Clinical, economic and methodological studies in elderly patients with dementia and their informal caregivers

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The cost-effectiveness of two forms of case management compared to a control group for persons with dementia and their informal caregivers from a societal perspective

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ABSTRACT

Objective

To evaluate the costs and cost-effectiveness of two types of case management, as well as care without access to case management for people with dementia and their informal caregivers.

Design

Economic evaluation from a societal perspective embedded within a prospective, observational, controlled, cohort study.

Setting

Community care in the Netherlands.

Participants

A total of 521 dyads.

Intervention

Case management provided within one care organization (intensive case management, ICMM), case management where multiple case management organizations are present within one region (Linkage model, LM), and a group with no access to case management (control).

Measurements

Health and social service use (costs), neuropsychiatric symptoms (NPI), general health of the informal caregiver (GHQ-12), and quality adjusted life years (QALY) of the patient and informal caregiver were measured over a 24-month period. Inverse-propensity-score-weighted models were used to evaluate differences in outcomes between the control group and the two case management models.

Results

A total of 521 dyads participated. There were no significant differences in clinical or total cost outcomes between the three groups. Informal care costs were significantly lower in the ICMM model compared to the control and LM group. For all outcomes, the probability that the ICMM was cost-effective in comparison with LM and the control group was larger than 0.95 at a threshold ratio of 0 EUR/incremental unit of effect.

Conclusion

This study provides preliminary evidence that the ICMM is cost-effective compared to the control group and the LM. However, the findings should be interpreted with caution since this study was not a randomized controlled trial.

INTRODUCTION

Dementia is a chronic disorder marked by memory loss, cognitive impairment and behavioral lapses resulting in pronounced consequences for the people with dementia, their families and society. The global prevalence of dementia is estimated at 48.1 million in 2020 and approximately 90.3 million in 2040(1). Worldwide costs of dementia were estimated at US$ 604 billion in 2010 (2,3). In high-income countries, informal care (45%) and formal social care (40%) make up the majority of costs, while the contribution of direct medical costs (15%) is smaller (2,3). The provision and financing of measures to meet long-term care needs, including support for their informal caregivers are important societal and political issue as the number of people with dementia are expected to increases and the workforce decreases (1).

Although there is a variety of community and care services available for community-dwelling people with dementia and their informal caregivers, after the diagnosis people often lack information regarding available support that may address all their care needs (4,5). Many experience insufficient alignment, management and continuity of care and support during the disease course (6). Around 80 percent of caregivers are at risk of becoming overburden and this is one of the major risk factors for acute hospitalisation and institutionalization of persons with dementia (7,8). Moreover, informal caregivers of persons with dementia are at very high risk to develop depressive or anxiety disorders (9,10). Both institutionalization and mental disorders in informal caregivers are associated with increased costs for the healthcare system.

Case management has been proposed as an instrument to delay institutionalization and improve the mental health of informal caregivers. Case management is defined as a "collaborative process of assessment, planning, facilitation, care coordination, evaluation, and advocacy for options and services to meet an individual's and family's comprehensive health needs through communication and available resources to promote quality and cost-effective outcomes"(11). Reviews and meta-analyses have yielded inconsistent results regarding case management on patient and caregivers outcomes such as care satisfaction, institutionalization, hospitalization, caregiver burden, depression, and economic outcomes (12-15).

The objective of this article is to compare the costs and cost-effectiveness of the two most prominent types of case management in the Netherlands (intensive case management and linkage models) with no access to case management (control group) for people with already diagnosed dementia and their informal caregivers.

METHODS

The COMPAS (Case management of dementia patients and their caregivers) project was a prospective, observational, controlled, cohort study. The study protocol was registered with the Dutch Trials Registry (NTR3268) and published (16). The Medical

Ethics Committee of the VU University medical center provided ethical approval and all participants gave written consent. The informal caregiver signed on behalf of the person with dementia if they were unable to understand and reproduce the study goals.

