

Dementia case management and risk of long-term care placement: a systematic review and meta-analysis

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Objectives: The objective of our study is to evaluate the effectiveness of dementia case management compared with usual care on reducing long-term care placement, hospitalization, and emergency department visits for adult patients with dementia. We also sought to evaluate the effectiveness of this intervention on delaying time to long-term care placement and hospitalization.

Methods: We searched electronic databases supplemented by bibliographies and conference proceedings for randomized controlled trials testing the effectiveness of dementia case management in reducing resource utilization in a population of caregiver–care recipient dyads living in the community. We meta-analyzed the risk ratio (RR) and weighted mean differences of long-term care placement and the RR of hospital admissions. Pooled estimates were further stratified by study characteristics and measures of study quality.

Results: Seventeen studies were included in the meta-analysis. The overall pooled RR of long-term care placement was 0.94 (95% confidence interval [0.85, 1.03]; $p = 0.227$) for dementia case management compared with usual care. Stratification by follow-up duration indicated a statistically significant reduction in risk of long-term care placement when follow-up duration was less than 18 months (RR 0.61, 95% confidence interval [0.41, 0.91], $p = 0.015$). There was no effect of dementia case management compared with usual care for the other outcomes.

Conclusion: Dementia case management demonstrated a short-term positive effect on reducing the risk of long-term care placement among older people with dementia residing in the community. However, other sources of resource utilization and more extended effects of dementia case management on risk of long-term care placement warrant further investigation. Copyright © 2012 John Wiley & Sons, Ltd.

Key words: dementia; case management; caregivers; long-term care; hospitalization; meta-analysis; systematic review; resource utilization; emergency department visits; randomized controlled trials

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Introduction

A consequence of aging among industrialized nations is the growing pressure on healthcare systems and societies to provide care for greater numbers of people with age-associated illnesses. Care providers and decision makers are faced with serious challenges when trying to accommodate increasing demands among systems with limited resources (Binstock, 2007;

Christensen *et al.*, 2009). The pressure is increased further in the case of seniors with mental health disorders, such as Alzheimer's disease and related dementias.

The World Health Organization estimated that there were 35.6 million people living with dementia in 2010 and that the total number of people with dementia will double every 20 years (World Health Organization, 2012). Absence of a family caregiver or high caregiver burden is associated with an increase in the likelihood

of long-term care (LTC) placement for individuals with dementia (Brodaty *et al.*, 1993). Not only do institutional and hospital care pose a significant economic burden (Bharmal *et al.*, 2012), they may further exacerbate the risk of poor health outcomes for vulnerable patients with dementia (Rudolph *et al.*, 2010; Mukadam and Sampson, 2011). Hence, there is a need for interventions to assist people with dementia (and their caregivers) to allow for their continued care in the community. Dementia case management (CM) is a collaborative intervention that involves assessment, planning, and advocacy for people with dementia and their caregivers (Case Management Society of America, 2010). Further, it aims to empower caregivers and facilitate timely access to essential care services to help support their caregiver needs.

Three prior systematic reviews investigating the impact of dementia CM (or key components of dementia CM) on healthcare resource utilization suggest an equivocal impact of dementia CM on delaying institutionalization, from no impact to a slightly delayed effect (Brodaty *et al.*, 2003; Pimouguet *et al.*, 2010; Somme *et al.*, 2012). Two meta-analyses found a positive statistically significant effect (Pinquart and Sørensen, 2006; Spijker *et al.*, 2008). Although Pinquart and Sørensen (2006) looked at the effect of the intervention length on the odds of institutionalization, neither of these two meta-analyses looked at the sustained effect of the intervention over an extended period of follow-up. Given the limitations of prior reviews, along with the recent publication of additional relevant studies, we undertook a systematic review and meta-analysis of randomized controlled trials (RCTs) that examined the effect of dementia CM interventions compared with usual care on reducing LTC placement. We also sought to determine the effect of dementia CM on other secondary outcomes including hospitalization and emergency department visits, as well as time to LTC placement and hospitalization.

Methods

Data sources and searches

We performed this systematic review and meta-analysis using a predetermined protocol, designed to meet the PRISMA (Moher *et al.*, 2009) standards for reporting of meta-analyses.

We searched the following electronic databases: MEDLINE (OVID), EMBASE, PsycINFO, CINAHL, Cochrane Controlled Trials Register, and Cochrane Database of Systematic Reviews. Databases were not

limited by start date, and the last search was conducted on October 2011. Our search strategy followed four steps:

1. To identify the relevant study population, for the first Boolean search, we used the term “or” to map keywords and establish subject headings and incorporate relevant title and abstract words with the following Medical Subject Headings: “dementia” or “vascular dementia” or “Alzheimer disease” or “Lewy Body disease” or “frontotemporal lobar degeneration” or “Pick’s disease of the brain” and keyword “dementia.”
2. To identify the relevant CM intervention, for the second Boolean search, we used the term “or” to map keywords and establish subject headings and incorporate relevant title and abstract words with the following Medical Subject Headings: “patient care planning” or “advance care planning” or “case management” or “critical pathways” or “patient care management” or “comprehensive health care” or “critical pathways” or “delivery of health care” or “disease management” or “patient-centered care” or “patient care teams” or “counseling” or “directive counseling” or “managed care programs” or “competitive medical plans” or “health maintenance organizations.”
3. The two comprehensive searches were combined using the Boolean operator “and.”
4. We limited the search to RCTs using the appropriate Cochrane Collaboration RCT filters for each of the databases.

To capture recently published articles, the PubMed database was searched from January 2009 to October 2011. Finally, we hand-searched reference lists of included articles, relevant reviews, previous meta-analyses, and two major and recent conference proceedings: the 19th World Congress of Gerontology & Geriatrics, International Association of Gerontology and Geriatrics (2009) and the Gerontological Society of America (2009 and 2010).

