013) and are cared for by family members or friends (hereafter referred to as 'carers') estimated to provide the equivalent of more than 40 million full time workers worldwide (Wimo, Gauthier, & Prince, 2018). However, one study found only 43% of 161 family carers of nursing home residents considered dementia a disease you can die from (van der Steen, Onwuteaka-Philipsen, Knol, Ribbe, & Deliens, 2013).

Being a carer is associated with a high level of burden (Abreu, Tolson, Jackson, & Costa, 2018) and dementia carers have a greater risk of having a depressive disorder (Cuijpers, 2005). Grief is also common among dementia carers, with between 47-71% of carers experiencing grief before the death of the person with dementia as they experience losses in their roles and the relationship with the person with dementia (Chan, Livingston, Jones, & Sampson, 2013). This 'pre-death grief' has been defined as the carers' "emotional and physical response to the perceived losses in a valued care recipient." (p2203) (Lindauer & Harvath, 2014).

While the death of a relative can sometimes be a relief for carers of people with dementia, around 20% will go on to experience prolonged grief disorder after death (Chan et al., 2013). Feeling unprepared for end of life is associated with prolonged grief disorder, depression and anxiety (Barry, Kasl, & Prigerson, 2002; Hebert, Dang, & Schulz, 2006). Feeling prepared for end of life is multifaceted but a key element is having an understanding of the prognosis and recognising symptoms of decline and having good communication with healthcare providers to address any concerns and questions (Durepos et al., 2018; Hebert, Prigerson, Schulz, & Arnold, 2006). Schulz et al (2006) showed that interventions that provide education, skills training and

support groups for carers of people with dementia reduced their depression and level of burden. These interventions were also found to have a knock-on effect on the level of grief among carers after the death of their loved ones.

Increasing carers' understanding of prognosis of dementia could also be beneficial to people dying with dementia, as carers' with more extensive understanding of the disease progression tend to choose less aggressive care (Mitchell et al., 2009), and it also predicts care recipients' comfort when dying (van der Steen et al., 2013). The importance of education about the progressive and terminal nature of dementia therefore appears to be an important element in supporting family carers whilst they are caring for someone with dementia. This is also reflected in the European Association of Palliative Care's white paper on optimal palliative care in dementia where they recommend that education on the progression of dementia should be provided to carers alongside treatment options (van der Steen et al., 2014). However, knowledge of the life-limiting course of dementia is an area that is less well understood among nurses, care staff and family carers of those with advanced dementia (Robinson et al., 2014).

Clinical guidelines and studies highlight the importance of increasing carers' knowledge and understanding of dementia as a progressive disease you can die from. Improving carers' knowledge of dementia should increase their preparedness for end of life (Steinhauser et al., 2001) which we anticipate will consequently benefit their mental health. Although there has been evidence that educational interventions that aimed to improve carers' caregiving skills resulted in a small to moderate effect on depression and burden (Jensen, Agbata, Canavan, & McCarthy, 2015), no systematic review to date has explored the evidence on the effect of education about the progression of dementia on carers' mental health.

Aim

The aim of this review was to explore whether interventions that incorporated education regarding the progressive nature of dementia could increase carers'

understanding of dementia, and in turn, could reduce their depression, burden and pre-death grief.

Method

Inclusion criteria

- Randomised controlled trials (RCT) in any setting.
- Participants who were family carers defined as non-paid, non-professional carers who provide care for a relative or friend with dementia of any type and severity.
- Studies where the intervention of interest involved an educational intervention that aimed to improve carers' knowledge and understanding of the progression of dementia. Multi-component interventions involving for instance psychotherapeutic support were also included, however, there must have been a specific educational component that focused on progression of dementia.
- Interventions delivered in individual or group format.
- Studies that assessed at least one of the outcomes of interest: knowledge of dementia, depression, burden and pre-death grief.

Exclusion criteria

- Studies not written in English.
- Studies where the control group also received education on the progression of dementia.

Outcomes of interest

The primary outcomes of interest were knowledge of dementia, depression, burden and pre-death grief. These may be captured by validated scales such as the Center for Epidemiologic Studies Depression scale (Radloff, 1977) for depression, the Zarit Burden Interview (Zarit, Reever, & Bach-Peterson, 1980) for carer burden or the Marwit-Meuser Caregiver Grief Inventory (Marwit & Meuser, 2002) for pre-death

grief. We were interested in impact over time and consider post intervention follow-up and longer term follow-up, anticipating that most would be within a 6 month period from baseline assessment.

Search strategy

We searched MEDLINE, PsycINFO and CINAHL to April 2018. The search strategy included terms associated with dementia, intervention and study design as shown in Table 1.

Table 1: Search terms by database

Database	Search Terms
Ovid PsycINFO	1. exp Dementia/ or dement* or alzheimer* or (frontotemporal* or FTD or FTLD) or (lew* adj2 bod*) 2. caregiver* or carer* or famil* or relatives or kin* or spouse* 3. (1 and 2) 4. education or knowledge or information or teach* or train* or health promotion or booklet* or leaflet* 5. (3 and 4) 6. exp Intervention/ or exp Clinical Trials/ or randomly or (randomised or randomized or RCT or trial) or "double-blind" or "single blind" 7. (5 and 6)
Cinahl EBSCO	1. (MH "Dementia") or TX dement* or TX alzheimer* or TX "lew* bod*" or TX (FTLD or FTD or frontotemporal*) 2. TX caregiver* or TX carer* or TX famil* or TX relatives or TX kin* or TX spouse* 3. (1 and 2) 4. TX education or TX knowledge or TX information or TX teach* or TX train* or TX health promotion or TX leaflet* or TX booklet* 5. (3 and 4) 6. (MH "Randomized Controlled Trials") or TX randomised or TX randomized or AB randomly or AB "double blind" or AB "single blind" or AB RCT 7. (5 and 6)
Ovid Medline	1. exp Dementia/ or dement* or alzheimer* or (lewy* adj2 bod*) or (chronic adj2 cerebrovascular) or ("organic brain disease" or "organic brain syndrome") or (cerebr* adj2 deteriorat*) or (cerebral* adj2 insufficient*) or (pick* adj2 disease) or (creutzfeldt or JCD or CJD) or binswanger* 2. caregiver* or carer* or family* or relatives or kin* or spouse* 3. (1 and 2) 4. education or knowledge or information or teach* or train* or health promotion or booklet* or leaflet* 5. (3 and 4) 6. randomized controlled trial or controlled clinical trial or random$ or groups or RCT or intervention 7. (5 and 6)

Note: *=truncated or wildcard search; FTD=Frontotemporal Dementia; FTLD= Frontotemporal lobar degeneration; adj2=adjacent to; RCT=Randomised Controlled Trial; MH= MeSH Heading (Medical Subject Headings); CJD= Creutzfeldt-Jakob disease; JCD= Jakob-Creutzfeldt disease; TX=full text, AB=Abstract

Data collection and analysis

Selection of studies

Two review authors (CYL, KJM) independently screened for inclusion the citations retrieved. Full text versions of citations that were classified as relevant by either

author were retrieved for definitive assessment of eligibility. Any disagreement regarding inclusion were resolved through discussion, or where necessary, with reference to a third author (BC).