Participants and setting

The primary informal caregivers (n=521) and persons with dementia (n=363) were recruited from various regions of the Netherlands from April 2011 to November 2012. In case management regions, case managers of the participating organizations provided lists of their patients who met the inclusion criteria. In the control group, recruitment took place via outpatient geriatric or neurologic (memory) clinics, Alzheimer centers and general medical practices. Persons with dementia were eligible for this study if they lived at home, had an established/formal diagnosis of dementia, were not terminally-ill, were not anticipated to be admitted to a long term care facility within 6 months, and had an informal caregiver. The informal caregivers were eligible if they were the primary informal caregiver responsible for looking after the patient, had sufficient language proficiency and were not severely ill.

Care Models

The case management models that were evaluated in this study and the content of care in regions without case management were described in detail elsewhere and summarized here (16,17).

Case managers in the Intensive Case Management Model (ICMM) are appointed to one organization which is specialized in dementia care. They guide and support people with dementia for long periods of time usually starting after diagnosis, and offer medical and psychosocial services from their organization (18). The case manager works in collaboration with an 'in-home' multidisciplinary team to tailor care needs of the person with dementia and the informal caregiver (18).

The Linkage Model (LM) is a collaboration between multiple care providers (e.g. home care organizations, general practitioners, social care services) who were already providing health care services in the region and who then were given the mandate to initiate case management services. After a formal diagnosis, persons with dementia are connected to a case manager who provides educational, emotional and practical support such as advice on disease-related issues and recommends supportive health and social services until time of nursing home admission or death of the patient. In general, informal caregivers are involved in this process whenever possible. Expert advice can be sought through multidisciplinary meetings held regularly with experts from the various collaborating organizations.

The control group was recruited in areas without access to a case manager(19). In these regions, no central coordination of dementia care is provided by a dedicated, trained and educated health care professional. Care is usually initiated by the person with dementia, his /her informal caregiver or health care provider involved. In some cases, care may be monitored by a registered nurse working in the general practice in addition to the general practitioner. Access to home or respite care did not differ across regions.

Data Collection

Data were collected through interviews and questionnaires by trained interviewers at baseline and every six months for 24 months. The informal caregiver filled in cost diaries that were collected at each interview.

Outcome Measures

The primary outcome in the person with dementia was the presence of neuropsychiatric symptoms as measured with the Neuropsychiatric Inventory (NPI) which assesses twelve neuropsychiatric domains in persons with dementia (20). The NPI was rated by a caregiver familiar with the person with dementia's behaviour (20). It assesses presence, frequency, severity and the symptom specific caregiver distress in the previous month. (20) Calculation of the total score is the sum of the 12 domain scores which ranges from 0-144 points with higher scores indicating more problems (20).

The primary outcome in the informal caregiver was psychological health as measured by the general health questionnaire (GHQ-12) (21). The score ranges from 0-12 with higher scores indicating more severe psychological health problems.

Secondary outcomes included Quality-Adjusted Life-Years (QALYs) based on the EuroQol (EQ-5D). Proxy measurements for the EQ-5D for the person with dementia were taken by interviewing the informal caregiver. Informal caregivers also filled out the EQ-5D for themselves. The health states from the EQ-5D were subsequently converted to utilities using the Dutch tarif.(22). We calculated QALYs by multiplying the utility of each health state by the time in between two measurements and summing the results over the 24 month treatment period. Subsequently, combined QALY scores for the dyads were calculated by summing the QALYs for the patient and the caregiver.

Costs

Resource utilization and associated costs were measured from a societal perspective. Cost diaries were used to collect data on use of care and support by persons with dementia to estimate costs from a societal perspective. Direct healthcare costs included formal care such as general practitioner visits and medication use. Direct non-healthcare costs consisted of time spent on care by informal carers. We limited the maximum number of informal care hours per day to 18 hours. Indirect non-healthcare costs included days absent from paid work or unable to do daily activities such as housekeeping or voluntary work because of caregiver responsibilities. Supplementary Table 1 lists the cost categories and prices used in the economic evaluation. All prices were adjusted for the year 2010 using consumer price index figures (23). Costs of medications were valued using prices from the Royal Dutch Society for Pharmacy (24).

To estimate the costs of case management, 73 case managers (92% of all case managers that were included in this study) were interviewed about their caseloads and the number of hours they worked per week. Based on this information we calculated the time spent per patient and applied the median hourly wage for a case manager.