Study selection

Two reviewers (MC and HT) independently screened titles and abstracts to select articles eligible for full-text review. During this initial stage, an abstract was selected for full-text review if it described the evaluation of a CM intervention or a key component of CM for caregivers of people with dementia living in the community. During the second stage of literature screening, both reviewers reviewed full-text articles and determined articles to be included in the systematic review on the

basis of the following criteria: the study design was an RCT, the study population included adults living in the community and diagnosed with dementia (regardless of methods used to make the diagnosis) and their caregivers, the study compared standard practice or usual care as defined in the article to CM intervention involving at least one healthcare professional (e.g., nurse or social worker) and providing at least one key component of care (i.e., assessment and planning, education, emotional support, service facilitation, or legal advice and financial counseling) for caregivers and people with dementia, and the study reported on at least one of the resource utilization measures, namely, LTC placements, hospitalizations, emergency department visits, time to LTC placement, or time to hospitalization.

No language restrictions were applied; screening of non-English articles (Chinese, German, and Spanish) was undertaken by individuals able to translate to determine eligibility.

Data abstraction and quality assessment

Agreement between reviewers was assessed by the kappa statistic, with disagreements resolved by consensus. We abstracted data on study characteristics, details of the intervention and comparator, and outcomes. Further, we assessed the quality of the studies using the CONSORT statement for RCTs of non-pharmacological treatments (Boutron *et al.*, 2008) and calculated the Jadad *et al.* (Jadad *et al.*, 1996) score (from a 5-point scale) for each study. Attempts were made to contact authors of studies for which data were unavailable or unclear.

Data analysis

Our primary outcome of interest was LTC placement, with secondary outcomes of hospitalization, emergency department visits, and time to hospitalization and LTC placement. The time to hospitalization or time to LTC placement was defined as the number of days from randomization to the subject's first hospitalization or placement in a LTC facility, respectively.

The risk ratio (RR) was used as the common measure of effect of the intervention on LTC placement and hospitalization, compared with usual care. Although the rate ratio would be an ideal measure, as it takes into account time at risk and censoring, the studies reviewed did not provide sufficient information for these calculations.

From our *a priori* knowledge of variability in CM interventions, we performed a meta-analysis of the RRs using a random-effects model. Forest plots were

used to visually assess pooled estimates and the corresponding 95% confidence intervals (CI). To assess for heterogeneity, we calculated the Q statistic (significance level of $p < 0.1$) and the I^2 statistic. Fixed-effect models were also performed in the presence of low to moderate heterogeneity (I^2 : 25–50%) to test the robustness of the pooled estimates (Higgins *et al.*, 2003). We identified *a priori* several variables that might affect variability between studies, on the basis of the characteristics and quality of the studies and study samples. These variables include follow-up duration (less than 18 months, equal to 18 months, and greater than 18 months), “dosage” or duration of the intervention (as long as follow-up duration versus less than follow-up duration), blinding of the outcome assessor (blinded versus not blinded), severity of dementia (mild versus moderate to severe), management of the intervention (case manager versus multidisciplinary team), comparator (usual care versus augmented usual care), and management with medications for the treatment of dementia (yes versus no). The 18-month cutoff point for the duration of follow-up was used to define the short term as this duration was most commonly reported in the studies included (Mohide *et al.*, 1990; Chu *et al.*, 2000; Callahan *et al.*, 2006; Duru *et al.*, 2009). We stratified the RRs of LTC placement according to these variables. We also tested for publication bias in the reporting of the risk for LTC placement using both Egger and Begg tests (Egger *et al.*, 1997).

For the outcome of time to LTC placement (none of the studies reported on time to hospitalization), the weighted mean difference (WMD) of days to LTC placement was meta-analyzed. The WMD is the sum of the differences between the intervention and control groups in the individual studies, weighted by the variances for each study. The sample size is the main factor in determining the weight for a study, and studies with higher event rates are assigned more weight (Follmann *et al.*, 1992). If there was only one study that reported an outcome of interest, the results were reported descriptively.

All analyses were performed using the STATA 11 metan package (StataCorp, 2009, College Station, TX).

Results

Figure 1 summarizes the stages of the systematic review. Citation searching identified 4634 potentially relevant articles for review. After removing duplicates, title and abstract citations ($n = 3313$) were screened according to the inclusion and exclusion criteria. A total of 3215 articles were excluded at this stage after the two

