REVIEW

Cost-effectiveness of Case Management: A Systematic Review

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ABSTRACT

OBJECTIVES: In this time of aging and increasingly multimorbid populations, effective and efficient case management approaches play a crucial role in supporting patients who are navigating complex health care systems. Until now, no rigorous systematic review has synthesized studies about the cost-effectiveness of case management.

STUDY DESIGN: A systematic review was performed.

METHODS: The bibliographic databases PubMed and CINAHL Plus were systematically searched using key blocks and synonyms of the terms *case management*, *effectiveness*, and *costs*. The methodological quality of the studies was assessed using the Consensus Health Economic Criteria list.

RESULTS: A total of 29 studies were included. In 3 studies, the intervention was less effective and more costly than the control group and can therefore be considered not cost-effective. Two studies found that the intervention was less effective and less costly. A more effective and less costly intervention, and therefore a strong recommendation for case management, was found in 6 studies. In 17 studies, the intervention was more effective while being more costly. Nearly half of the studies met most of the quality criteria, with 16 or more points out of 19.

CONCLUSIONS: Existing studies often have adequate quality and, in many cases, show cost-effective or even cost-saving results. Case management appears to be a promising method to support patients facing complex care situations. However, variation among case management approaches is very high, and the topic needs further study to determine the most cost-effective way of providing such care coordination.

Am J Manag Care. 2022;28(7):294-e302. doi:10.37765/ajmc.2022.89186

Health systems around the world are getting more complex. This increasing complexity may affect patients' ability to access the right health services at the right time. This struggle to navigate the system has individual implications for the care seeker's well-being and economic implications when it results in wasting the health system's scarce resources and delaying the provision of the right treatment to the right patient or providing unnecessary care. Case management programs intend to guide individuals with complex medical needs through the health system to improve health service effectiveness and the efficiency of service provision. The concept of case management is not new; it has been practiced in the United States for more than a century, primarily in the disciplines of nursing and social services.[1] Case management programs are generally designed to tackle the challenges of episodic care, which are often fraught with inadequate transitions between care services and health care settings. The programs aim to coordinate fragmented services by providing guidance to individuals, attempting to improve health service effectiveness and reduce cost. Ideally, a case management program facilitates communication and the coordination of care, and its collaborative practice includes patients, caregivers, nurses, social workers, physicians, payers, support staff, other practitioners, and the community.[2]

The oldest and largest case management membership organization in the world, the Case Management Society of America, which facilitates the growth and development of case management, defines case management 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 patient safety, quality of care, and cost-effective outcomes."[3] As defined by the UK-based Medical Research Council as well, case management is quite complex.[4] The complexity of case management interventions arises from, among other factors, the number of groups or organizational levels targeted by the intervention, the number and variability of outcomes, the number and difficulty of behaviors required by those delivering or receiving the intervention, and the degree of flexibility or tailoring of the intervention. Furthermore, there

is complexity in the intervention components, among them case finding and assessment, case planning, navigation and coordination, monitoring, and reviewing of the case plan. These components aim to improve continuity of care and to enhance patients' self-management skills and hence are intended to increase efficiency within the health care system.

Especially in regard to the aging multimorbid population, case management may play an important role in the support of patients facing complex care situations. With better coordination, it is posited, the health system's ability to provide high-quality care and maintain resource requirements can improve. One recent analysis of case management's effectiveness is the RubiN project (funded by the Federal Joint Committee's German Innovations Fund), which is evaluating the implementation of case management for geriatric patients. The goal of RubiN is to develop a form of care throughout Germany that enables older people to remain in their homes for as long as possible. It is hoped that by case managers informing and guiding patients and their (caretaking) relatives, the quality of treatment will rise—by closing gaps in care—and support will be provided to physicians—by conserving scarce personnel resources.

Here, we set out to provide an overview of the evidence regarding cost-effectiveness of case management; until now, no systematic review has been conducted on this topic. Yet systematic reviews that have been done on case management's overall effectiveness are promising: They have found that case management can effectively reduce hospital use and improve satisfaction with care when chronic illnesses are present.[5-7] Furthermore, a systematic review of reviews has found evidence that case management interventions reduce health care utilization in patients with chronic illnesses.[8]

However, the question of whether case management is *cost*-effective has so far not been adequately addressed. Further, it is unclear whether cost-effective case management interventions have certain characteristics in common. The aim of this systematic review is therefore to investigate the cost-effectiveness of case management.