Data extraction and management

Key data were extracted by one author (CYL) using a data extraction form and was verified by the second author (KJM). Outcome data as appropriate were entered into Review Manager 5 (RevMan, 2014) for meta-analysis.

Assessment of risk of bias of included studies

As only RCTs were included, the Cochrane risk of bias tool (Higgins & Green, 2011) was used to assess the quality of the included studies. Two authors (CYL, BC) independently assessed the risk of bias, any disagreements were resolved through discussion, or where necessary, with reference to another author (KM). Five items were considered as reported in Table 2. Each parameter was classified as either low risk, unclear risk or high risk of bias.

Table 2: Assessment of bias

Bias	How bias was assessed.
Selection bias: random sequence generation and allocation concealment	We assessed whether the allocation sequence to trial arms was generated randomly. For allocation concealment, we assessed whether the participants' allocation to treatment groups could be foreseen before assignment.
Detection bias	We attempted to ascertain whether trial outcome assessors were blinded to participants' treatment allocation.
Attrition bias	We explored the reasons for dropouts or withdrawal, and whether it was clearly reported.
Sample size	As small sample sizes are likely to lead to an overestimation of the treatment effect, we considered small sample sizes, with less than 50 participants per treatment arm to be high risk (Zhang, Xu, & Ni, 2013).

Statistical analysis

We considered meta-analyses for studies assessing the same outcome of interest and with a similar follow-up period (3-6 months post baseline). For studies that had more than one follow-up, we used the first assessment within the 3-6 month follow-up period in the meta-analysis. If the same scale was used across the studies, we reported treatment effect in terms of mean difference (MD). If different scales were used across the studies, the treatment effect was reported as the standardised mean difference (SMD). As we envisaged heterogeneity between trials we used random effect models for all analyses. We considered an I^2 statistic of 50% or greater as an indication of substantial heterogeneity across the studies and explored reasons for this through subgroup analyses to explore whether certain characteristics of trials accounted for heterogeneity. We undertook exploratory analyses to explore whether excluding studies with a high risk of bias or a different intervention format (such as group presentation or online) reduced heterogeneity.

Grading of Recommendations Assessment, Development and Evaluation (GRADE)

The GRADE system (Ryan & Hill, 2016; Schünemann et al., 2017) was used to judge the certainty of evidence behind each outcome. The quality of the evidence was graded as either:

- **High**: We were very confidence that the true effect lies close to that of the effect estimate.
- **Moderate**: We were moderately confidence in the effect estimate. The true effect is likely to be close to the effect estimate, but there is a possibility that it is substantially different.
- **Low**: Our confidence in the effect estimate was limited. The true effect may be substantially different from the effect estimate. Or,
- **Very low**: We had very little confidence in the effect estimate. The true effect is likely to be substantially different from the effect estimate.

Depending on the seriousness of the limitation, we would downgrade the evidence by one or more levels. The GRADE judgements were undertaken by one author (CYL) and checked by another (BC). Any disagreements were resolved through discussion, or where necessary, with reference to another author.

We first assumed that the quality of the evidence was high, but downgraded if there were serious limitations in:

1. **Risk of bias of contributing studies**: This was based on the risk of bias assessment described above. For instance, if most information is from studies at an unclear risk of bias then downgrading by one level may be appropriate as it is likely that there is plausible bias that could seriously alter the results.
2. **Indirectness of evidence**: Whether the population, intervention, control or outcomes were not directly relevant to this review. For instance, if the focus of the review is only adults but the studies included involved participants of all ages.
3. **Inconsistency of the results**: for example if the individual studies yielded widely differing estimates of effect. If only one study was identified this could

not be judged, however downgrading would occur if appropriate for other reasons such as imprecision or risk of bias if sample size was small.

4. **Imprecision of results**: if a wide confidence interval was identified which represented uncertainty of the magnitude of the estimated effect, or a limited number of events, then evidence would be downgraded.
5. **The probability of publication bias:** Whether there is under or over estimation of impact due to selective publication of the studies. This can be assessed by looking at the pattern of the study results, in particular if small studies tend to report results in a particular direction compared to larger. The presence of small studies alone is not necessarily an indication of this bias.

Results

Selection of studies

We identified 3221 unique citations of which 3205 were excluded at screening. For a number of abstracts limited information was provided on the intervention so we further reviewed the method section in the full paper where necessary for a more detailed evaluation. Eighty-nine citations were excluded at this additional 'screening' stage. The full texts of the remaining 16 citations were retrieved and reviewed in-depth. Of the 16 studies, 11 meet our inclusion criteria (Chien & Lee, 2011; Cristancho-Lacroix et al., 2015; Gavrilova et al., 2009; Guerra, Ferri, Fonseca, Banerjee, & Prince, 2011; Hepburn, Tornatore, Center, & Ostwald, 2001; Kurz, Wagenpfeil, Hallauer, Schneider-Schelte, & Jansen, 2010; Lindstrom Bremer, 2007; Martin-Cook, Remakel-Davis, Svetlik, Hynan, & Weiner, 2003; Onor et al., 2007; Pahlavanzadeh, Heidari, Maghsudi, Ghazavi, & Samandari, 2010; Paun et al., 2015). Four studies were excluded, as they did not state whether the intervention consisted of a specific educational component on the progression of dementia (Beauchamp, Irvine, Seeley, & Johnson, 2005; Ducharme et al., 2011; Dolores Gallagher-Thompson, Gray, Dupart, Jimenez, & Thompson, 2008; D. Gallagher-Thompson et al., 2007), and one other study was excluded because the control condition also consisted of an education component on progression of dementia (Bramble, Moyle, & Shum, 2011). Paun et al (2015) described their study as a quasi-experimental trial where randomisation was by long-term care facility. Through consulting a

statistician, we recategorised the study as a cluster-randomised controlled trial and included it in our review. Two other studies were pilot studies (Cristancho-Lacroix et al., 2015; Paun et al., 2015). Figure 1 shows the review flow diagram.