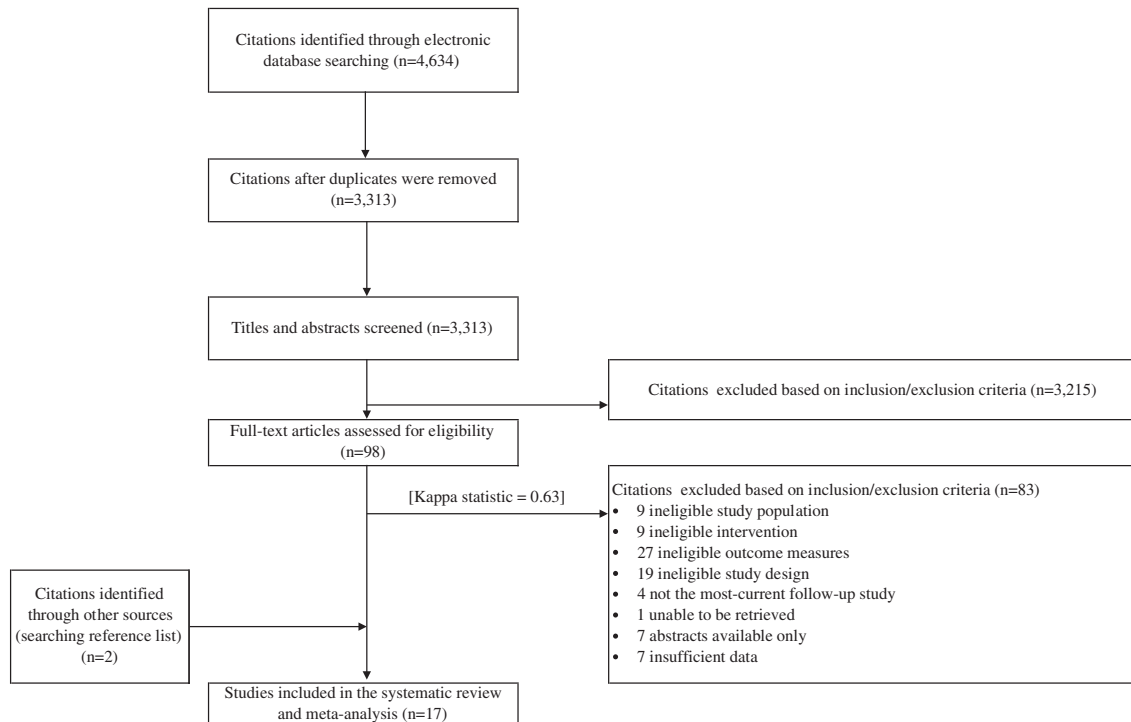


Figure 1 Study flow diagram.

reviewers reached consensus. The full-text of the articles selected ($n = 98$) were assessed in detail for eligibility. Articles were excluded ($n = 83$, kappa statistic = 0.63) according to our exclusion criteria. A total of 17 articles (including two additional studies identified from reference lists) (Mohide *et al.*, 1990; Vernooij-Dassen, 1993; Mittelman *et al.*, 1996; Brodaty *et al.*, 1997; Miller *et al.*, 1999; Chu *et al.*, 2000; Eloniemi-Sulkava *et al.*, 2001; Wright *et al.*, 2001; Teri *et al.*, 2003; Nobili *et al.*, 2004; Callahan *et al.*, 2006; Gaugler *et al.*, 2008; Brodaty *et al.*, 2009; Duru *et al.*, 2009; Eloniemi-Sulkava *et al.*, 2009; Fortinsky *et al.*, 2009; Wray *et al.*, 2010) were included in our analysis.

Study characteristics

The study characteristics of the selected RCTs are summarized in Table 1; the outcomes reported in the trials are summarized in Table 2. The trials were published over two decades, from 1990 to 2010. The intervention and control groups included 5257 and 4909 caregiver–care recipient dyads, respectively. From 15 studies that provided information regarding the gender of their participants, the proportion of female participants with dementia varied from 32% to 70%, and the majority of their caregivers were women (ranging from 51% to 96%). The participants

with dementia had a mean age varying between 70 and 81 years, whereas their caregivers' mean age varied between 57 and 76 years. In two studies that reported on the age range, the age of participants with dementia ranged from 49 to 96 years, and the age of their caregivers ranged from 19 to 88 years. The majority of studies included participants with mild to moderate levels of dementia severity at baseline.

Sixteen trials reported on the outcome of LTC placement (Mohide *et al.*, 1990; Vernooij-Dassen, 1993; Brodaty *et al.*, 1997; Miller *et al.*, 1999; Chu *et al.*, 2000; Eloniemi-Sulkava *et al.*, 2001; Wright *et al.*, 2001; Teri *et al.*, 2003; Nobili *et al.*, 2004; Callahan *et al.*, 2006; Gaugler *et al.*, 2008; Brodaty *et al.*, 2009; Duru *et al.*, 2009; Eloniemi-Sulkava *et al.*, 2009; Fortinsky *et al.*, 2009; Wray *et al.*, 2010). Three studies reported on the outcome of hospitalization (Mohide *et al.*, 1990; Callahan *et al.*, 2006; Duru *et al.*, 2009), whereas only one study (Miller *et al.*, 1999) evaluated the outcome of emergency department visits. Sufficient data for time to LTC placement were available from five studies (Mohide *et al.*, 1990; Mittelman *et al.*, 1996; Brodaty *et al.*, 1997; Wright *et al.*, 2001; Brodaty *et al.*, 2009). No studies reported on time to hospitalization.

The follow-up duration varied among the trials, ranging from 6 months to 15.9 years. There was also variation in characteristics of the intervention. Interventions involved a single case manager from a variety

Table 1 Study characteristics of the 17 trials included for review

Study	Country	Method of randomization	Follow-up duration	Sample size ^a		CM intervention	Control	Dementia severity	Outcome measurements
				CM	Control				
Brodaty <i>et al.</i> (1997)	Australia	Caregiver-care recipient dyad randomization	6.5–8.5 years (mean 7.7 years, SD 0.50 years)	33	31	10-day intensive training program for caregivers: (reducing distress, isolation, guilt, and separation; new ways of thinking and coping skills; fitness; medical aspects of dementia, community services, planning, coping with problem behaviors); patients had their own programme with activities and specific programs	10-day respite for the caregivers and no training, and care recipients were admitted for the patient part of the program	Mean (SD) MMSE score 17.0 (6.5)	Number of people with dementia admitted to an LTC facility
Brodaty <i>et al.</i> (2009)	Australia, UK, USA	Caregiver-care recipient dyad randomization	5 months - 8.5 years (mean 5.4 years, SD 2.4 years)	79	76	Usual care plus psychosocial caregiver intervention: five counseling sessions in the first 3 months from enrollment (education about dementia, information about resource, and help in managing difficult behavior), <i>Ad hoc</i> counseling on demand by telephone or face to face was available for at least 2 years	Donepezil (a cholinesterase inhibitor) and standard services (resource information and help in emergency)	Mean (SD) MMSE score 20.3 (5.61)	Number of people with dementia admitted to an LTC facility
Callahan <i>et al.</i> (2006)	USA	Cluster randomization by physician	18 months	84	69	Two care managers (advanced practice nurses). Intervention: education on communication skills, caregiver coping skills, legal and financial advice, patient exercise guidelines, and caregiver guide	Augmented usual care	Mean (SD) MMSE score 18	Hospitalization rates, LTC placement rates
Chu <i>et al.</i> (2000)	Canada	Cluster randomization by physician	18 months	17	19	Early Home Care Program: case management, occupational, physical and respiratory therapy, social work, respite, homemaking, personal care assistance, and psychiatric consultation	Information package on community resources	Mean (SD) MMSE score 22.7 (3.8) intervention, 22.8 (4.2) control	LTC placement
Duru <i>et al.</i> (2009)	USA	Cluster randomization by clinic	18 months	170	126	Care manager: structured home assessment, identified problems, initiated care plan actions, sent a summary to the primary care physician and other providers	Usual care	Mean (SD) Blessed-Roth Dementia Scale score 5.3 (3.4) intervention, 5.9 (4.2) control	LTC placement, hospitalization rate, ER visits