TAKEAWAY POINTS

- Case management approaches play a crucial role in supporting patients who are navigating complex health care systems.
- Case management intervention studies often have adequate quality and, in many cases, show cost-effective or even cost-saving results.
- Variation among case management approaches is very high, and the topic needs further study to determine the most cost-effective way of providing such care coordination.

TABLE 1. Eligibility Criteria

Inclusion	Exclusion
Population	
• Adults (≥ 18 years)	
Intervention	
Case management, including:	• Collaborative care without case manager
• Case finding	
• Assessment	
• Case planning	
• Navigation and coordination	
• Monitoring and review of case plan	
Comparison	
• Usual care	• Same sample (before-after comparison)
	• Usual care that includes standard case management
Outcomes	
• Cost-effectiveness	• Partial economic evaluation (eg, cost analysis)
• Outcome should be health related	
• Outcome should be related to patients	
Setting	
• Transferability to the German context possible	
Study design	
• Clinical trials	• Models and simulations (eg, Markov model, microsimulations)
• Randomized controlled trials	• Meta-analyses
• Nonrandomized controlled trials	• Reviews
• Interrupted time series	• Systematic reviews

METHODS

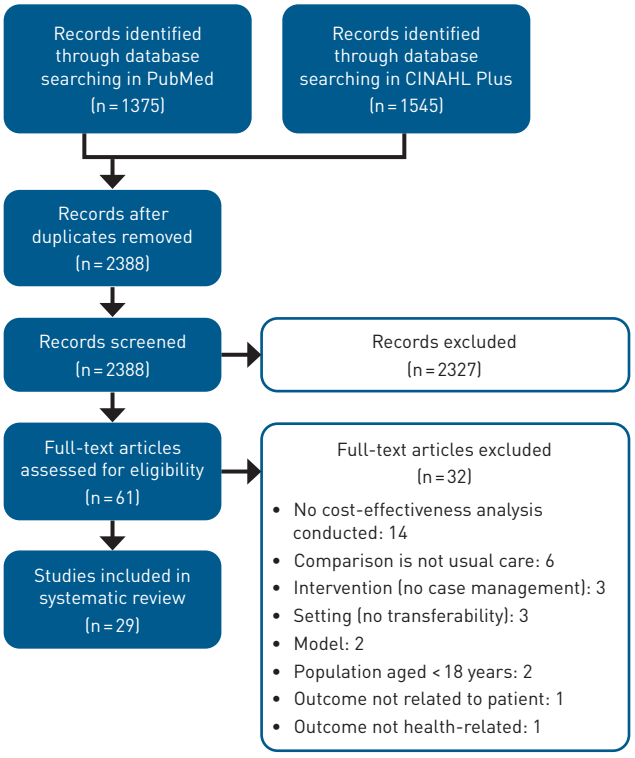
Objectives and Study Design

The objective of this systematic review was to synthesize the evidence for cost-effectiveness of case management. We conducted a systematic review of the literature following the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines.[9] Also, this review reported according to the PICOS (Population, Intervention, Comparison, Outcomes, Setting) Framework.[10] A protocol was developed before searching electronic databases.

Eligibility Criteria

Inclusion and exclusion criteria are outlined in **Table 1**. Briefly, the review included cost-effectiveness studies that compare case management interventions with usual care. Model-based studies were excluded. No limits were applied to language and publication date.

FIGURE 1. PRISMA Flowchart of Screening and Selection Process[9]



PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses. Source: Moher et al (2009).[9]

Electronic Bibliographic Database Searches

The bibliographic databases PubMed and CINAHL Plus were systematically searched using key blocks of the terms *case management*, *effectiveness*, and *costs* and their synonyms. A complete search strategy list is provided in the **eAppendix** (available at **ajmc.com**).

Study Selection

Two authors (A.K.K. and J.J.) independently screened titles and abstracts from unduplicated references. The full text was reviewed when a decision was not possible from reading the abstract. Any discrepancies were resolved by discussion.

Data Collection and Synthesis

Data were collected using an extraction form developed to retrieve relevant information. This included study characteristics (nation, setting, patient group and sample size, comparison group, study design, type of economic evaluation, study duration), case management characteristics (case management model [with description], intensity of intervention, team or single case manager, training received, supervision, 24-hour availability of case manager, caseload per manager/team), and outcome characteristics (outcome measures, costs included, cost perspective, time horizon, cost analysis method, findings, sensitivity analysis/uncertainty assessment). The studies were summarized and synthesized by the first author independently. The extraction table is provided in the eAppendix.

