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SYSTEMATIC REVIEWS

Economic Impact of Integrated Care Models for Patients with Chronic Diseases: A Systematic Review

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ABSTRACT

Objectives: To assess the costs and potential financial benefits of integrated care models for patients with chronic diseases, that is, type 2 diabetes mellitus, schizophrenia, and multiple sclerosis, respectively. **Methods:** A systematic search of the literature was performed using EMBASE, MEDLINE, and Web of Science. Studies that conducted a cost analysis, considered at least two components of the chronic care model, and compared integrated care with standard care were included. **Results:** Out of 575 articles, 26 were included. Most studies examined integrated care models for type 2 diabetes mellitus (n = 18) and to a lesser extent for schizophrenia (n = 6) and multiple sclerosis (n = 2). Across the three disease groups, the incremental cost per patient per year ranged from − €3860 to + €613.91 ($\bar{x}$ = − €533.61 ± €902.96). The incremental cost for type 2 diabetes mellitus ranged from − €1507.49 to + €299.20 ($\bar{x}$ = − €518.22 ± + €604.75), for schizophrenia from − €3860 to + €613.91 ($\bar{x}$ = − €677.21 ± + €1624.35), and for multiple sclerosis from − €822 to + €339.43 ($\bar{x}$ = − €241.29 ± + €821.26). Most of the studies (22 of 26 [84.6%]) reported a positive economic impact of integrated care models: for type 2 diabetes mellitus (16 of 18 [88.9%]), schizophrenia (4 of 6 [66.7%]), and multiple sclerosis (1 of 2 [50%]). **Conclusions:** In this systematic literature review, predominantly positive economic impacts of integrated care models for patients with chronic diseases were found.

Keywords: chronic disease, cost analysis, integrated care, multiple sclerosis, schizophrenia, type 2 diabetes mellitus.

Introduction

The fast-growing scientific knowledge, the rapid technological innovations, the fragmentation of care, the rapidly aging population, and the increasing number of patients with (multiple) chronic diseases represent major challenges for health care systems worldwide [1]. Nevertheless, one must guard the primary goal of health care, that is, to provide high quality of care. The American Institute of Medicine (IOM) defines quality of care as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge" [2]. The second IOM report "Crossing the Quality Chasm" recommended that the delivery of health care must be based on six dimensions: safety, timeliness, equitability, patient centeredness, effectiveness, and efficiency [3]. Nevertheless, the significant rise in the number of people with chronic diseases jeopardizes the financial sustainability of health care systems and, therefore, the efficiency of health care. Total health care costs for chronic diseases in Europe are estimated at €700 billion annually [4]. The annual health care costs for type 2 diabetes mellitus, schizophrenia, and multiple sclerosis in Europe are estimated at €90 billion [5], €94 billion [6], and €15 billion [6], respectively.

Health care systems are mostly historically organized to respond to acute diseases [7]. Patients with chronic diseases, however, are in great need of long-term care, which brings together a broad range of professionals, who integrate and coordinate services along the continuum of care. So, health care systems are facing the challenge of efficiently meeting the

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complex care needs of the chronically ill. At present, integrated care receives increasing attention because it is considered appropriate in reducing the fragmentation of care, improving the quality of patient care, and controlling costs [8]. Moreover, it is considered to be a new innovative strategy to overlap the existing gaps and to help in changing health care systems into more "demand-driven, client-centred and cost-conscious systems" [7]. The World Health Organization [9] defined integrated care as "the management and delivery of health services so that clients receive a continuum of preventive and curative services, according to their needs over time and across different levels of the health system."

Integrated care is driven by the so-called triple aim approach, which has a simultaneous focus on 1) cost savings, 2) better patient care experience, and 3) improved health outcomes [1]. Furthermore, different terms are used for labeling particular models of integrated care such as "disease management" [10], "case management" [11], "continuous care" [12], "care pathways" [13], and "integrated delivery networks" [14]. Integrated care is, therefore, an umbrella term of various alternative forms rather than an exact definition.

Although there is a widespread belief that integrated care can control or even reduce health care costs, relatively few studies have evaluated the economic impact of integrated care models so far. The present body of literature is inconclusive about the potential economic impact of integrated care [1]. Ofman et al. [15] reported that 1 article out of 7 (14%) showed a positive economic impact. Ouwens et al. [16] found that 4 out of 7 articles (57%) showed a financial benefit of integrated care. In a recent review conducted by de Bruin et al. [17], 13 articles out of 21 (62%) reported cost savings [17]. Specifically for type 2 diabetes mellitus [17] and schizophrenia [18], the results are also inconclusive. To the authors' knowledge, no similar review has been undertaken for multiple sclerosis. Therefore, there is a great need for economic evaluations of integrated care.