(Continues)

Table 1. (Continued)

Study	Country	Method of randomization	Follow-up duration	Sample size ^a		CM intervention	Control	Dementia severity	Outcome measurements
				CM	Control				
Eloniemi-Sulkava <i>et al.</i> (2001)	Finland	Caregiver-care recipient dyad randomization	2 years	53	47	Nurse case manager: advocacy, comprehensive support, counseling, training, follow-up calls, in-home visits, arrangements for social and healthcare services, 24-h-day availability	Usual services provided in community care	Mean (SD) MMSE 14.4 (6.2) intervention, 15.3 (5.5) control	LTC placement
Eloniemi-Sulkava <i>et al.</i> (2009)	Finland	Cluster randomization by physician	2 years	63	62	Family care coordinator (public health nurse) provided individually tailored support activities. Also, geriatrician medical investigation and treatment, support group, and individualized services were provided	Usual community care	Mean (SD) MMSE 13.4 (6.2) intervention, 14.2 (6.6) control	LTC placement, crude HR of LTC placement, adjusted HR of LTC placement
Fortinsky <i>et al.</i> (2009)	USA	Cluster randomization by practice site	12 months	54	30	Dementia care consultant had monthly contact with each family caregiver for 12 months, discuss caregiver's concerns, discuss action steps, and compose a written care plan	Educational materials	Mean (SD) Cognitive Status Scale score 11.7 (5.7) intervention, 11.0 (7.2) control	LTC placement, OR of LTC placement
Gaugler <i>et al.</i> (2008)	USA	Caregiver-care recipient dyad randomization	15.9 years	203	203	Study counselor: six sessions of individual and family counseling (information on dementia, management of behavior problems, and communication strategies), support group, and <i>ad hoc</i> counseling	Services available, contact the counselor for information or referral purposes only	Number (%) GDS 85 (44.5) intervention, 73 (37.6) control	LTC placement
Miller <i>et al.</i> (1999)	USA	Caregiver-care recipient dyad randomization	3 years	4151	3944	CM-to-participant ratio of 1:30, \$430-\$699 benefit per participant per month for services	CM-to-participant ratio of 1:100, \$290-\$489 benefit per participant per month for services	Majority mild to moderate dementia, MMSE score 16-25	LTC placement, median time to LTC placement
Mittelman <i>et al.</i> (1996)	USA	Caregiver-care recipient dyad randomization	3.5 years	103	103	Two individual and four family counseling sessions (promoting communication, techniques for problem solving and management of problem behavior, improving emotional and instrumental support for the caregiver, education about dementia, resource information), support groups, and continuous availability of counselors	Usual care provided at the center	Majority mild to moderate dementia, GDS score 4 or	Median time to LTC placement

Author	Country	Design	Follow-up	Sample Size	Intervention	Comparison	Mean (SD) MMSE	LTC placement
Mohide <i>et al.</i> (1990)	Canada	Caregiver-care recipient dyad randomization	18 months	30	Caregiver support, nurse made home visits, provided dementia and caregiving education, helped caregiver examining solutions, offered weekly in-home respite, and encouraged participation in a support group	Usual patient-oriented community nursing services	Mean (SD) MMSE 13.21 (6.83) intervention, 11.04 (6.17) control	LTC placement
Nobili <i>et al.</i> (2004)	Italy	Caregiver-care recipient dyad randomization	12 months	35	One psychologist and one occupational therapist made home visits and discussed dynamics among relatives, communication, management of problem behavior and adaptation of the environment to meet the needs of people with dementia. Information manual and a list of physicians or clinical centers to contact if needed	Usual care at a nonprofit association	Mean (SD) MMSE 12.0 (7.4) intervention, 11.1 (7.0) control	LTC placement
Teri <i>et al.</i> (2003)	USA	Caregiver-care recipient dyad randomization	2 years	76	Home health professionals experienced in dementia care conducted 12-h-long sessions on a schedule of two sessions per week for the first 3 weeks, followed by weekly sessions for 4 weeks, and then biweekly sessions over the next 4 weeks. The program consisted of an exercise component for people with dementia and a behavioral management component for caregivers	Usual care	Mean (SD) MMSE 17.6 (6.8) intervention, 15.9 (7.4) control	LTC placement
Vernooij-Dassen (1993) ^b	The Netherlands	Caregiver-care recipient dyad randomization	10 months	58	Home-based support program administered by home-helps, providing guidelines for emotional and practical support	N/A	N/A	LTC placement
Wray <i>et al.</i> (2010)	USA	Caregiver-care recipient dyad randomization	12 months	83	Telehealth Education Program conducted by three social workers and one nurse dementia care manager: education about dementia, emotion-focused and problem-focused coping strategies, group support	Usual services from Veterans Association	Mean (SD) GDS 4.63 (0.82) intervention, 4.48 (0.87) control	Mean LTC placement

(Continues)

Table 1. (Continued)

Study	Country	Method of randomization	Follow-up duration	Sample size ^a		CM intervention	Control	Dementia severity	Outcome measurements
				CM	Control				
Wright <i>et al.</i> (2001)	USA	Caregiver-care recipient dyad randomization	12 months	68	25	Nurse discussed handling problem behaviors, provided medication monitoring and referrals (three in-home visits and one phone call)	Usual care	Mean (SD) Blessed Dementia Rating: 7.87 (3.47) intervention, 9.62 (3.38) control	LTC placement, mean time to LTC placement

UK, United Kingdom; USA, United States of America; MMSE, Mini mental state examination; GDS, Global Deterioration Scale; CM, case management; SD, standard deviation; LTC, long-term care; ER, emergency room; HR, hazard ratio; OR, odds ratio.