Quality Assessment

The methodological quality of the cost-effectiveness analyses was assessed by the Consensus Health Economic Criteria (CHEC) list.[11] If a study qualified in a criterion, it scored 1; otherwise, it scored 0. Thus, this tool's range was 0 to 19. In cases in which criteria were not applicable (eg, the question about the appropriate discount rate in a year-long study), the overall achievable score was reduced. Quality appraisal was verified by a second reviewer.

RESULTS

Study Selection

A total of 2388 unduplicated studies were retrieved from the database searches. After reading titles and abstracts, 61 full texts were analyzed, and inclusion and exclusion criteria were applied. From these, 32 studies were excluded. The remaining 29 studies were included in the qualitative analysis of the review. A flow diagram of this process, according to PRISMA guidelines, is presented in **Figure 1**.[9]

Quality Assessment

The results of the CHEC list show that nearly half of the studies (n = 13) met most of the quality criteria (≥ 16 of 19).[12-24] The main limitations were the narrow perspective chosen, as only about a quarter (n = 7) of all studies chose a broad societal perspective,[12,16,17,20,23,25,26] and the chosen short time horizon, which was only 1 year in about half the studies (n = 14).[13,16,19,26-36]

Study Characteristics

Studies were from the United States (n = 12)[13-16,18,28,29,34,35,37-39] more than from any other nation, followed by studies from Germany (n = 8),[12,20,21,24,26,30,31,33] the Netherlands (n = 4),[17,19,22,23] the United Kingdom (n = 2),[32,40] Sweden (n = 1),[25] Denmark (n = 1),[36] and Canada (n = 1).[27] Except for one,[33] all studies were trial-based economic evaluations, assessing the cost-effectiveness of case management compared with usual care. Twenty-two of the economic evaluations were based on randomized controlled trials (RCTs)[12-16,18,20-30,32,34,36,39,40]; the rest used non-RCT designs, such as nonrandomized controlled observational studies. Twenty of the studies adopted a health care system perspective in the analysis.[13-15,19,21,24,27-40] A societal perspective was adopted by 7 studies.[12,16,17,20,23,25,26] One study took the employers' perspective.[18] One study adopted a health care perspective, a social care perspective, and a societal perspective.[22]

Patient Groups

The patient group represented more than any other (see **Table 2**[12-40]) were those with psychiatric disorders (n = 9), such as depressive disorders, anxiety, and/or posttraumatic stress disorder[12,15,16,18,22,30,31,35,39]; they were followed by older patients (n = 4),[19,25,29,38] patients with

TABLE 2. Study Population and Case Management Components[12-40]

Study	Study population	Assessment	Case planning/ care plans	Navigation/ coordination	Monitoring	Health education	Other
Bosanquet et al (2017)[40]	465 participants ≥ 65 years with major depressive disorder			✓	✓		
Bourbeau et al (2006)[27]	96 previously hospitalized patients ≥ 50 years with COPD				✓	✓	
Dehmer et al (2018)[28]	299 patients ≥ 21 years with elevated blood pressure	✓	✓	✓	✓	✓	
Dorman Marek et al (2018)[29]	301 participants ≥ 60 years with impaired cognitive functioning and needing help to manage oral medications	✓	✓	✓	✓	✓	
Gensichen et al (2013)[12]	562 patients with major depression			✓	✓	✓	
Grochtdreis et al (2018)[30]	325 patients with anxiety, depressive, or somatic symptoms	✓		✓		✓	
Handley et al (2008)[13]	339 English-, Spanish-, and Cantonese-speaking patients with type 2 diabetes				✓	✓	
Hay et al (2012)[14]	387 low-income, predominantly Hispanic patients with diabetes and comorbid depression			✓	✓		Problem-solving therapy
Hay et al (2018)[37]	1406 patients with type 2 diabetes			✓	✓		
Jacke and Salize (2014)[31]	954 patients with incapacity to work for a duration of 28 to 56 days in connection with an affective disorder, discharged from hospital in the 14 days prior to study initiation			✓			
Joesch et al (2012)[15]	1004 patients with panic disorder, generalized anxiety, social anxiety, and/or PTSD with or without major depression				✓	✓	Optimization of medications
Lavelle et al (2018)[16]	629 active-duty service members with PTSD or depression				✓		Increased behavioral health support and stepped psychosocial treatment
Lewis et al (2017)[32]	705 participants ≥ 75 years during the pilot phase and ≥ 65 years during the main trial with subthreshold depression			✓	✓		Behavioral activation
Long and Marshall (2000)[38]	317 functionally impaired clients ≥ 75 years with severe functional disability, excessive hospital use, or ED use		✓	✓	✓		
MacNeil Vroomen et al (2016)[17]	521 informal caregivers and community-dwelling persons with dementia		✓	✓		✓	
Michalowsky et al (2019)[24]	444 participants with dementia, ≥ 70 years, living at home	✓	✓	✓			
Mostardt et al (2012)[33]	48 patients with dementia			✓			
Paez and Allen (2006)[34]	228 adults with hypercholesterolemia, who underwent coronary artery bypass grafting or percutaneous coronary intervention		✓		✓	✓	
Rost et al (2004)[18]	326 primary care patients with depression, with full- or part-time work	✓	✓		✓	✓	
Ruikes et al (2018)[19]	369 frail patients ≥ 70 years	✓	✓	✓	✓		
Saleh et al (2006)[35]	662 participants with more than 1 drug- or alcohol-related offense, a breathalyzer test with a blood alcohol content of 0.2 or higher, or involved in a drug- or alcohol-related accident	✓	✓	✓	✓		
Sandberg et al (2015)[25]	153 frail patients ≥ 65 years	✓	✓	✓	✓	✓	
Seidl et al (2015)[26]	329 patients ≥ 65 years with myocardial infarction	✓			✓	✓	
Seidl et al (2017)[20]	329 patients ≥ 65 years with myocardial infarction	✓			✓	✓	
Simon et al (2009)[39]	600 consecutive primary care patients starting antidepressant treatment			✓	✓		
Sørensen et al (2017)[36]	150 patients with COPD	✓	✓	✓	✓	✓	
Ulrich et al (2019)[21]	505 patients with a long-term indication for oral anticoagulation therapy				✓	✓	
Wansink et al (2016)[22]	49 participants with long-standing psychiatric problems and an accumulation of risk factors for poor parenting	✓	✓	✓	✓	✓	
Wijnen et al (2019)[23]	223 patients with HIV at risk for viral rebound (ie, a recent detectable viral load and suboptimal adherence)				✓	✓	