There are several guidelines for economic evaluations. First, economic evaluations of integrated care models require a comparison of their costs and health consequences with care provided in the usual setting (i.e., routine or standard care). Generally, there are five types of economic analyses [19]: 1) cost minimization (the simplest form of analysis that considers only the costs and savings, leading to a calculation of net costs), 2) cost consequence (an analysis that relates the costs to an array of output measures), 3) cost benefit (an analysis that expresses the outputs in monetary terms), 4) cost effectiveness (an analysis that relates the costs to a single, common effect), and 5) cost utility (an analysis that adjusts the life-years gained by a series of utility weights). Second, each economic evaluation must also consider the relevant type of costs [1]: 1) direct costs (costs of health care services, i.e., hospitalization, consultation, medication, etc.), 2) indirect costs (productivity losses due to disability and premature mortality), and 3) intangible costs (psychological burden on patients and family members). Finally, guidelines also recommend to state the viewpoint for the analysis [19]: 1) patient and/or family members, 2) employer, 3) professional organization, and 4) society or third-party payer.

Because integrated care models receive a more prominent role in health care, the present study aimed to assess the economic impact of integrated care models for patients with chronic diseases. The present study is a part of CORTEXS (Care Organization: a Re-Thinking EXpedition in search for Sustainability), an extensive multidisciplinary research project in Flanders (Belgium), which studies integrated care from the microlevel of care recipients and their caregivers, over the mesolevel of intraorganizational and interorganizational processes, to the macrolevel of legal and financial frameworks [7].

Methods

Eligibility Criteria

The eligibility criteria for this review were decided a priori. First, and in line with the two basic approaches to economic evaluations [19], potential designs for inclusion were randomized controlled trials, nonrandomized controlled trials, before-after studies (i.e., trial-based studies), or observational studies and modeling studies, on the basis of existing clinical trials. Consequently, editorials, opinion articles, and descriptive articles were excluded. Second, this systematic review included studies that conducted a cost analysis because the review was interested only in the costs and potential financial benefits of integrated care. Third, articles were included if they specifically dealt with type 2 diabetes mellitus (one of the most common chronic diseases), schizophrenia (representing a mental disease, the impact of which is likely to considerably increase in the future), and multiple sclerosis (a chronic disease with different phases of severity), together covering a broad range of chronic illness consequences. In line with previous research [20–23], integrated care models were categorized according to the components of the chronic care model (CCM) of Wagner. Therefore, for the fourth inclusion criterion, the models were considered as "integrated care" if they targeted two or more CCM components. Finally, to assess the positive or negative economic impact of a given model, the presence of an alternative type of care, typically usual or standard care, was required.

Search Strategy

A systematic literature review was conducted in the 50th week of 2014, searching the electronic peer-reviewed databases EMBASE, MEDLINE, and Web of Science. The search strategy was divided into three categories: 1) alternative terms of integrated care, 2) cost analysis, and 3) chronic disease. Table 1 lists the corresponding Medical Subject Headings (MeSH) and keywords for each category. The search was performed using the following queries: ("integrated delivery system" [MeSH] OR "integrated care" OR "disease management" [MeSH] OR "case management" [MeSH] OR "patient care management" [MeSH] OR "patient-centered care" [MeSH] OR "managed care" OR "transmural care" OR "coordinated care" OR "seamless care" OR "continuity of patient care" [MeSH] OR "clinical pathways" OR "patient care planning" [MeSH] OR "patient care team" [MeSH]) AND ("cost analysis" [MeSH] OR "economic evaluation" OR "economic impact" OR "cost-minimization analysis") AND ("diabetes mellitus type 2" [MeSH] OR "schizophrenia" [MeSH] OR "multiple sclerosis" [MeSH]). Because different terms are used for labeling particular models of integrated care, broad search terms were applied without date restrictions to make the search strategy as sensitive as possible. In addition, bibliographies of included articles were hand-searched for other relevant articles.