^aNumber of Caregiver-care recipient dyads included in the analysis.

^bThe study information reported in this table is taken from Spijker *et al.* (2008).

of professions (e.g., social worker or nurse), a partner (e.g., a psychologist working with an occupational therapist), or a multidisciplinary team-based model (e.g., a team consisting of a psychiatrist, dietitian, psychologist, occupational therapist, physical therapist, social worker, and/or nurse) with different types of professionals acting to fulfill the demands of CM. The delivery of CM varied from home visits to telephone counseling or a combination of both. The duration of the intervention also ranged from a single visit lasting approximately 3 h to continued CM for the entire length of follow-up. Variation in the control groups was also observed. Control groups included usual care (e.g., educational materials and availability of a counselor), respite, and, to a lesser degree than the intervention group, access to a case manager and to community services. The trials originated from seven countries in North America, Oceania, and Europe.

Quality assessment

The assessment of study quality is summarized in Table 3. Of the 17 trials, there was blinding of the outcome assessor in six, allocation concealment in four, and intention-to-treat analysis in eight. Only three trials provided a description of loss to follow-up, and six provided an adequate description of randomization. All the studies reviewed received Jadad scores ranging from 1 to 3 (on a 5-point scale), suggesting that the quality of the RCTs of dementia CM was low to moderate.

Effect of dementia case management on risk of long-term care placement

With a random-effects model ($n = 16$ trials), there was no statistically significant effect of dementia CM compared with usual care on the risk of LTC placement (pooled RR 0.94, 95% CI [0.85, 1.03], $p = 0.203$) (Figure 2). We observed minimal heterogeneity ($I^2 = 16.3\%$, $p = 0.266$). Similar results were obtained using a fixed-effects model (pooled RR 1.00, 95% CI [0.96, 1.05], $p = 0.875$).

The stratified analysis by follow-up duration (Figure 3) showed a statistically significant reduction in the risk of LTC placement for dementia CM compared to usual care when follow-up duration was less than 18 months (average follow-up of 1 year), (pooled RR 0.61 [95% CI, 0.41, 0.91], $p = 0.015$). The effect decreased and was no longer significant when the duration of follow-up was at 18 months (pooled RR 0.95 [95% CI, 0.62, 1.46], $p = 0.827$) or greater than 18 months (pooled RR 1.01 [95% CI, 0.97, 1.06], $p = 0.654$). Further stratification by duration of

Table 2 Study outcomes

Study	LTC placements (%)		Time to LTC placement (days)		Hospitalizations (%)		ED visits (%)	
	CM	Control	CM	Control	CM	Control	CM	Control
Brody <i>et al.</i> (1997)	78.8	87.1	Total (SD): 17,349.4 (SD not available)		Total (SD): 10,080.9 (SD not available)			
Brody <i>et al.</i> (2009)	44.3	47.4	Total (SD): 1497.5 (876.6)		Total (SD): 1570.6 (876.6)			
Callahan <i>et al.</i> (2006)	8.3	7.2			29.8	24.6		
Chu <i>et al.</i> (2000)	11.8	42.1						
Duru <i>et al.</i> (2009)	14.1	12.7			31.2	32.5	56.5	52.4
Eloniemi-Sulkava <i>et al.</i> (2001)	32.1	29.8						
Eloniemi-Sulkava <i>et al.</i> (2009)	23.8	29.0						
	Additional information: crude HR of LTC placement (95%CI): 0.66 (0.31–1.4); adjusted HR of LTC placement (95% CI): 0.53 (0.23–1.19)							
Fortinsky <i>et al.</i> (2009)	14.8	33.3						
	Additional information: OR of LTC placement (95% CI): 0.4 (0.14–1.18)							
Gaugler <i>et al.</i> (2008)	48.8	54.7						
Miller <i>et al.</i> (1999)	44.1	42.9	Median (SD): 1011 (SD not available)	Median (SD): 1023 (SD not available)				
Mittelman <i>et al.</i> (1996)			Median (SD): 1356 (288)	Median (SD): 905 (178)				
Mohide <i>et al.</i> (1990)	36.7	36.7			6.7	13.3		
Nobili <i>et al.</i> (2004)	11.4	11.8						
Teri <i>et al.</i> (2003)	27.6	28.6						
Vernooij-Dassen (1993) ^a	13.8	27.8						
Wray <i>et al.</i> (2010)	9.6	20.0						
	Additional information: mean number of LTC placement (SD) 0.1 (0.4) in CM and 0.2 (0.6) in control							
Wright <i>et al.</i> (2001)	25.0	20.0	Mean (SD): 121 (107.64)	Mean (SD): 126 (110.45)				

CM, case management; ED, emergency department; LTC, long-term care; OR, odds ratio; SD, standard deviation.

^aThe study information reported in this table is taken from Spijker *et al.* (2008).

intervention, blinding, severity of dementia, type of CM, comparator, and medication management, did not show any changes in RRs of LTC placement by strata.