COPD, chronic obstructive pulmonary disease; ED, emergency department; PTSD, posttraumatic stress disorder.

dementia (n = 3),[17,24,33] and patients with diabetes (n = 2).[13,37] Further, several studies included patients belonging to more than 1 patient group, such as patients with diabetes and depression,[14] older patients with depression,[32,40] and older patients with myocardial infarction.[20,26] The rest of the studies included patients with HIV,[23] chronic obstructive pulmonary disease,[27,36] elevated blood pressure,[28] hypercholesterolemia,[34] and a long-term indication for oral anticoagulation therapy.[21]

Case Management Model

In most studies, the case management interventions were described in enough detail to identify the program components. These components are case finding and assessment, case planning, navigation and coordination, monitoring, and reviewing of the case plan (Table 2[12-40]).

The component of monitoring could be found in most descriptions of the case management intervention: Symptom monitoring and regular visits or telephone calls were described in 24 studies. Furthermore, the case management models often included navigation and coordination (n = 19) and health education (n = 17) components, such as informing the patient about the disease, counseling on general health behavior, emphasizing lifestyle changes, and promoting treatment adherence, self-care, and autonomy.

A combination of the components of monitoring and health education was often described,[13,15,21,23,27] as was the combination of monitoring and navigation/coordination.[14,32,37,39,40]

A case management model with all components (assessment, case planning, navigation and coordination, monitoring, and health education) was described in 5 studies.[22,25,28,29,36]

Case Managers

Case managers were nurses, health care assistants, social workers, physiotherapists, clinical therapists, pharmacists, and mental health workers. About half the studies (n = 14) stated that the case managers received training beforehand. The scope of the training received was heterogenous, with a duration of several hours, 2 days, or even 2 weeks. Case managers worked alone, although they frequently collaborated closely with the patient's physician. Caseloads ranged between 10 and 76 patients, although 1 study analyzing a telecommunication-supported case management model stated a caseload of up to 120 less-active cases.[35]

Outcomes and Costs

Highly heterogeneous among the studies were the outcomes. They included patient utility measures (eg, quality of life with EuroQol 5-dimension instrument, Short Form-36 questionnaire, World Health Organization Quality of Life), patient health effect measures (eg, mortality, symptoms, functioning in activities of daily living), other patient-relevant measures or system measures (eg, outpatient contacts, time in patients' home environment, absenteeism), and situational program measures (eg, quality of parenting, abstinence).