Statistical Analysis

As this was a non-randomized controlled study, advanced statistical methods were needed to control for any baseline imbalances between the different treatment groups (25). Therefore, propensity scores were calculated using generalized boosted methods for multiple treatments using the 'twang' package in R (26). Balance and overlap of propensity score distributions in the three groups were assessed. The 'twang' package provides propensity scores based weights for the estimation of the average treatment effects (ATE) for more than two treatment groups. All covariates that significantly differed among groups at baseline or that were associated with the baseline NPI total score were included in the calculation of propensity score and weights. A separate propensity score and weight was created for secondary outcomes that included variables that significantly differed at baseline. The propensity score based weights were then exported to Stata to be used as sampling weights in the analysis (27).

As the time horizon of this study was two years costs and effects in the second year were discounted at 4% and 1.5%, respectively. Multiple imputation by chained equations using predictive mean matching (PMM) was used to impute missing values for cost and effect data.(28) We created 100 imputed datasets that were each analyzed. We included the propensity weight as one of the predictor variables in the imputation model (25). The analysis results from the imputed datasets were pooled together using Rubin's rules. Individual sub costs per category were imputed instead of total costs to maximize the accuracy of the imputation.

We used a generalized linear regression model with a gamma distribution and an identity link to estimate mean differences in total costs and to account for the right skew of the cost data. A generalized linear regression model was also used to estimate the incremental effect in quality adjusted life years (QALYs) adjusted for baseline utility estimates with a Gaussian distribution and an identity link (29). A generalized estimating equation (GEE) model was used for the comparison of costs with a gamma distribution and an identity and separate GEE models with a Gaussian distribution and an identity link for NPI and GHQ-12 scores to allow for repeated measurements. An exchangeable correlation structure was used with robust standard errors. The estimated changes in mean NPI, GHQ and sub costs that are reported are for the two year follow-up period. Mean differences and standard errors from each imputed dataset were pooled using Rubin's rules (30).

We estimated the correlation between the incremental total costs and the different outcome measures in the imputed datasets. In the multiple imputation procedure, the covariance between total costs and effect outcomes measures were calculated based on the Fisher z transformation and were then pooled using Rubin's rules (31,32).

Incremental Cost-Effectiveness Ratios (ICERs) were calculated using the pooled cost and effect estimates. The ICER is calculated as $\frac{\hat{\Delta}_c}{\hat{\Delta}_e}$ where $\hat{\Delta}_c$ is the difference in total costs between the two intervention groups and $\hat{\Delta}_e$ is the difference in QALYs between the two

intervention groups.

Incremental net benefit (INB) estimates were calculated using the following formula: $\hat{b}(\lambda) = \hat{\Delta}_e\lambda - \hat{\Delta}_c$ (33,34) where $\hat{\Delta}_e$ is the difference in outcome (for example QALY) between the two intervention groups, λ is the willingness to pay, and $\hat{\Delta}_c$ is the difference in costs. The variance of INB was calculated using: $V[\hat{b}(\lambda)] = \hat{V}(\hat{\Delta}_e)\lambda^2 + \hat{V}(\hat{\Delta}_c) - 2\hat{C}(\hat{\Delta}_e,\hat{\Delta}_c)\lambda$ where $\hat{C}$ is the covariance between the differences in total costs and QALYs (33,34). The probability of cost-effectiveness was calculated by estimating the probability that INB was positive using a normal-based approach.

Cost-effectiveness acceptability curves (CEAC) were estimated to quantify the uncertainty due to sampling and measurement errors and because lambda (λ) is generally unknown. The CEAC is a plot of the probability that the intervention is cost-effective in comparison with its comparator (y-axis) as a function of the money society might be willing to pay for one additional unit of outcome (threshold ratio (λ), x-axis). The pooled coefficients and variance parameters from the regression models were used to estimate the CEACs. CEACs were estimated for three comparisons: ICMM versus control, LM versus control, and ICMM versus LM.