Of the 16 studies, that of Miller *et al.* (30) was the largest ($n = 8095$), contributing a disproportionate weight to the overall estimate. When this study was removed, dementia CM was associated with a

Table 3 Quality assessment of the studies included for review

Study	Randomization description	Blinding	Intention to treat	Allocation concealment	Description of loss to follow-up	Jadad score ^b
Brodaty <i>et al.</i> (1997)	No	No	No	No	No	1
Brodaty <i>et al.</i> (2009)	Yes	Yes (outcome assessors)	No	No	No	2
Callahan <i>et al.</i> (2006)	Yes	Yes (physicians)	No	Yes	No	3
Chu <i>et al.</i> (2000)	No	No	No	No	No	1
Duru <i>et al.</i> (2009)	No	No	Yes	No	No	1
Eloniemi-Sulkava <i>et al.</i> (2001)	Yes	Yes (outcome assessors)	No	No	No	2
Eloniemi-Sulkava <i>et al.</i> (2009)	Yes	No	Yes	Yes	No	3
Fortinsky <i>et al.</i> (2009)	Yes	Yes (outcome assessors)	No	Yes	No	3
Gaugler <i>et al.</i> (2008)	Yes	No	No	No	No	2
Miller <i>et al.</i> (1999)	No	No	No	No	No	1
Mittelman <i>et al.</i> (1996)	Yes	No	Yes	No	Yes	2
Mohide <i>et al.</i> (1990)	Yes	No	No	No	No	2
Nobili <i>et al.</i> (2004)	Yes	No	Yes	No	Yes	2
Teri <i>et al.</i> (2003)	Yes	Yes (outcome assessors)	Yes	No	No	3
Vernooij-Dassen, 1993 ^a	Yes	Yes (outcome assessors)	Yes	Yes	Yes	3
Wray <i>et al.</i> (2010)	Yes	No	Yes	No	No	2
Wright <i>et al.</i> (2001)	Yes	No	Yes	No	No	2

^aThe study information reported in this table is taken from Spijker *et al.* (2008).

^bBased on a 5-point Jadad score (Jadad *et al.*, 1996).

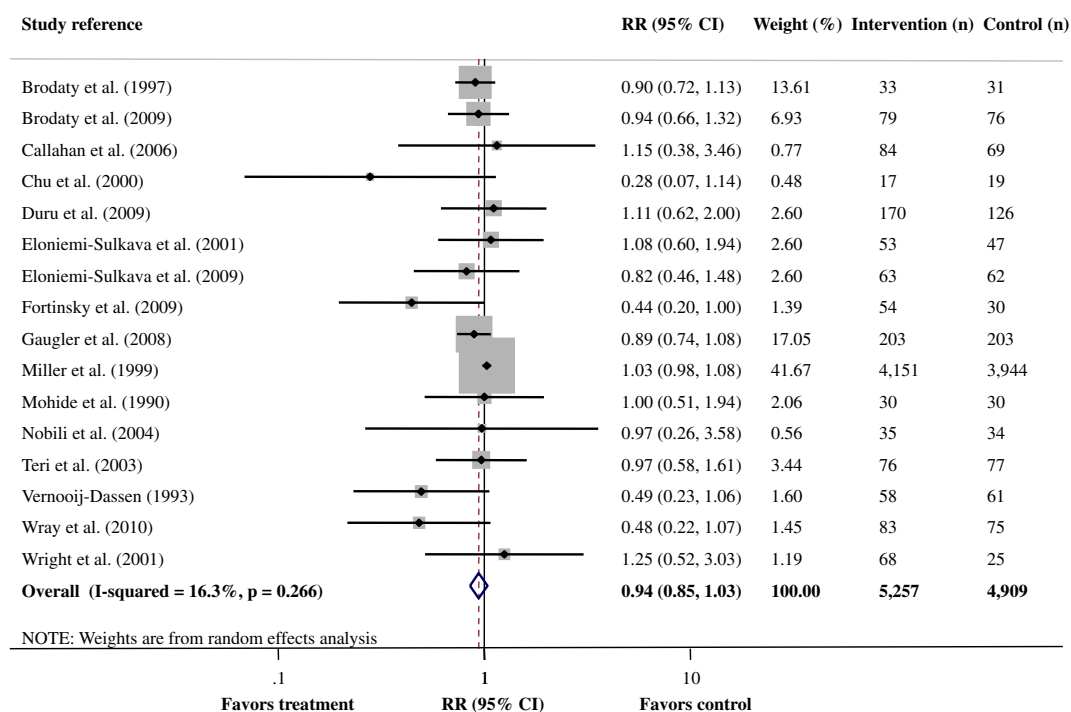


Figure 2 Forest plot for risk of long-term care placement (risk ratio) for dementia case management compared with usual care. CI, confidence interval; RR, risk ratio; n, number of caregiver-care recipient dyads.