Depending on the perspective chosen, intervention costs, direct medical costs (eg, inpatient and outpatient costs, emergency department costs, medication costs), direct nonmedical costs (costs for social support services [eg, community care such as nurse care and family support]), and indirect costs (eg, informal care costs and productivity losses) were included in the analyses of the studies. A table of perspectives chosen and costs included is provided in the eAppendix.

Economic Analyses

Findings regarding the economic analyses, the classification within the cost-effectiveness plane, and the results of the quality assessment using the CHEC list are listed in the results grid (**Table 3**[12-40]).

All except 2 studies[20,25] included an incremental analysis of costs and outcomes; most calculated an incremental cost-effectiveness ratio (n = 24) and conducted a sensitivity analysis (n = 24).

In **Figure 2**, results are visualized in a cost-effectiveness plane, which is used to visually represent the differences in costs and health outcomes (effects) between treatment alternatives in 2 dimensions by plotting the costs against effects on a graph. Effects and costs are plotted on the x-axis and y-axis, respectively. The cost-effectiveness plane includes 4 quadrants: northwest (NW), southwest (SW), northeast (NE), and southeast (SE).

In 3 studies, the intervention was less effective and more costly than the control group (NW quadrant) and can therefore be considered not cost-effective.[19,30,35] The intervention is dominated by usual care.

Two studies found that the intervention was less effective and less costly (SW quadrant). One of these studies found that both costs (–€17.61) and effects (–0.0163 quality-adjusted life-years [QALYs]) were lower in the intervention group; therefore, the incremental cost-effectiveness ratio (€1080/QALY) represents the savings per additional QALY lost.[26] A study from the Netherlands,[17] which analyzed the cost-effectiveness of case management for patients with diagnosed dementia and their informal caregivers, found that the intervention saves costs and there is an approximately 45% chance that the intervention also has positive effects.

A more effective and less costly intervention (SE quadrant), and therefore evidence for cost-effectiveness, was provided in 6 studies.[12,20,24,27-29]

The majority of studies (n = 18) found that the intervention was more effective while being more costly (NE quadrant). Of these, 7 studies reported incremental cost-effectiveness ratios below a willingness-to-pay threshold of US$50,000 for the gain of 1 QALY.[14,16,21,23,32,36,40] Only 1 study used QALYs and found that case management is not cost effective at US$50,000.[13] The remaining studies either used different outcome measures or did not provide a recommendation.

Case management interventions across all studies varied considerably. In cost-effective case management interventions, no patterns of common characteristics, such as case management model, type of case manager, or patient group, could be identified. No correlation of cost-effectiveness with a certain kind of health care system, study design, or time horizon could be observed either. Therefore, it remains unclear what makes some case management interventions cost-effective.

TABLE 3. Results Grid[12-40]