RESULTS

Participant characteristics and differences between groups are shown in table 1. A total of 521 participants were included, 234 (45%) in the ICMM group, 73 (14%) in the control group and 214 (41%) in the LM group. The average age of informal caregivers was 65 years (range 22-91 years), and the average age of the patients was 80 years (range 54-97 years). Sixty-seven percent of the informal caregivers and 55% of the persons with dementia were female. The number of participants that dropped out was 207 (40%) after 24 months. The main reason for drop out was death (36%). There was no significant difference in the number of drop outs between the three groups.

Table 1 | baseline table of characteristics of care models, persons with dementia and informal caregivers

	Intensive Case Management	Linkage model	Control	Total group	P- value
Person with Dementia	N=234	N=214	N=73	N=521	
Age, mean (SD) [1]	79.9 (7.7)	81.0 (7.5)	75.9 (8.7)	79.8 (7.9)	< 0.001
Female gender, n (%) [2]	122 (52.4)	134 (62.6)	32 (43.8)	288 (55.3)	0.009
Married or in a relationship , n (%) [2]	128 (56.4)	98 (47.8)	51 (70.8)	277 (55.0)	0.003
Living situation					0.065
Living alone, n (%) [2]	92 (40.5)	95 (46.3)	19 (26.8)	206 (41.0)	
Living with another person	130 (57.3)	105 (51.2)	49 (69.0)	284 (56.5)	
Living in an elderly home	5 (2)	5 (2.4)	3 (4.2)	13 (2.6)	
Born in the Netherlands, n (%) [2]	209 (92.1)	178 (86.8)	64 (88.9)	451 (89.5)	0.204
Education, n(%) [2]					0.011
Elementary/lower, n (%)	93 (41.9)	99 (49.5)	21 (29.6)	213 (43.2)	
Secondary, n (%) [2]	111 (50.0)	81 (40.5)	37 (52.1)	229 (46.5)	
Higher/University, n (%) [2]	18 (8.1)	20 (10.0)	13 (18.3)	51 (10.3)	
MMSE, mean (0-30[a]) (SD) [1]	19.6 (5.5)	18.7 (6.4)	20.4 (4.8)	19.3 (5.8)	0.150
Time since symptoms in years, median (IQR) [3],	3.5 (2.0-5.0)	3.8 (2.0-5.3)	4 (2.7-5.5)	3.7 (2.0-5.2)	0.641
Time since diagnosis in years, median (IQR)) [3]	2.4 (1.4-3.7)	2.1 (1.3-3.3)	2.0 (1.3-3.0)	2.3 (1.3-3.5)	0.267
Time in Case Management in years, median (IQR) [4]	2.1 (1.3-3.1)	1.7 (0.42-2.5)	NA	1.8 (1.1-2.8)	< 0.001
Multi-morbidity (more than two diseases),n (%) [2]	203 (88.7)	172 (83.5)	55 (76.4)	430 (84.8)	0.032
Utility from the EQ-5D-Proxy (0-1) [a] (SD)	0.74 (0.2)	0.71 (0.3)	0.74 (0.2)	0.73 (0.23)	0.299
EQ 5d utility from persons with dementia (0-1) (SD)	0.82 (0.2)	0.79 (0.2)	0.83 (0.2)	0.81 (0.21)	0.415
QOL-AD proxy (13-52) (SD)	31.89 (5.1)	31.73 (5.2)	32.70 (5.0)	32.0 (5.1)	0.483
Age (SD) [1]	64.5 (12.8)	64.4 (12.4)	65.8 (11.7)	64.6 (12.5)	0.687

Table 1 | Continued

Informal Caregiver	Intensive Case Management	Linkage model	Control		P- value
Female gender, n (%) [2]	163 (70.0)	136 (63.6)	49 (67.1)	348 (66.8)	0.390
Spouse of the person with dementia, n (%) [2]	122 (53.3)	94 (45.6)	50 (69.4)	266 (52.5)	0.002
Living together with person with dementia, n (%) [2]	127 (55.5)	100 (48.8)	50 (70.4)	277 (54.9)	0.007
Multi-morbidity (one or more diseases), n (%) [2]	149 (65.1)	119 (57.8)	50 (69.4)	318 (62.7)	0.129
Education, n (%) [2]					0.370
Elementary/lower	36 (16.0)	31 (15.3)	10 (13.9)	77 (15.4)	
Secondary	139 (61.8)	127 (62.6)	38 (52.8)	304 (60.8)	
Higher/University	50 (22.2)	45 (22.2)	24 (33.3)	119 (23.8)	
EQ 5d utility (0-1) (SD)	0.83 (0.2)	0.85 (0.2)	0.86 (0.2)	0.84 (0.21)	0.261