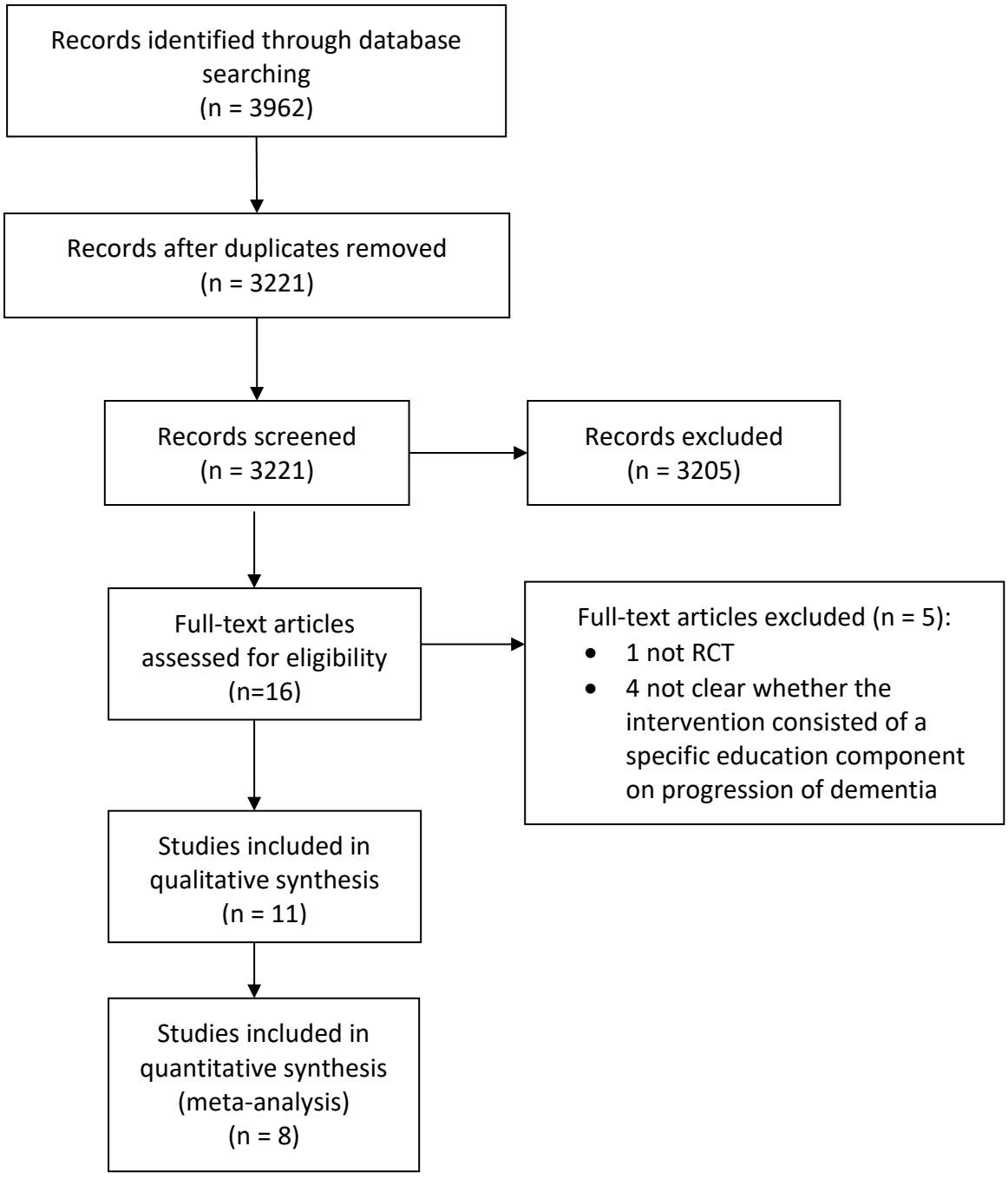


Figure 1. Study flow diagram.

Participants and settings

The sample sizes of the included studies ranged from 16 to 292. One study (Martin-Cook et al., 2003) did not report any details regarding participants' characteristics but only recruited primary carers who were spouses or adult children of a person with dementia who also had behavioral disturbance. In the other studies, participants were family or friends of a person with dementia, with the majority being either spouse or adult child of the person with dementia. Seventy-one percent of all participants across the 11 studies were female carers. Eight studies reported carers' education level (Chien & Lee, 2011; Cristancho-Lacroix et al., 2015; Hepburn et al., 2001; Kurz et al., 2010; Lindstrom Bremer, 2007; Onor et al., 2007; Pahlavanzadeh et al., 2010; Paun et al., 2015); most participants completed high school and a minority of them had also completed college or above. Seven studies reported care recipients' characteristics; most had mild to moderate severity dementia (Chien & Lee, 2011; Cristancho-Lacroix et al., 2015; Gavrilova et al., 2009; Guerra et al., 2011; Kurz et al., 2010; Onor et al., 2007; Pahlavanzadeh et al., 2010).

Four studies took place in the United States (Hepburn et al., 2001; Lindstrom Bremer, 2007; Martin-Cook et al., 2003; Paun et al., 2015), three in Europe (Cristancho-Lacroix et al., 2015; Kurz et al., 2010; Onor et al., 2007), three in a range of low- to middle-income countries (Gavrilova et al., 2009; Guerra et al., 2011; Pahlavanzadeh et al., 2010), and one in Hong Kong (Chien & Lee, 2011). Most trials took place in the community. Four studies took place in the carers' home (Chien & Lee, 2011; Cristancho-Lacroix et al., 2015; Gavrilova et al., 2009; Guerra et al., 2011), two at long-term care facilities and nursing homes (Lindstrom Bremer, 2007; Paun et al., 2015), one at a medical centre (Hepburn et al., 2001), one at a hospital (Pahlavanzadeh et al., 2010) and one at Alzheimer's society centres (Kurz et al., 2010). Despite the location of sessions at a nursing home for the Lindstrom Bremer (2007) study, the person with dementia had to be living at home. The remaining two studies did not specify where the intervention took place (Martin-Cook et al., 2003; Onor et al., 2007).

Characteristics of the intervention

Table 3 shows the key intervention characteristics of the eleven studies. Seven evaluated a group-based intervention (Hepburn et al., 2001; Kurz et al., 2010; Lindstrom Bremer, 2007; Martin-Cook et al., 2003; Onor et al., 2007; Pahlavanzadeh et al., 2010; Paun et al., 2015), two used a home-based intervention where any carers (paid and family) could participate in the education sessions (Gavrilova et al., 2009; Guerra et al., 2011), one was a one-to-one intervention (Chien & Lee, 2011), and one was a computerized intervention where participants could access the intervention online from home (Cristancho-Lacroix et al., 2015). The total duration of the intervention ranged from 4 weeks to 15 months, the number of sessions from 4 to 16 and the length of sessions from 15-30 minutes to 120 minutes.

Interventions were delivered by various professionals. Two studies reported the involvement of a multi-disciplinary team (Hepburn et al., 2001; Lindstrom Bremer, 2007). In five studies the intervention was delivered by personnel who had undergone some training before delivering the intervention (Chien & Lee, 2011; Gavrilova et al., 2009; Guerra et al., 2011; Kurz et al., 2010; Paun et al., 2015). In one study, the intervention was delivered by psychiatrists and educators (Onor et al., 2007) and another by the lead author (masters in psychiatry with experience as a university lecturer and educator of patients and their families) (Pahlavanzadeh et al., 2010). The remaining study did not specify who delivered the intervention (Martin-Cook et al., 2003).

All interventions were multi-component, with education/information on progression of dementia being one to three of the components. Most studies provided teaching sessions only (Chien & Lee, 2011; Gavrilova et al., 2009; Guerra et al., 2011; Hepburn et al., 2001; Kurz et al., 2010; Lindstrom Bremer, 2007; Onor et al., 2007). Of the other studies, two provided both education and written information (Martin-Cook et al., 2003; Paun et al., 2015), another education and a CD (Pahlavanzadeh et al., 2010), and one education as written information on a computer (Cristancho-Lacroix et al., 2015).