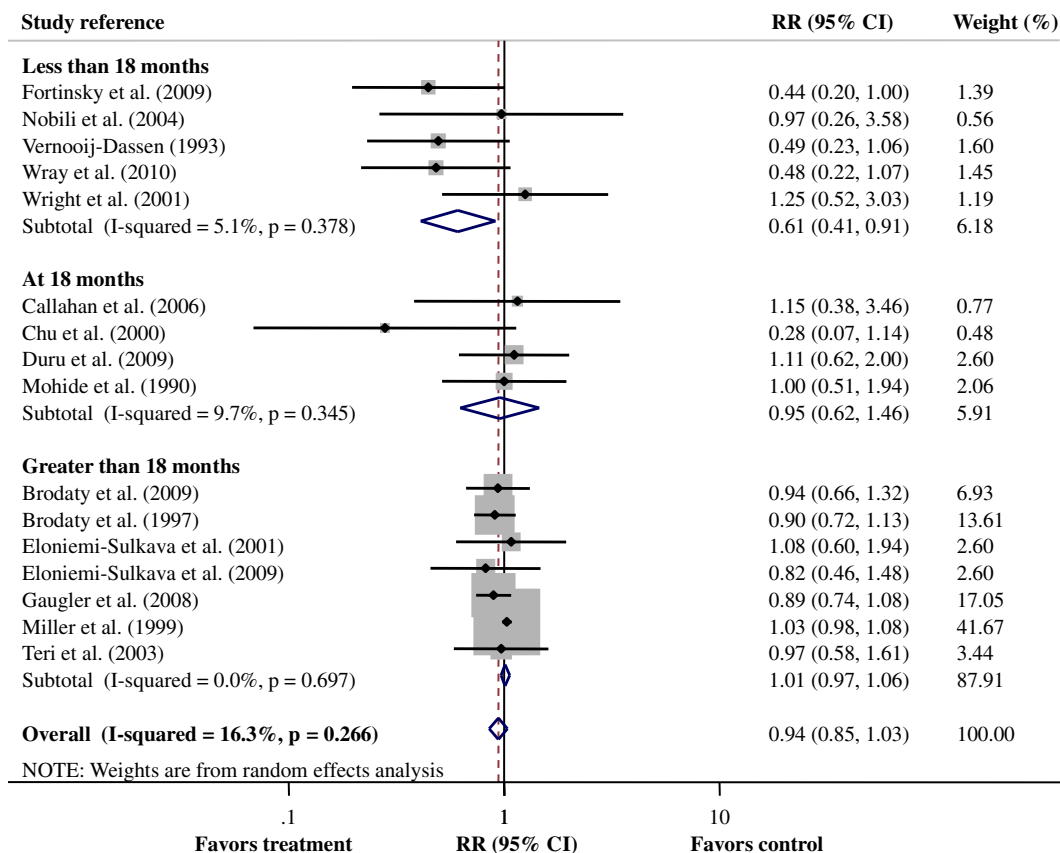


Figure 3 Forest plot for risk of long-term care placement (risk ratio) for dementia case management compared with usual care, by duration of follow-up. CI, confidence interval; RR, risk ratio; n, number of caregiver-care recipient dyads.

significant reduction in the risk of LTC placement compared with the control group (pooled RR 0.89, 95% CI [0.79, 0.99], $p = 0.037$).

Effect of dementia case management on time to long-term care placement

Five trials reported on time (mean days) to LTC placement (Mohide *et al.*, 1990; Mittelman *et al.*, 1996; Brody *et al.*, 1997; Wright *et al.*, 2001; Brody *et al.*, 2009). The pooled WMD suggested that there was no difference in time to LTC placement for dementia CM compared with usual care (WMD 77.79, 95% CI [-70.53, 226.12], $p = 0.304$) (Figure 4). However, there was evidence of significant heterogeneity ($I^2 = 98.7%$, $p < 0.001$). A stratified analysis was not conducted because of the limited number of studies.

Effect of dementia case management on risk of hospitalization and emergency department visits

We estimated the pooled RR of hospitalization using data from three studies (Mohide *et al.*, 1990; Callahan

et al., 2006; Duru *et al.*, 2009) and found no difference in the risk of hospitalization for the dementia CM group compared with usual care (pooled RR 1.00, 95% CI [0.76, 1.33], $p = 0.984$) (Figure 5). The one study that reported emergency department visits (Duru *et al.*, 2009) showed no difference in the risk of the outcome for the dementia CM group compared with usual care (RR 1.08, 95% CI [0.87, 1.33], $p = 0.485$). None of the studies reported on time to hospitalization.

Publication bias

Publication bias was assessed using the Begg test. Although visual inspection of the funnel plot might suggest the presence of publication bias, the test was not statistically significant (Begg test $p = 0.753$).

Discussion

In our systematic review and meta-analysis, we qualitatively and quantitatively summarized 17 studies

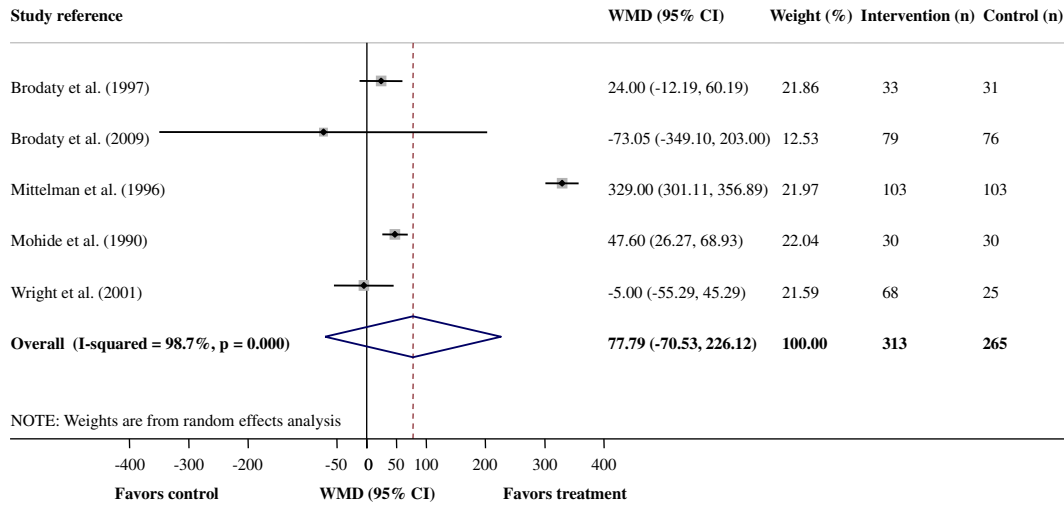


Figure 4 Forest plot for time to long-term care placement (weighted mean difference) for dementia case management compared with usual care. CI, confidence interval; WMD, weighted mean difference; n, number of caregiver-care recipient dyads.