[1] One-way-Anova, [2] Chi-square test, [3] Kruskall-Wallis test [4] Mann-Whitney test, [a] The underlined scores indicates the more positive outcomes.*
SD is standard deviation, IQR is Interquartile range

Clinical outcomes

Table 2 presents the results of the two-year clinical outcomes. Differences in the primary outcomes among groups were small and not statistically significant.

Table 2 | Clinical outcomes raw mean scores and standard errors after 24 months

	ICMM (n=234)		LM (n=214)		Control (n=73)	
primary outcomes	mean	SE	mean	SE	mean	SE
patient QALY	1.30	0.04	1.23	0.04	1.31	0.06
informal caregiver+ patient QALY combined score	2.94	0.04	2.87	0.05	2.98	0.07
NPI						
Baseline	16.8	1.0	19.9	1.1	15.0	1.6
6 month	21.7	1.6	21.9	1.6	23.2	2.7
12 month	19.7	1.4	21.7	1.5	19.5	2.1
18 month	22.2	1.5	24.9	1.7	24.4	3.0
24 month	23.0	1.6	26.3	1.9	26.5	3.4
GHQ-12						
Baseline	3.2	0.2	3.3	0.2	3.0	0.4
6 month	3.3	0.2	2.9	0.2	4.1	0.4

Table 2 | Continued

	ICMM (n=234)		LM (n=214)		Control (n=73)	
12 month	3.5	0.2	3.4	0.3	3.8	0.4
18 month	3.4	0.3	3.6	0.3	4.4	0.5
24 month	3.4	0.3	3.7	0.3	4.0	0.5

Costs

Table 3 presents the unadjusted mean costs in all three groups and the adjusted differences in costs between the groups. Informal care costs in the ICMM were significantly lower than in the control group and the LM. Case management costs of the ICMM were higher than the LM. We found that total costs were lowest for the ICMM followed by LM and finally the control group. The adjusted total costs were EUR 113,786 (95%CI: EUR 71,058 to EUR 156,514) for the control group, EUR 90,375 (95%CI: EUR 78,359 to EUR 102,392) for the LM group, and EUR 76,512 (95%CI: EUR 65,747 to EUR 87,276) for the ICMM group respectively. However, differences in total costs were not statistically significant between groups

Economic evaluation

QALY of the person with dementia

Table 4 lists the results of the economic evaluation. There are cost savings between the ICMM versus the control group of EUR 37,275 and a difference in QALY of -0.02. This results in an ICER of 2,460,506 indicating that EUR 2,460,506 is saved per QALY lost. At a λ of 0 EUR/QALY there is 0.95 probability that the ICMM is cost-effective in comparison with control. The ICER for LM versus control is 562,732 indicating that a decrease of 1 QALY in the LM is associated with cost savings of EUR 562,732 in comparison with control. The ICER for the ICMM group versus the LM was -524,082 which indicates that there is a saving of EUR 524,082 per additional QALY in the ICMM as compared to the LM. For all comparisons, the CEAC curves show a high probability of cost-effectiveness that remains high across increasing thresholds (figures not shown).

Combined QALY of the person with dementia and informal caregiver

The ICER for the ICMM versus the control group was at -6,872,306, indicating that for an increase of one combined (informal caregiver and person with dementia)-QALY there would be a cost-saving of EUR 6,872,306. Figure 1 presents the CEAC curves per pairwise group comparison for the combined-QALY. At a threshold of 0 EUR/QALY, the probability of cost-effectiveness for the ICMM versus control is over 0.95 and decreases with increasing threshold ratios. The ICER for the LM versus the control group indicates EUR 494,593 in cost savings per QALY lost. A willingness to pay of zero EUR/QALY gives 0.85 probability of cost-effectiveness for the LM versus control and the function slightly decreases with increasing threshold ratios. The ICER for the ICMM versus the LM was -262,780 indicating that for one combined-QALY gained, there is savings of EUR 262,780 for the ICMM versus the LM. The CEAC for the ICMM versus LM cuts the y-axis at 0.95 and the function increases to 0.97 with increasing threshold ratios.