The proportion of the interventions that focused on progression of dementia was small, for four it was one session of the entire intervention (Hepburn et al., 2001; Lindstrom Bremer, 2007; Martin-Cook et al., 2003; Pahlavanzadeh et al., 2010). Education/information on progression of dementia accounted for 2 out of 5 sessions in both Gavrilova et al (2009) and Guerra et al (2011) studies, and 2 and 3 out of 12 sessions in Cristancho-Lacroix et al (2015) and Paun et al (2015) studies, respectively. At the most, the intervention component on the progression of dementia accounted for 3/7 of the initial teaching sessions in Kurz et al (2010) study. Based on the details in the papers for Chien and Lee (2011) and Onor et al (2007) studies, we were unable to determine the proportion of the intervention that focused on the progression of dementia. Control group participants were either provided with usual care or were waitlist controls.

Shorter-term interventions (of less than 3 months duration)

Six studies involved an intervention of shorter duration, that is lasting less than 3 months and had less than 10 sessions (Gavrilova et al., 2009; Guerra et al., 2011; Hepburn et al., 2001; Lindstrom Bremer, 2007; Martin-Cook et al., 2003; Pahlavanzadeh et al., 2010). These interventions aimed to provide in addition to education or information to carers, strategies for managing care recipient's behavioural and psychological symptoms (BPSD). One also provided information on environmental, safety and financial issues to carers, as well as psychological support (Martin-Cook et al., 2003).

Table 3: Characteristics of included studies

Study, Country, setting	Sample size (N)	Total duration; number of sessions	Format and who delivered the intervention	Contents of the intervention	Comparator	Outcomes	Follow-up
Chien & Lee (2011), Hong Kong; carers' home	92	6 months; 10X120min sessions	One-to-one; case manager	Education on dementia, its prognosis and current treatment and care; social and financial support; psychological support; also targets relationships within the family	Routine care through a dementia research centre	Burden (Family Caregiving Burden Inventory)	**Immediately after intervention:** 6 months **Additional follow-up:** 18 and 24 months post baseline
Cristancho-Lacroix (2015), France, online	49	3 months; 12X15-30min sessions	Computerized intervention	Education on the progression of Alzheimer's Disease and what to expect in the future. Other sessions focused on communication skills, strategies for managing everyday difficulties, social and financial support	Usual care	Knowledge of dementia (self-report on a visual analogue scale), Depression (Beck Depression Inventory), Burden (ZBI)	**Immediately after intervention:** 3 months **Additional follow-up:** 6 months post baseline
Gavrilova et al (2009), Russia; home	60	5 weeks; 5X30min sessions	Family based; newly qualified doctors who received a 2-day	One assessment session. Two sessions provided education on causes and treatment of dementia and what to expect in the future; two sessions	Medical care as usual	Burden (ZBI)	**Immediately after intervention:** No Assessment

Study, Country, setting	Sample size (N)	Total duration; number of sessions	Format and who delivered the intervention	Contents of the intervention	Comparator	Outcomes	Follow-up
			training programme	provided training in managing care recipient's problem behaviours.			**Additional follow-up:** 6 months post baseline
Guerra et al (2011), Peru; home	58	5 weeks; 5X30min sessions	Family-based; junior psychologists and social workers who received a 2-day training programme	Same as above (Gavrilova et al, 2008)	Medical care as usual (received intervention after the follow-up assessment)	Burden (ZBI)	**Immediately after intervention:** No Assessment **Additional follow-up:** 6 months post baseline
Hepburn et al (2001), U.S; Medical Centre	117	7 weeks; 7X120min sessions	Group based; multidisciplinary team (MDT; nurse, educator, family therapist, occupational therapist)	Information on the progressive effect of dementia; information regarding the caregiving role; developing beliefs about caregiving; strategies to manage care recipient's problem behaviours	Usual care (received intervention after the follow-up assessment)	Depression (CES-D), Burden (ZBI)	**Immediately after intervention:** No assessment **Additional follow-up:** 5 months post baseline
Kurz et al (2010), Austria,	292	15 months; 7X90min	Group based; psychologists or	Session 1 focuses on general information about	Usual care	Depression (Montogomery-	**Immediately after**

Study, Country, setting	Sample size (N)	Total duration; number of sessions	Format and who delivered the intervention	Contents of the intervention	Comparator	Outcomes	Follow-up
Switzerland, Germany; Alzheimer's society centres		sessions + 6 refresher meetings	social workers who received study-specific training	Alzheimer's disease with a focus on diagnosis and therapy options. Session 4 focuses on late stage of disease including decision making, symptoms and issues of role change. Session 5 focuses on legal and insurance issues including legal representation and advance directives		Asberg Depression Rating Scale)	**intervention:** 15 months
Lindstrom Bremer (2007), U.S; Sessions took place in day care centres and nursing homes but the person with dementia had to be living at home	54	6 weeks; 6X120min sessions	Group based; gerontologist and nurses (concurrent sessions were run for person with dementia by an occupational or music therapist)	Participants were randomized to one of 2 intervention groups or the control group. The two interventions were the Day-to-Day and Decision Making groups. The two interventions had similar content and the same number of sessions and statistical analysis found no differences between them so they were merged for	Waitlist	Depression (CES-D), Burden (ZBI)	**Immediately after intervention:** No assessment **Additional follow-up:** 6 months post baseline

Study, Country, setting	Sample size (N)	Total duration; number of sessions	Format and who delivered the intervention	Contents of the intervention	Comparator	Outcomes	Follow-up
				analyses. Both included introduction to dementia and progression of dementia in Session 1 and identifying and tailoring activities to dementia stage in Session 3. The Day-to-Day group focused on teaching carers to tailor everyday task and activities to care recipients' level and also communication skills. The Decision Making group focused on strengthening carers' decision making skills			
Martin-Cook et al (2003), U.S; Not specified	37	4 weeks; 4X120min sessions	Group based; not specified	Session 1 provided an overview of dementia pathology, pathology, symptoms, course, and treatments. The remaining sessions covered strategies for managing problem behaviours; communication skills; environmental, safety	Waitlist	Depression (CES-D)	**Immediately after intervention:** 6 weeks post baseline **Additional follow-up:** 14 weeks post baseline

Study, Country, setting	Sample size (N)	Total duration; number of sessions	Format and who delivered the intervention	Contents of the intervention	Comparator	Outcomes	Follow-up
				and financial issues, carer feelings and coping strategies			
Onor et al (2007), Italy; Not specified	16	4 months; 16X60min weekly sessions	Group based, psychiatrist and educator	Information about dementia, the course of illness, disease stages, progression of cognitive and behavioural symptoms	No treatment	Depression (Brief Symptom Inventory), Burden (Caregiver Burden Inventory)	**Immediately after intervention:** 4 months post baseline **Additional follow-up:** 2 months post baseline (half-way through intervention)
Pahlavanzadeh et al (2010), Iran; Hospital	60	5 weeks; 5X90min sessions	Group based; supervised by researcher (masters in psychiatry) with experience as a university lecturer and educator of	Session 1 covered "Changes in the elderly, the definition, stages and symptoms, risk factors, diagnostic methods, and treatment of dementia" (p104). None of the remaining sessions covered disease progression but focused on behavioural symptoms	Did not attend training programme	Burden (ZBI)	**Immediately after intervention:** 5 weeks post baseline **Additional follow-up:** 9 weeks post baseline