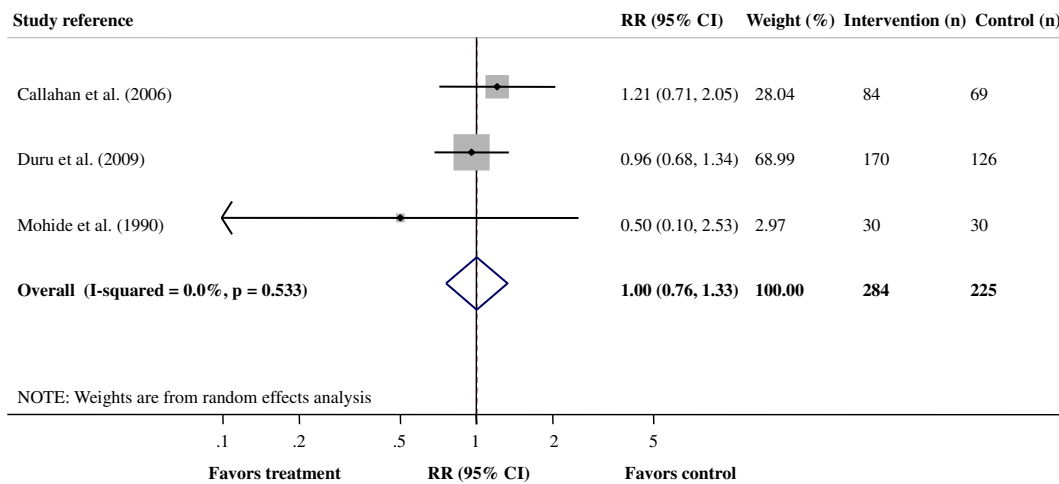


Figure 5 Forest plot for risk of hospitalization (risk ratio) for dementia case management compared with usual care. CI, confidence interval; RR, risk ratio; n, number of caregiver-care recipient dyads.

evaluating the effect of dementia CM interventions on LTC placement and hospitalization. Compared with usual care, dementia CM was not associated with a statistically significant reduction in the risk of LTC placement. However, there appeared to be a short-term effect in that dementia CM was associated with a significant reduction in LTC placement within the first 18 months following the intervention.

Our overall finding differs from that reported in previous meta-analyses. Two meta-analyses that explored the association between non-pharmacological interventions and institutionalization of older adults with dementia reported a reduction in risk of LTC

placement associated with dementia CM (Pinquart and Sørensen, 2006; Spijker *et al.*, 2008). Pinquart and Sørensen (2006) used a composite measure (the average between the immediate and follow-up risk of institutionalization) to maximize the number of studies included in their analysis, by including studies reporting only the immediate or the follow-up risk of institutionalization. Therefore, a comparison between the short-term and long-term effects of the interventions based on duration of follow-up was not possible. Spijker *et al.* (2008) found that non-pharmacological interventions (which included dementia CM and other interventions) significantly decreased the odds of

institutionalization and increased the time to institutionalization. The studies included in this meta-analysis had a relatively short follow-up (to permit a similar follow-up duration), and their results were similar to our findings when the risk of LTC was stratified by follow-up duration. This study did not allow the assessment of the effect of longer follow-up durations on the odds of institutionalization.

The lack of effect of dementia CM on the risk of LTC placement in studies with follow-up durations of 18 months or greater should be interpreted in light of several clinical and methodological issues. The literature suggests that dementia CM may have a positive effect on the caregiver but does not improve the care receiver's symptoms over the long term (Pinquart and Sörensen, 2006). It is possible that the positive effect of dementia CM on the risk of LTC placement decreases after 18 months because of the natural progression of the disease (Oh *et al.*, 2011). Another explanation of decreasing effectiveness of dementia CM may be that non-sustained interventions lose their effect over longer periods, similar to other community interventions that target older adults (Choi and Hector, 2012; Gustafsson *et al.*, 2012). This observation calls for repeated dementia CM interventions that address the progression of symptoms in care receivers and the fading effect of a single time intervention. Further research is needed to determine whether repeated CM interventions would sustain the short-term benefits on resource utilization.

In our meta-analysis, there was no overall significant effect of dementia CM on time to LTC placement. Because the older adult population may have a considerable number of comorbidities (Karamangla *et al.*, 2007), the presence of competing risks (Berry *et al.*, 2010) is an important consideration for the interpretation of this result. Hospitalization and death are the main competing risks for LTC placement in this population. In most cases, the indication for hospitalization overlaps the indication for LTC placement, which makes it difficult to consider in the analysis (Berry *et al.*, 2010). The increased risk of death in adults with dementia can alter the composition of the study population over extended follow-up times and may lead to selection bias in longitudinal studies (Murphy *et al.*, 2011). Nevertheless, this would unlikely be a major source of bias in the RCTs reviewed here.

The studies in our review also included substantial variability in CM interventions targeting caregivers of people with dementia. This variability likely explains the non-significant overall pooled findings, as some components of the interventions might be effective whereas others are not. Hence, it is unclear which

specific components of CM interventions are effective for which particular groups of people with dementia. The components most frequently used were education about dementia, psychological support, and referrals to community services. The first two components improve caregivers' coping skills (Mittelman *et al.*, 1993), which might delay institutionalization and facilitate aging in place. The latter component might reduce the fragmentation of dementia-related health services available in the community and help caregivers to navigate the system more easily (Mittelman *et al.*, 1993; Wright *et al.*, 2001; Case Management Society of America, 2010). To obtain a comprehensive benefit, a standardized CM intervention would ideally include all three components.

Our meta-analysis has several limitations. Timely and appropriate LTC placement may be considered a goal of CM in some cases (e.g., severe and/or medically complex dementia). Consequently, the intervention may have hastened LTC placement for such cases (and may be viewed as a positive outcome). Our stratified analysis showed no effect of severity of dementia on the risk of LTC placement. Nevertheless, we were not able to perform a stratified analysis of the time to LTC placement because of limited studies reporting this outcome. Further, we noted high variability in the CM interventions and the care available to the control group, which limits the ability to assess the effect of the intervention specifically. We attempted to identify features of the intervention that may explain the effect, and only duration of follow-up was determined to be associated with risk of LTC placement. The majority of the trials also lacked blinding and allocation concealment, which compromised their quality. Finally, most trials were underpowered to detect statistically significant differences in effect size between the intervention and control groups.

In conclusion, our results suggest that dementia CM may have a short-term positive effect on reducing the risk of LTC placement among older people with dementia residing in the community. However, other sources of resource utilization (including hospitalization and emergency department visits) and longer-term effects of dementia CM on risk of LTC placement warrant further investigation.

Key points

- Compared with usual care, dementia CM was associated with a decrease in the risk of LTC placement in people with dementia.
- However, the effect of CM on LTC placement was no longer significant after 18 months.

Conflict of interest

None declared.

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