Table 3 | unadjusted mean costs along with the adjusted differences between groups over 24 months

cost category	ICMM n=234 mean	SE	LM n=214 mean	SE	Control n=73 mean	SE	ICMM vs Control	95% CI	LM vs Control	95% CI	ICMM vs LM	95% CI
General practice	1,382	144	1,205	142	1,466	211	-22	-605; 560	-291	-839; 258	269	-179; 716
hospital and hospital clinics	3,018	657	3,604	838	5,357	1,787	-2,580	-6,621; 1,460	-2,028	-6,232; 2,177	-553	-2,672; 1,566
nursing home days, home care, day care	36,328	3,470	47,462	5,268	38,329	6,652	-10,252	-28,750; 8,276	-3,861	-23,228; 15,507	-6,391	-19571; 6,788
support groups	2,735	644	2,770	717	11,653	9,256	-17,084	-48,699; 14,530	-17,167	-48,787; 14,452	83	-2,263; 24,30
medications	2,183	387	1,875	372	1,998	493	250	-1,405; 1,905	-38	-1,615; 1,539	288	-921; 1,496
informal care costs	24,100	1,721	32,888	2,264	33,194	3,306	-10,703	-19,322; -2,085	-2,495	-11,532; 6,542	-8,208	-13,951; -2,466
case management costs	3,120	12	2,469	0	0	0	NA		NA		NA	
total costs	72,867	4,552	92,274	6,068	91,997	14,407	-37,275	-81,221; 6,672	-23,411	-67,767; 20,945	-13,864	-29,839; 2,112

SE is standard error, ICMM is Intensive Case Management model ,LM is Linkage model, CI is confidence interval, QALY is Quality-adjusted-life-year, ICER is Incremental Cost Effectiveness Ratio, NPI is Neuropsychiatric Inventory,GHQ-12 is General healthquestionnaire-12

Table 4 | Adjusted mean differences in outcomes and ICERs

outcome	costs	QALY	combined QALY	NPI	GHQ-12	ICER €/ QALY	ICER €/ combined QALY	ICER €/ NPI	ICER €/ GHQ-12
	Mean difference	Mean difference	Mean difference	Mean difference	Mean difference				
ICMM vs control	-37,275 (-81,221; 6,672)	-0.02 (-0.14; 0.11)	0.01 (-0.13; 0.14)	-1.82 (-7.49; 3.84)	-0.10 (-0.94; 0.74)	2,460,506	-6,872,306	19,688	354,280
LM vs control	-23,411 (-11,532; -6,542)	-0.04 (0.51; 0.08)	-0.05 (-0.19; 0.09)	-0.0.3 (-5.78; 5.72)	-0.09 (-0.93; 0.74)	562,732	494,593	701,654	243,838
ICMM vs LM	-13,864 (-29,839; 2,112)	0.03 (-0.05; 0.12)	0.05 (-0.05; 0.15)	-1.79 (-5.30; 1.73)	-0.01 (-0.58; 0.56)	-524,082	-262,780	7,210	1,830,600

SE is standard error
ICMM is Intensive Case Management model
LM is Linkage model
CI is confidence interval
QALY is Quality-adjusted-life-year
ICER is Incremental Cost Effectiveness Ratio
NPI is Neuropsychiatric Inventory
GHQ-12 is General health questionnaire-12