Study, Country, setting	Sample size (N)	Total duration; number of sessions	Format and who delivered the intervention	Contents of the intervention	Comparator	Outcomes	Follow-up
			patients and their families				
Paun et al (2015), U.S; Long term care facilities	93	12 weeks; 12 sessions (60-90mins)	Group based; psychiatric nurses who received 8-hours preparatory workshop	Three sessions provided information about late stage of Alzheimer's Disease or related dementia, community resources and long term care facility. In the remaining sessions, communication, conflict resolution and grief management skills were addressed	Two check-in calls	Knowledge of dementia (Knowledge of Alzheimer's Test), Depression(CES-D), The 50-item Marwit-Meuser Caregiver Grief Inventory – subscale of Personal sacrifice burden was used for carer burden and the total score was used for grief	**Immediately after intervention:** 3 months post baseline **Additional follow-up:** 6 months post baseline

Notes: CES-D=The Centre for Epidemiologic Studies Depression Scale; ZBI=Zarit Burden Interview (ZBI)

In both the Hepburn et al (2001) and the Lindstrom Bremer (2007) studies, the intervention aimed to help carers to adapt to the caregiving role. Apart from information on progression of dementia, carers in the intervention group in the Hepburn et al study (2001) were also given information regarding what the caregiving role entails, and strategies in managing care recipients' BPSD. In the Lindstrom (2007) study, the intervention focused on teaching carers to tailor everyday activities to care recipient's level and strengthening carers' decision making skills.

Longer-term interventions (of more than 3 months duration)

Five studies consisted of an intervention of longer duration, lasting for 3 months or more, and consisted of at least 10 sessions (Chien & Lee, 2011; Cristancho-Lacroix et al., 2015; Kurz et al., 2010; Onor et al., 2007; Paun et al., 2015). Apart from education, most interventions also provided psychological support to carers.

In Chien and Lee (2011) and Kurz et al (2010) studies, the intervention was tailored to carers' needs. Psychological supports were offered to carers in two studies (Onor et al., 2007; Paun et al., 2015); the Onor et al study (2007) focused on addressing carers' stress and emotion, and the Paun study (2015) targeted carers' grief management skills in order to reduce their chronic grief. In Cristancho-Lacroix et al (2015) study, a computerised intervention was used, where information regarding dementia as well as information regarding how to manage BPSD was provided, it also targeted cares' communication skills, and social and financial support.

Risk of bias of included studies

Figure 2 presents the risk of bias assessment of the studies. Overall, most studies were classified as unclear risk of bias due to under reporting. Six studies provided details on how they generated random sequence generation. None of the studies reported sufficient details regarding allocation concealment. Blinding of assessors was only evident in four studies. There was no evidence of attrition bias in the studies. All but one study had a small sample size, with less than 50 participants per

treatment arm, therefore, they were considered high risk of bias. Nonetheless, six studies conducted a power analysis to determine the sample size required in their studies (Chien & Lee, 2011; Cristancho-Lacroix et al., 2015; Gavrilova et al., 2009; Guerra et al., 2011; Kurz et al., 2010; Pahlavanzadeh et al., 2010). Three studies achieved the required sample size (Chien & Lee, 2011; Kurz et al., 2010; Pahlavanzadeh et al., 2010). Table 4 presents more detailed reasons for each risk of bias judgement for each study.

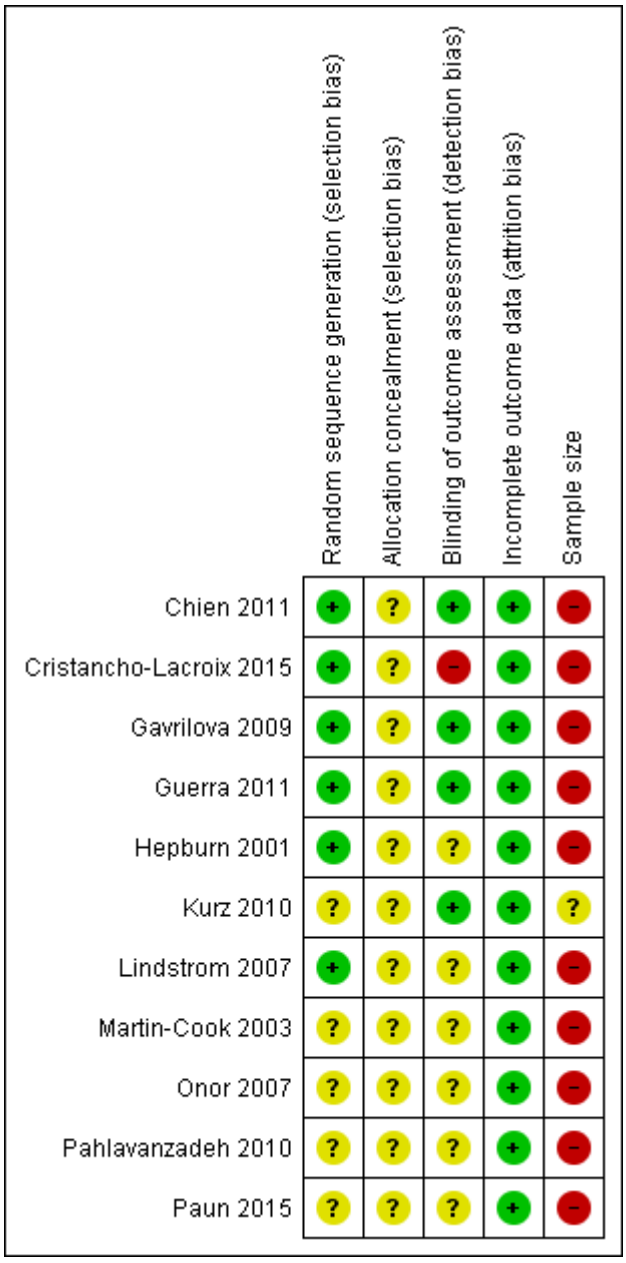


Figure 2. Risk of bias summary: review authors' judgements about each Cochrane risk of bias item for each included study.