Study Selection and Data Abstraction

After removal of duplicates, the first selection of articles was made on the basis of their titles and abstracts. Articles selected for full-text review were screened according to the eligibility criteria. Two reviewers (M.D. and D.V.) investigated independently the relevance and methodological quality of the extracted articles. In case of inconclusiveness, a third researcher (S.V.) helped to obtain consensus. For each study found eligible for this systematic review, the study characteristics (i.e., author, year, country, study design, study period, usual care condition, and term used for the integrated care model), components of the CCM included in the intervention (i.e., characteristics of the integrated care model), characteristics of the cost analysis (i.e., type of costs and viewpoint

Table 1 – Keywords of the search strategy.

Integrated care	Cost analysis	Chronic disease
Integrated delivery system (MeSH)	Cost analysis (MeSH)	Diabetes mellitus type 2 (MeSH)
Integrated care	Economic evaluation	Schizophrenia (MeSH)
Disease management (MeSH)	Economic impact	Multiple sclerosis (MeSH)
Case management (MeSH)	Cost-minimization analysis	
Patient care management (MeSH)		
Patient-centered care (MeSH)		
Managed care		
Transmural care		
Coordinated care		
Seamless care		
Continuity of patient care (MeSH)		
Clinical pathways		
Patient care planning (MeSH)		
Patient care team (MeSH)		

MeSH, Medical Subject Headings.

for the analysis), and study outcomes (i.e., incremental cost, return on investment [ROI], and clinical outcomes) were extracted. A data abstraction form (see Appendix 1) was created to collect and catalogue the relevant data. Assessment for risk of bias was conducted using the Cochrane Collaboration Tool for Assessing Risk of Bias (see Appendices 2A and 2B), which recommends addressing the following domains: sequence generation and allocation concealment, blinding of participants, personnel, and assessors, incomplete outcome data, and selective outcome reporting.

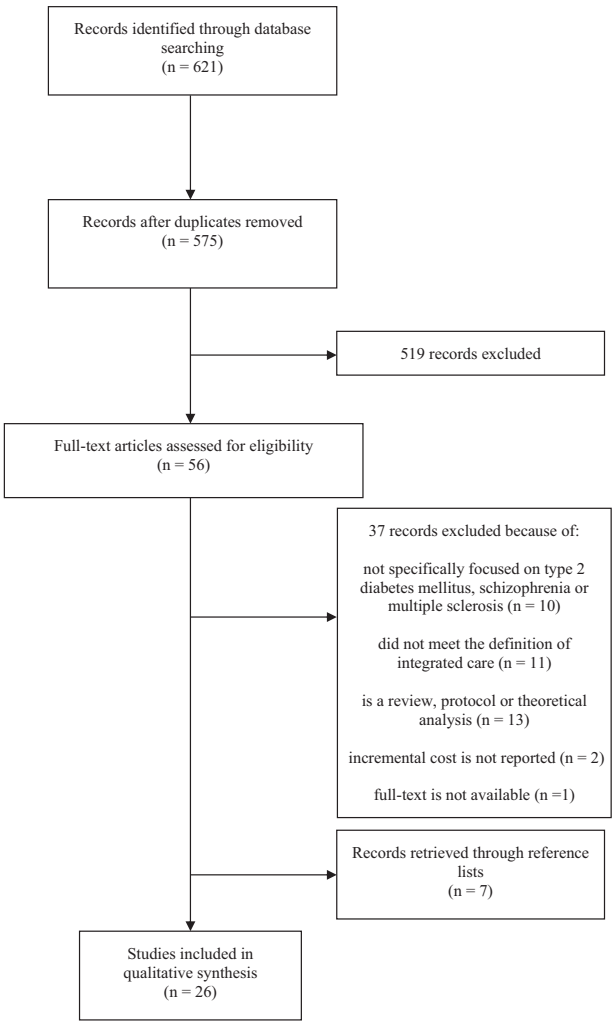

Fig. 1 – Flowchart of the literature screening process.