Study	Findings	Cost-effective	CHEC score
Bosanquet et al (2017)[40]	The mean cost per incremental QALY for collaborative care compared with usual care was £26,016. For participants attending 6 or more sessions, collaborative care was £9876/QALY.	NE	15
Bourbeau et al (2006)[27]	The ICER was $4214 per hospitalization prevented for a caseload of 14 patients per case manager.	Yes, SE	13/18
Dehmer et al (2018)[28]	Total medical costs in the intervention group were lower compared with the usual care group by an average of $281 per person, but this difference was not statistically significant. Clinic-based office visit, radiology, pharmacy, and hospital costs were also nonsignificantly lower in the intervention group. The intervention cost $7337 per person achieving hypertension control and $139 or $265 per mm Hg reduction in systolic or diastolic blood pressure, respectively. If including the nonsignificant $281 per person reduction in 12-month medical care costs associated with the intervention, these costs would be moderately lower: $5809, $110, and $210, respectively. Finally, although overall pharmacy costs were equivocal, if the $82 per person significant increase in hypertension- and lipid-related medication costs were added to the intervention cost, these costs would increase modestly to $7782, $148, and $281, respectively.	Yes, SE but not significant	15
Dorman Marek et al (2018)[29]	NCC + machine group improving 0.1091 QALYs. NCC+ Mediplanner gained 0.0930 QALYs. Cost per QALY gained was $29,807 in the NCC + machine group; in the NCC + Mediplanner group, it was $19,484.	Yes, SE	11/18
Gensichen et al (2013)[12]	The point estimate for the cost-utility ratio was €38,429 per QALY gained if only direct costs were considered, and the intervention dominated if total costs were considered. The probability of the intervention being cost-effective was never above 90%.	Yes, SE	17
Grochtdreis et al (2018)[30]	The adjusted differences in QALYs and mean total costs between intervention group and control group were +€0.02 and +€1145, respectively. Neither of the 2 differences was statistically significant. The unadjusted ICUR for an additional QALY showed dominance (ie, less costs and more health effects) of the control group over the intervention group.	No, NW	14/18
Handley et al (2008)[13]	The intervention was associated with a gain of 0.012 QALYs relative to usual care. The annual cost of the ATSM intervention per QALY gained, relative to usual care, was $65,167 for start-up and ongoing implementation costs combined and $32,333 for ongoing implementation costs alone.	NE	16/18
Hay et al (2012)[14]	The program cost effectiveness averaged $4053/QALY per intervention recipient and was more than 90% likely to fall below $12,000/QALY.	NE	16
Hay et al (2018)[37]	The intervention dominated usual care, showing both statistically significantly lower costs and better patient outcomes. The intervention had a greater than 50% probability of being cost effective relative to the team-supported care model at willingness-to-pay thresholds of more than $50,000 per QALY.	NE	14
Jacke and Salize (2014)[31]	Intervention yielded benefits for patients at comparable costs. A conservative estimation of the ICER was €44.16. Maximum willingness to pay was €378.82 per year.	NE	13/18
Joesch et al (2012)[15]	The mean incremental net benefit was positive when an anxiety-free day was valued at $4 or more. For QALYs the mean incremental net benefit was positive at $5000 or more.	NE	16
Lavelle et al (2018)[16]	The intervention was estimated to cost $49,346 per QALY gained. There is a 58% probability that the intervention is cost-effective at a $100,000/QALY threshold.	NE	16/18
Lewis et al (2017)[32]	The incremental cost-effectiveness ratio was £9633 per QALY. Participants allocated to collaborative care displayed significantly higher QALYs than those allocated to the control group (annual difference in adjusted QALYs of 0.044; 95% bias-corrected CI, 0.015-0.072; $P = .003$).	NE	15/18
Long and Marshall (2000)[38]	Although the average costs for the case-managed group were greater than the costs for the regular-care group, clients in the case-managed group lived an average of 106 days longer. The cost per additional day of life was $40. The difference in death rates was so small that, by extrapolation, the cost per life saved was more than $42 million.	NE	14
MacNeil Vroomen et al (2016)[17]	No significant differences were seen in clinical or total cost outcomes among the 3 groups. For all outcomes, the probability that the ICMM was cost-effective in comparison with LM and the control group was larger than 0.97 at a threshold ratio of €0/incremental unit of effect. Cost savings were accompanied by a small nonsignificant negative effect on quality of life for the person with dementia in both case management groups compared with the control group.	SW	19
Michalowsky et al (2019)[24]	DCM increased QALYs (+0.05) and decreased costs (–€569) due to a lower hospitalization rate and a delayed institutionalization (7 months) compared with usual care. The probability of DCM being cost-effective was 88% at willingness-to-pay thresholds of €40,000 per QALY gained and higher in patients living alone compared with those not living alone (96% vs 26%).	Yes, SE	17
Mostardt et al (2012)[33]	Time remaining at home was 16.1 months with a mean of 12.2 months ($P = .02$) in the control group. Additional costs for the health insurance companies amounted to €41-€53 per additional month in a home environment.	NE	15/18

(*continued*)

TABLE 3. Results Grid[12-40]