Table 4: Risk of bias judgements of included studies

Author	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Sample size
Chien & Lee (2011)	Low risk: Computer-generated randomisation	Unclear risk: No details	Low risk: Assessment were conducted by a research assistant blinded to randomisation status	Low risk: 3 participants from the intervention group dropout of the study, due to mortality of the person with dementia or insufficient time and deterioration of care recipient's condition. 1 participant from the control group dropout due to death of care recipient.	High risk: Less than 50 per treatment arm
Cristancho-Lacroix (2015)	Low risk: Computer-generated randomisation list using blocks and stratified by sex and relationship	Unclear risk: No details	High risk: Unblinded pilot RCT	Low risk: 8 participants from the intervention group and 7 from the control dropped out of the study, with reasons being hospitalization, institutionalisation, became illegible through the course of the study and ended participation.	High risk: Less than 50 per treatment arm
Gavrilova (2009)	Low risk: Randomisation carried out in London and stratified using a permuted block method based on carer's burden at baseline	Unclear risk: Central randomisation in London, and transmitted back to Russia by email	Low risk: Blinded assessment	Low risk: 5 participants from intervention group and 2 participants lost to follow-up due to death of care recipient	High risk: Less than 50 per treatment arm

Author	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Sample size
Guerra (2011)	Low risk: Randomisation carried out in London and stratified using a permuted block method based on carer's burden at baseline	Unclear risk: Central randomisation in London, and transmitted back to Peru by email	Low risk: Blinded assessment	Low risk: 2 participant from intervention group dropped out due to mortality of the person with dementia	High risk: Less than 50 per treatment arm
Hepburn (2001)	Low risk: Computer-generated randomisation		Unclear risk: No details except to indicate questionnaires were self-completed by participants	Low risk: 23 participants dropout from this study, 12 from the intervention group and 11 from control, with reasons being worsening care recipient's condition, or other reasons (e.g. transportation difficulties)	High risk: Less than 50 per treatment arm
Kurz (2010)	Unclear risk: Randomisation using a block length of six participants, without any extra information regarding method of randomisation	Unclear risk: Central randomisation, with no further details	Low risk: Blinded assessment	Low risk: No dropouts	Unclear risk: Less than 200 in each treatment arm

Author	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Sample size
Lindstrom Bremer (2007)	Low risk: Block randomisation, generated by computer programme	Unclear risk: No details	Unclear risk: No details	Low risk: 9 drop-outs from intervention groups and 4 from control group	High risk: Less than 50 per treatment arm
Martin-Cook (2003)	Unclear risk: No details	Unclear risk: No details	Unclear risk: No details	Low risk: 1 from intervention group and 2 from control group missing both follow-ups plus another control group participant missing the second follow-up	High risk: Less than 50 per treatment arm
Onor (2007)	Unclear risk: Stated 'simple randomisation was used'	Unclear risk: No details	Unclear risk: No details	Low risk: No dropouts	High risk: Less than 50 per treatment arm
Pahlavanzadeh (2010)	Unclear risk: No details	Unclear risk: No details	Unclear risk: No details	Low risk: 10 participants, 5 from each group, dropout due to lack of presence in programme, not available for data collection at follow-up	High risk: Less than 50 per treatment arm
Paun (2015)	Unclear risk: No details	Unclear risk: No details	Unclear risk: No details	Low risk: 10 participants dropout from the study, 3 from intervention group and 7 from control group due to lack of interest and care recipient's death	High risk: Less than 50 per treatment arm

Effects of intervention

Knowledge of dementia

Only two studies reported on the impact of the intervention on carers' knowledge of dementia (Cristancho-Lacroix et al., 2015; Paun et al., 2015) and therefore we did not pool their data. In Cristancho-Lacroix et al (2015) study, they measured carers' knowledge about Alzheimer's disease using a visual analogue scale where carers evaluated their knowledge of Alzheimer's disease on a scale from 0 (low) to 100 (high). Paun et al (2015) measured knowledge using the 22-item Knowledge of Alzheimer's Test (KAT). For both scales, higher scores indicate better knowledge. Both had follow-up at immediately post intervention (3 months) and 3 months later.

In Paun et al's (2015) study there was no statistical significant difference between the trial arms in mean change from baseline in carers' knowledge immediately after intervention (3 months) (MD=0.70 [95% CI -0.12 to 1.52] or at 6 months follow-up (MD=0.19 [-95% CI -0.72 to 1.10]. Scores reported by Cristancho-Lacroix et al (2015) for the intervention group were baseline=45.4 (SD=23.2); 3 months=59.2 (SD=25.9) and 6 months=58.6 (SD=24.4) compared with the control group baseline=44.5 (SD=23.5); 3 months=44.4 (SD=21.6) and 6 months=51.7 (SD=18.8). They reported a statistically significant difference favouring the intervention compared with the control group at the 3 month assessment (Cohen's d=.79, P=.008) but not at 6 months.

Using the GRADE system, we judged the quality of evidence on improvement in carers' knowledge of dementia at the end of the three-month intervention to be very low and at six months to be low. Our confidence in the effect estimate was limited. We downgraded the evidence from high by two levels because of study limitations at both time points (low sample size in both and not blinding outcome assessors in the Cristancho-Lacroix study (2015)). In addition we downgraded another level due to inconsistency in results at the end of the three-month intevention.

Depression

Seven studies reported on carers' depression (Cristancho-Lacroix et al., 2015; Hepburn et al., 2001; Kurz et al., 2010; Lindstrom Bremer, 2007; Martin-Cook et al., 2003; Onor et al., 2007; Paun et al., 2015) using four depression scales (See Table 3). In all scales, a higher score indicated more severe symptoms of depression. The study by Martin-Cook et al (2003), however, did not anticipate an improvement in depression as their intervention aimed to reduce carers' resentment and attribution of their relative's behavioural disturbances without increasing depression.

A meta-analysis was undertaken using data from three studies including two (Hepburn et al., 2001; Lindstrom Bremer, 2007) using the first follow-up score at 5 and 6 months post baseline respectively. The third study (Onor et al., 2007) undertook assessments at 2 months (during the intervention) and 4 months post baseline. We used the 4 month post baseline data in the meta-analysis as this was the first assessment after the intervention and also fitted within our requirement of between 3-6months post baseline. The pooled analysis of the three trials (n=151) showed a significant statistical effect of education on depression at follow-up (SMD=-0.48 [95% CI -0.82 to -0.14]; I^2=0%; p=0.006; Figure 3).

Four studies were not included in the meta-analysis (Cristancho-Lacroix et al., 2015; Kurz et al., 2010; Martin-Cook et al., 2003; Paun et al., 2015). Two (Martin-Cook et al., 2003; Paun et al., 2015) did not provide scores at follow-up and one did not have follow-up within 3-6 months (Kurz et al., 2010). Cristancho-Lacroix (2015) reported significant baseline differences between the control and intervention groups on depression so we excluded their follow-up scores from the meta-analysis. Only 2 studies (Cristancho-Lacroix et al., 2015; Paun et al., 2015) reported mean change scores (from baseline to follow-up) with standard deviations and therefore, this was insufficient to undertake a meta-analysis. Overall, these four studies did not show statistically significant differences in depression between intervention and control groups either as change scores or mean follow-up scores.

Using the GRADE system, we judged the quality of evidence on reducing depression as low. We downgraded the evidence from high by two levels because of study limitations (lack of detail on allocation concealment, random allocation and blinding of assessors) and imprecision of results (high SDs across studies).

Burden

Nine studies measured carer burden (Chien & Lee, 2011; Cristancho-Lacroix et al., 2015; Gavrilova et al., 2009; Guerra et al., 2011; Hepburn et al., 2001; Lindstrom Bremer, 2007; Onor et al., 2007; Pahlavanzadeh et al., 2010; Paun et al., 2015). Four different scales were used (See Table 3). Higher scores represents higher levels of burden in all four scales.