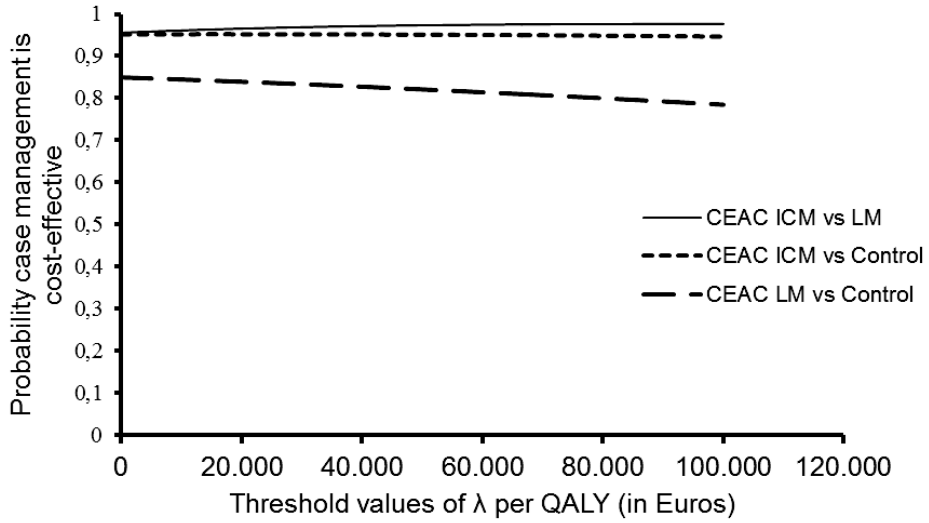

Figure 1 | Cost-effectiveness acceptability curve for combined-QALY

NPI

The ICER for NPI is 19,688 indicating that a 1 point improvement on the NPI in the ICMM is associated with cost savings of EUR 19,688 compared to the control group. For the LM versus the control group, the ICER indicates that there are savings of EUR 701,654 per one point improvement in NPI score. For ICMM versus LM, the ICER indicates that there are savings of EUR 7,210 per one point improvement in NPI score. For all comparisons, the CEAC is a decreasing function with increasing threshold ratios.

GHQ-12

The ICER for GHQ-12 is 354,280 indicating that a 1 point improvement on the GHQ-12 in the ICMM is associated with cost-savings of EUR 354,280 as compared to the control group. The ICER for the LM in comparison with control is 243,838 indicating that 1 point improvement on the GHQ-12 in the LM is associated with cost-savings of EUR 243,838 as compared to the control group. For ICMM versus LM, the ICER is 1,830,600 indicating that 1 point improvement on the GHQ-12 in the ICMM is associated with cost-savings of EUR 1,830,600 as compared to the LM. For all comparisons, the CEAC is a decreasing function of the threshold ratio.

DISCUSSION

This study evaluated the cost-effectiveness of two case management models and no access to case management (control). Informal care costs were significantly lower in the ICMM than the control group. For all outcomes, the probability that the ICMM was cost-effective in comparison with LM and the control group was larger than 0.95 at a threshold ratio of 0 EUR/incremental unit of effect.

A recent Cochrane review found that participants in case management used more social care services and general practitioner consultations than control groups but used similar amounts of health care services. This review found no differences in informal care time between the case management group and usual care group.(35) In contrast, in our study we found that both informal care costs and total costs in case management were lower, although not statistically different from the control group.

This study has several strengths. In this study, persons with dementia and their informal caregivers were followed over a period of 2 years. This is a relatively long period of time and provides good insight into resource utilization, quality of life, NPI scores of persons with dementia and mental health of informal caregivers. Another strength is that the case management models were implemented for many years previous to the start of this study. Therefore, the results have high external validity. The economic evaluation was performed from a societal perspective and also included informal care costs thereby providing detailed insight into the economic consequences of dementia care in the community.

There are also some limitations that should be considered. The observational design of the study led to baseline differences as well as possible selection bias. By using propensity scores, we tried to overcome this in the analyses. There was potentially more heterogeneity in the people recruited compared to a randomized control trial which may have resulted in greater uncertainty around outcomes. Another possible limitation is the use of the EQ-5D to measure quality of life as it may not be sensitive enough to pick up changes.

CONCLUSION

This study provides preliminary evidence that the intensive case management model is most cost-effective compared to a control group and the LM model as it appears to decrease total costs. However, further research is needed, since this was not a randomized controlled trial. Therefore, all results should be interpreted with caution. Despite this methodological limitation, results of the study are quite robust in showing that ICMM is more cost-effective than LM and control.

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