Study	Findings	Cost-effective	CHEC score
Paez and Allen (2006)[34]	The annual incremental cost-effectiveness of case management was $26.03 per mg/dL and $39.05 per percent reduction in LDL-C.	NE	13/18
Rost et al (2004)[18]	In consistently employed subjects, the intervention improved productivity by 8.2% over 2 years at an estimated annual value of $1982 per depressed full-time equivalent, and it reduced absenteeism by 28.4% or 12.3 days over 2 years at an estimated annual value of $619 per depressed full-time equivalent.	NE	16
Ruikes et al (2018)[19]	Adjusted mean total costs were €1583 higher in the intervention group than in the control group. No significant differences in functional dependence (adjusted mean difference of 0.37; 95% CI, −0.1 to 0.8) nor QALYs (adjusted mean difference of −0.031; 95% CI, −0.1 to 0.0). INMBs did not show significant differences among groups, but on average tended to favor usual care. INMBs are negative, meaning that the intervention does not provide value for money compared with usual care, although the results are not significant.	No, NW	16/18
Saleh et al (2006)[35]	Based on our results using cumulative costs, the case management conditions were not more cost-effective than the control group (amount spent per substance abuse–free day: control group, $6.30; social service agency group, $7.60; treatment agency group, $10.80; telecommunications group, $16.60). The results changed, however, when considering the add-on costs (per substance abuse–free day: telecommunications group, $43.20; treatment agency group, $36.70; social service agency, $30.10; control group, $37.50).	No, NW	13/18
Sandberg et al (2015)[25]	There were no significant differences between the intervention group and the control group for total cost, EQ-5D–based QALY, or EQ-VAS–based QALY for the 1-year study. Incremental cost-effectiveness ratio was not conducted because no significant differences were found for either EQ-5D– or EQ-VAS–based QALY or costs. However, the intervention group had significantly lower levels of informal care and help with instrumental activities of daily living both as costs (€3927 vs €6550; $P = .037$) and provided hours (200 vs 333 hours per year; $P = .037$).	N/A	14
Seidl et al (2015)[26]	For cost-utility analysis, both costs (−€17.61) and effects (−0.0163 QALYs) were lower in the intervention group; therefore, the ICER (€1080/QALY) represents the savings per additional QALY lost.	SW	15/18
Seidl et al (2017)[20]	Costs were lower (−€2576; $P = .2968$) and QALYs were higher (0.0295; $P = .7568$) in the intervention group but differences were not statistically significant. The probability of cost-effectiveness of the case management at a willingness-to-pay value of €0 per QALY was 84% in the case of QALYs and 81% in the case of VAS-ALs.	Yes, SE	16
Simon et al (2009)[39]	Over 24 months, telephone care management led to a gain of 29 depression-free days (95% CI, −6 to 63) and a $676 increase in outpatient health care costs (95% CI, $596 lower to $1974 higher).The incremental net benefit was negative even if a day free of depression was valued up to $20. Care management plus psychotherapy led to a gain of 46 depression-free days (95% CI, 12-80) and a $397 increase in outpatient costs (95% CI, $882 lower to $1725 higher). The incremental net benefit was positive if a day free of depression was valued at $9 or greater.	NE	14
Sørensen et al (2017)[36]	The intervention resulted in a QALY improvement of 0.0146 (95% CI, −0.0216 to 0.0585) and a cost increase of £494 (95% CI, −1778 to 2766) per patient. No statistically significant difference was observed either in costs or effects. The ICER was £33,865 per QALY gained. Scenario analyses confirmed the robustness of the result and revealed slightly lower ICERs of £28,100 to £31,340 per QALY.	NE	14/18
Ulrich et al (2019)[21]	The mean difference in QALYs between the groups was small and not significant (0.03; 95% CI, −0.04 to 0.11). The mean difference in total costs was statistically significant (€503; 95% CI, €188-€794) because of the costs of case management that applied only to the intervention group. The ICER was €16,767 per QALY. Regardless of the willingness of insurers to pay per QALY, the probability of the intervention being cost-effective never rose above 70%. If the health insurer was willing to pay €15,000 per additional QALY, the probability of cost-effectiveness was 50%.	NE	16
Wansink et al (2016)[22]	Parenting quality improved in the intervention group and declined in the control group. The intervention was shown to be more costly than usual care. ICERs differ from €461 (health care perspective) to €215 (social care perspective) to €175 (societal perspective) per 1-point improvement on the HOME T-score. The results of the sensitivity analyses, based on complete cases and excluding cost outliers, support the finding that the ICER is lower when adopting a broader perspective. The subgroup analysis and the analysis with baseline adjustments resulted in higher ICERs.	NE	18
Wijnen et al (2019)[23]	From a societal perspective, the intervention was slightly more expensive than usual care but also more effective, resulting in an ICER of €549 per reduction in log viral load and €1659 per percentage decrease in treatment failure. In terms of QALYs, AIMS resulted in higher costs but more QALYs compared with usual care, which resulted in an ICER of €27,759 per QALY gained. From a health care perspective, the intervention dominated usual care. Additional sensitivity analyses addressing key limitations of the base case analyses also suggested that the intervention dominates usual care.	NE	18