We undertook two meta-analyses based on whether outcomes were reported as mean change scores or follow-up scores. The first analysis reports on mean scores at follow up and includes 5 studies (Chien & Lee, 2011; Cristancho-Lacroix et al., 2015; Hepburn et al., 2001; Lindstrom Bremer, 2007; Onor et al., 2007). We used the first follow-up assessments for all studies except Onor (2007) where we used the second assessment which fitted within the 3-6 month timeframe and was after the intervention was completed (excluding the 2 month follow-up half way through the intervention). The pooled analysis showed a statistically non-significant effect of education on carers' burden (SMD=-0.31 [95% CI -0.64 to 0.03]; I^2=43%; p=0.07; n=292; Figure 4).

Four studies reported on mean changes (Cristancho-Lacroix et al., 2015; Gavrilova et al., 2009; Guerra et al., 2011; Paun et al., 2015) using the first follow-up assessment. Meta-analysis of these studies showed a statistically non-significant effect (SMD= -0.26 [95% CI -0.93 to 0.42]; I^2=85%; p=0.46; n=241; Figure 5). The I^2 for this meta-analysis suggests substantial heterogeneity across the trials. In a sub-group analyses we removed the Cristancho-Lacroix (2015) study given it used a computerized rather than face-to-face intervention but this did not substantially reduce heterogeneity.

Only one study measuring burden was excluded from both analyses due to follow-up assessments being undertaken in less than 3 months post baseline (Pahlavanzadeh et al., 2010). There were also limitations in the paper in that there were inconsistencies in the changes they described and the scores presented. We sought clarification from the author but did not receive a response.

Using the GRADE system, we judged the quality of evidence on reducing burden as very low. We downgraded the evidence from high by three levels because of risk of bias (lack of detail on allocation concealment, random allocation and blinding of assessors), imprecision of results (high SDs across studies) and inconsistency in results (high levels of heterogeneity in meta-analysis).

Pre-death grief

One study (Paun et al., 2015) measured carers chronic grief using the MM-CGI, with higher scores indicating higher level of grief. Follow-up was at 6 months. No statistical significant difference was found between intervention and control groups in carers' grief immediately after the intervention (3 months; MD -1.22 [95% CI -10.17 to 7.73]) or at 6 months follow-up (MD -1.53 [95% CI -10.27 to 7.21]).

Using the GRADE system, we judged the quality of evidence on reducing pre-death grief as low. We downgraded the evidence from high by two levels because of study limitations (lack of detail on: allocation concealment; random allocation; blinding of assessors; and small sample size) and imprecision of results (high SDs).

Figure 3. Meta-analysis: Depression follow-up scores by study arm

Study or Subgroup	Education Mean	Education SD	Education Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Hepburn 2001	11.994	7.672	60	16.086	9.111	34	64.3%	-0.49 [-0.92, -0.07]
Lindstrom 2007	10.67	8.3	30	14.4	11.32	11	24.1%	-0.40 [-1.10, 0.30]
Onor 2007	5.25	4.62	8	7.62	2.77	8	11.5%	-0.59 [-1.60, 0.42]
Total (95% CI)			**98**			**53**	**100.0%**	**-0.48 [-0.82, -0.14]**

Heterogeneity: Tau² = 0.00; Chi² = 0.10, df = 2 (P = 0.95); I² = 0%
Test for overall effect: Z = 2.76 (P = 0.006)

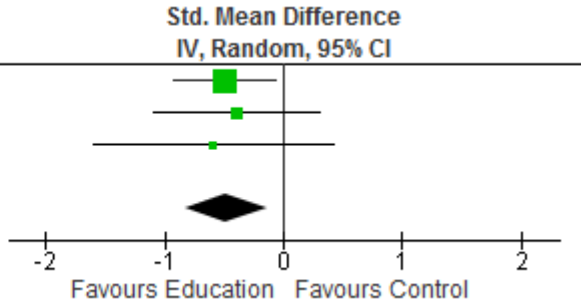


Figure 4. Meta-analysis: Burden follow-up scores by study arm

Study or Subgroup	Education Mean	Education SD	Education Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Chien 2011	56.9	14.8	46	64	13.1	46	27.7%	-0.50 [-0.92, -0.09]
Cristancho-Lacroix 2015	38.3	14.9	25	33.5	15.3	24	20.4%	0.31 [-0.25, 0.88]
Hepburn 2001	53.874	12.403	60	59.446	5.575	34	27.1%	-0.53 [-0.96, -0.10]
Lindstrom 2007	32.19	11.58	30	34.5	11.92	11	15.8%	-0.19 [-0.89, 0.50]
Onor 2007	27.5	14.67	8	36.5	10.84	8	8.9%	-0.66 [-1.67, 0.36]
Total (95% CI)			**169**			**123**	**100.0%**	**-0.31 [-0.64, 0.03]**

Heterogeneity: Tau² = 0.06; Chi² = 7.04, df = 4 (P = 0.13); I² = 43%
Test for overall effect: Z = 1.80 (P = 0.07)

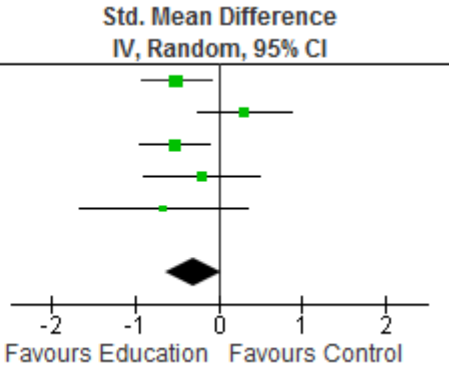
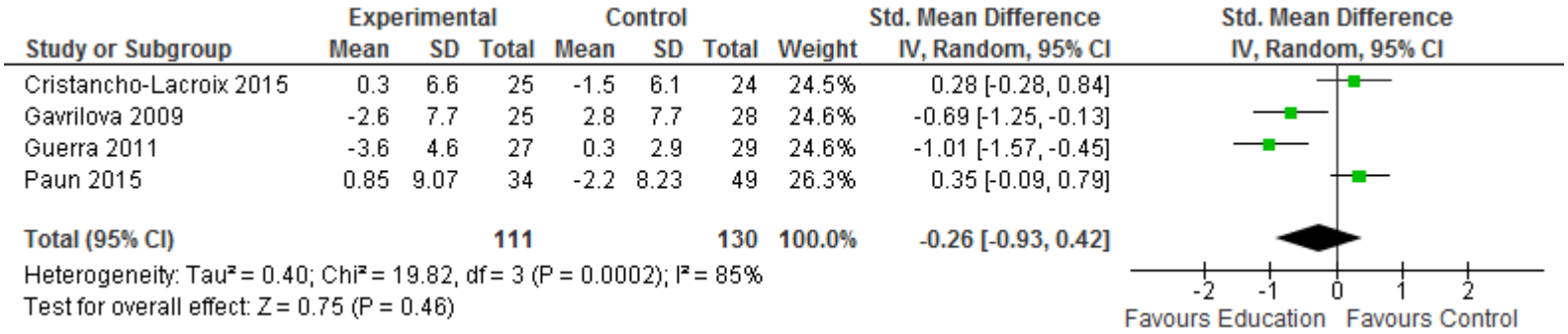


Figure 5. Meta-analysis: Burden mean changes from baseline to follow-up by study arm



Discussion

This systematic review is the first review to our knowledge to examine the effect of educating carers of people with dementia about the progression of dementia. It was undertaken in light of the European Association of Palliative Care's white paper (van der Steen et al., 2014), recommending education regarding the progressive course of dementia should be provided to families of the person with dementia. We found eleven RCTs that met our inclusion criteria.