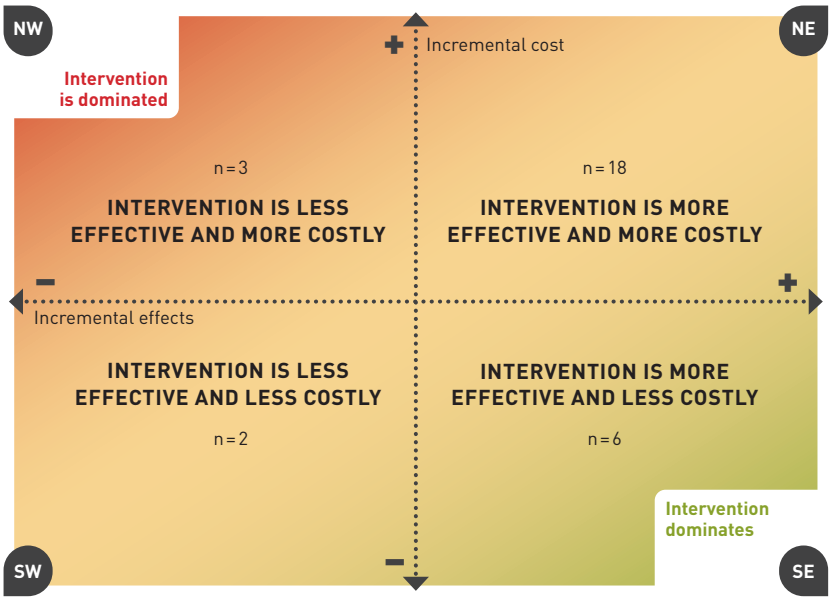
AIMS, Adherence Improving Self-Management Strategy; ATSM, automated telephone self-management support with nurse care management; CHEC, Consensus Health Economic Criteria; DCM, collaborative dementia care management; EQ-5D, European Quality of Life 5 dimensions; EQ-VAS, European Quality of Life visual analogue scales; HOME, Home Observation for Measurement of the Environment Inventory; ICER, incremental cost-effectiveness ratio; ICMM, intensive case management model; ICUR, incremental cost-utility ratio; INMB, incremental net monetary benefits; LDL-C, low-density lipoprotein cholesterol; LM, linkage model; NCC, nurse care coordination; NE, northeast; NW, northwest; QALY, quality-adjusted life-year; SE, southeast; SW, southwest; VAS-ALs, adjusted life-years from patients' self-rated health states according to the visual analogue scale.

DISCUSSION

To our knowledge, this is the first systematic review that systematically synthesized studies to identify the cost-effectiveness of case management interventions. We identified 29 studies, which were published between 2000 and 2019. All studies compared case management to usual care without case management.

The results of the quality assessment of economic evaluations show that the quality of the included studies is good, although most studies chose a payer's perspective and therefore did not include indirect costs such as productivity losses. In addition, in about half of all studies, the chosen time horizon was only 1 year. This is a short observation period, not appropriate to capture all relevant outcomes, because case management effects might be visible only after longer periods of time. In addition, considering that at the beginning of an intervention, costs of case management can be considerably higher because of up-front training costs, a relatively short study period of only 1 year might distort results. Results of the KORINNA studies illustrate this: After 1 year the case management for elderly patients with myocardial infarction was deemed less effective and less costly than usual care,[26] but a follow-up after 3 years[20] showed higher QALYs, significantly better quality of life, and lower costs (although not significantly lower). Hence, longer study durations are strongly recommended.

FIGURE 2. Results Within the Cost-effectiveness Plane



NE, northeast; NW, northwest; SE, southeast; SW, southwest.

To provide successful case management, case managers require specialized training. However, only half of the studies stated that the case managers received training. A detailed description of the scope and content of training was scarce. The same applies for data on caseloads and descriptions of the intensity of case management—in other words, the patient contacts. We therefore recommend that studies provide detailed intervention protocols.

Limitations

The studies included conducted their interventions in 7 nations in which transferability of the data and conclusions to the German context was possible. Evidence from low- and middle-income countries was not included in this systematic review, and therefore its results may not be broadly applicable.

CONCLUSIONS

This systematic review found that because of a large variation in case management programs, the evidence for cost-effectiveness is not yet fully conclusive for case management in general. More definitive studies with a defined protocol of case management are needed to determine cost-effectiveness. However, the existing studies often have adequate quality and, in most cases, produce recommendable conclusions. The confluence of highly developed health systems, fragmented health care services, and aging populations with multimorbidity is a situation that calls out for individualized coordination and support. Case management appears to be a promising method to support patients facing complex care situations. We therefore advise policy makers to establish case management programs as core components of effective, patient-oriented health care systems, and to support rigorous evaluation of each program. ■

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Source of Funding: This study was conducted in the context of the research project RubiN, funded by the Federal Joint Committee's German Innovations Fund.

Author Disclosures: The authors report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (AKK, JJ, FF, MA); acquisition of data (AKK, JJ); analysis and interpretation of data (AKK, MA); drafting of the manuscript (AKK); critical revision of the manuscript for important intellectual content (JJ, FF, MA); administrative, technical, or logistic support (AKK, FF); and supervision (MA).

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