We were unable to undertake meta-analyses on the outcomes of knowledge and grief due to fewer than three studies measuring these outcomes. Results from two studies (Cristancho-Lacroix et al., 2015; Paun et al., 2015) provided mixed evidence that education or information on progression of dementia could improve carers' knowledge of dementia. Based on data from one study (Paun et al., 2015), there was no evidence to support the effectiveness of an educational intervention in reducing carers' pre-death grief. Our meta-analyses showed no treatment effect on burden but found a significant benefit on depression.

These findings, however, need to be taken in light of the quality of the evidence. Using the GRADE system (Schünemann et al., 2017) we judged the quality of evidence to be very low for depression (we have very little confidence in the effect estimate and the true effect is likely to be substantially different) and low for burden, knowledge and pre-death grief (we have limited confidence in the effect estimate and the true effect may be substantially different). We downgraded outcomes for various reasons including small samples sizes, high SDs in change and lack of reporting of allocation concealment and blinding of assessors. Five studies provided unclear evidence of random sequence generation (Kurz et al., 2010; Martin-Cook et al., 2003; Onor et al., 2007; Pahlavanzadeh et al., 2010; Paun et al., 2015). We considered it not possible to conceal group allocation to participants or personnel involved in an education intervention and therefore did not include this in our assessment of risk of bias. It is important, however, to blind the outcome

assessment to reduce potential bias, but only four studies reported this (Chien & Lee, 2011; Gavrilova et al., 2009; Guerra et al., 2011; Kurz et al., 2010).

There are other reasons why our conclusions on the evidence derived from these studies are limited. The studies we identified also varied in terms of the outcomes they used, the duration and intensity of the interventions and the delivery method. Most were group sessions with carers who cared for someone at home (Hepburn et al., 2001; Kurz et al., 2010; Lindstrom Bremer, 2007; Martin-Cook et al., 2003; Onor et al., 2007; Pahlavanzadeh et al., 2010), while one was for carers of people who had moved into a nursing home (Paun et al., 2015). One study used a computerized intervention which found improvements in self-reported knowledge but not burden (Cristancho-Lacroix et al., 2015). The three studies using individual/family based face-to-face interventions all reported improvements in burden (Chien & Lee, 2011; Gavrilova et al., 2009; Guerra et al., 2011). These studies were the highest quality studies in the review with blinding of assessors and random sequence generation, however due to different reporting of results were not included in the same meta-analysis. Two of these individualized studies and another study (Gavrilova et al., 2009; Guerra et al., 2011; Pahlavanzadeh et al., 2010) were from low-middle income countries and also found significant reductions in burden. Further research is needed to examine whether education for carers is more effective on an individual basis or in particular countries. Possibly in higher income countries, education is offered more routinely and therefore the interventions offered were not a substantial addition to routine care. The overall small number of studies and low quality, however, prevented subgroup analyses to examine specific intervention features. The moderate to high heterogeneity in the two meta-analyses on burden also limit our interpretations of these findings.

The proportion of the interventions that focused on education/ information on progression of dementia in the included studies was small; one to three sessions of interventions ranging from 4-16 sessions in total. This further limits the extent to which we can determine whether it was the education around dementia progression

rather than other elements of the interventions which were impacting on carer knowledge and mental health.

While most of the studies reported on burden and depression, only one study reported on pre-death grief and two on dementia knowledge. As pre-death grief is common among dementia carers (Chan et al., 2013), it is important to identify effective interventions that could reduce grief which also help to reduce depression and burden (Lindauer & Harvath, 2014). Only two of our studies measured knowledge of dementia as an outcome (Cristancho-Lacroix et al., 2015; Paun et al., 2015). We expect that improving mental health from an educational intervention is a secondary outcome resulting from an improved understanding of disease progression. However, if we are not measuring improved knowledge it is difficult to determine whether improvements in mental health are due to improved knowledge or some other aspect of the intervention such as social connection or feeling heard.

Current evidence provides limited guidance on how we can improve dementia knowledge. In the UK a third of older adults have difficulty interpreting basic health information (Bostock & Steptoe, 2012) and low health literacy is more common amongst those from more deprived backgrounds, ethnic minorities, older people and those with chronic health conditions (Coulter & Jo, 2006). How do we know whether verbal and written information provided to family carers is accurate, understood and positively impacting on psychosocial wellbeing? The need to improve dementia knowledge amongst staff and the general public has been identified as a barrier to good quality palliative care in dementia (Carter, van der Steen, Galway, & Brazil, 2015) yet there is also some evidence that knowledge of the biomedical aspects of dementia is associated with increased anxiety (Proctor, Martin, & Hewison, 2002). Understanding the clinical course of dementia may be helpful for planning and preparing for the future but some carers may be reluctant to think about the impacts on their loved one of the progression of dementia. Denial and avoidance may be common coping strategies used by family carers but they have been associated with poorer psychological outcomes (Gilhooly et al., 2016). Perhaps greater attention is needed not only on the type of information delivered

but how we provide emotional support to carers trying to process and accept distressing information.

One of the promising findings from this review was the low dropout rate in most studies suggesting that educational interventions were generally viewed as acceptable by carers. Moreover, qualitative findings indicated that participants found education on the progression of the disease, the decision-making guidance, and caregiving strategies particularly useful (Lindstrom Bremer, 2007) and these findings can be built on in future research.

Strengths and limitations

This review was conducted as outlined in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins & Green, 2011); therefore the introduction of bias should be minimised. The search strategy used was extensive, increasing the chances of identifying all relevant studies. We also included grey literature if they were available from the selected databases and the full paper could be obtained. It is possible, however, that some of the studies we excluded consisted of an educational component focusing on progression of dementia, but since this was not clearly specified or even suggested in the abstract or method section of the full paper, they were not included in this review.

Although all but one study had been classified as high risk of bias in terms of sample size, three studies conducted a power analysis to determine the required sample size and achieved this sample size (Chien & Lee, 2011; Kurz et al., 2010; Pahlavanzadeh et al., 2010). However, power analysis was not a Cochrane criterion and this was not taken into account when assessing the possible biases confounded by sample size.

Conclusion

Based on the results obtained, there was not sufficient evidence available to support or refute the effectiveness of education on progression of dementia on carers' knowledge and mental health. Therefore, we cannot provide any clinical

recommendations based on these results. Nonetheless, the meta-analysis revealed that the treatment effect was in favour of intervention, suggesting a possibility that education on progression of dementia could help to improve mental health. Further robust research is required that use educational interventions regarding the progression of dementia which assess the impact on knowledge of dementia, mental health and burden outcomes. Consideration of the format, duration and stage of dementia are also required.

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Declaration of Conflicting of Interests

The authors declare that there is no conflict of interest.

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