Data Analysis

First, the relevant data (i.e., study characteristics, CCM components, characteristics of the cost analysis, and study outcomes) were tabulated and/or graphed. Afterward, a descriptive and narrative synthesis of the data was undertaken. The CCM components for each study were ascertained from the described intervention. The main outcome for this systematic review was the *incremental cost*, which can be defined as the difference in health care costs between the integrated care model and the usual care conditions. The incremental cost (reported per patient per year) can be either negative or positive. A negative incremental cost implies that health care costs in the integrated care model are lower compared with usual care. The incremental cost was either drawn directly from the articles or calculated from data provided in the articles. Whenever possible, this systematic review also reported the ROI, comparing cost savings with implementation and operational costs. An ROI of more than 1 indicates a profitable investment of the integrated care model. The ROI was also either drawn directly from the articles or calculated from data provided in the articles. The SD and/or confidence interval of the incremental cost were rarely reported, and so it was not appropriate to undertake a meta-analysis. To facilitate comparison, all amounts were converted into euro (conversion rate 0.89). In addition, this systematic review tried to examine the association between the number of CCM components and the incremental cost on the one hand and the association between the study period and the incremental cost on the other hand. The review not only expected a positive economic impact of integrated care models but also hypothesized 1) greater cost savings for models with a higher number of CCM components [21] and 2) greater cost savings for studies with a longer follow-up period because implementation and operational costs decrease [24].

Results

Results of the Search

The literature search yielded 575 potentially relevant studies after removing duplicates: 456 for type 2 diabetes mellitus, 76 for schizophrenia, and 43 for multiple sclerosis, respectively. On

the basis of titles and abstracts, 56 articles were selected for full-text screening. This screening process resulted in 19 articles: 14 for type 2 diabetes mellitus, 4 for schizophrenia, and 1 for multiple sclerosis. By screening the reference lists of the relevant studies, 7 additional articles were included. Finally, a total of 26 articles were included in this literature review (see Fig. 1). The most relevant reasons for exclusion were as follows: 1) the model did not specifically focus on type 2 diabetes mellitus, schizophrenia, or multiple sclerosis; 2) the model did not meet the definition of integrated care; and/or 3) the article was a review or a theoretical analysis (see Appendix 3).

Assessment of the Risk of Bias in Included Studies

All the included studies were prone to bias because of methodological decisions. Most of the articles [25–38] reported the results of nonrandomized studies, which resulted in potential selection bias. In addition, the methodological information was often difficult to find and therefore many questions concerning bias remained unanswered. Therefore, it is not feasible to make a selection of studies for further inclusion on the basis of the methodological assessment. The following potential types of bias, however, can be generalized. The first potential bias concerns the method of concealment. Four studies [25,30,33,39] allocated participants on the basis of medical data, and six studies [26,27,29,32,34,35] on a voluntary basis, resulting in potential selection and/or volunteer bias. Unlike allocation concealment, blinding is not always possible, especially for studies in this systematic review. Participants in the integrated care model are aware of the intervention they receive. It is, however, desirable to at least mask participants' treatment status from people collecting outcome data and from other clinicians providing normal care. Nevertheless, insufficient information was provided to make a judgment, which resulted in potential performance and/or detection bias. In addition, four studies [33,40–42] had high risk of bias because of inadequately addressed incomplete outcome data. Finally, all studies were free of suggestion of selective outcome reporting.

Study Characteristics

Out of 26 articles, 18 [25–37,39,40,43–45] focused on type 2 diabetes mellitus, 6 [41,46–50] on schizophrenia, and 2 [38,42] on multiple sclerosis. Most studies originated from the United States (n = 13), followed by Germany (n = 3) and the United Kingdom (n = 2). The other studies originated from France, China, Austria, Singapore, New Zealand, The Netherlands, Taiwan, and Italy (n = 1). Then, 12 randomized controlled trials, 6 before-after studies, 6 retrospective studies, and 2 prospective studies were included. Across all studies, the sample size varied from 16 to 67,080 patients. The duration of the included studies was mostly limited to 1 (n = 14), 2 (n = 5), or 3 (n = 4) years. Three studies [25,28,39] had a study period of 4 years. Table 2 presents the study characteristics of the included articles. The most common terms

Table 2 – Characteristics of the studies included in the systematic review.

Author (year)	Country	Design	Study period (y)	Usual care (comparator)	Integrated care
		Type 2 diabetes mellitus			
Naji (1994) [43]	United States	RCT	2	Conventional care	Integrated care
Berger et al. (2001) [25]	United States	Before-after study	4		Disease management
Sidorov et al. (2002) [26]	United States	Retrospective study	2		Disease management
Wagner et al. (2001) [44]	United States	RCT	2	Usual care	Chronic care clinics
Berg and Wadhwa (2002) [27]	United States	Before-after study	1		Disease management
Snyder et al. (2003) [28]	United States	Before-after study	4		Disease management
Villagra and Ahmed (2004) [29]	United States	Before-after study	1		Disease management
Boyer et al. (2008) [30]	France	Before-after study	3		Managed care
Scanlon et al. (2008) [31]	United States	Retrospective study	1		Team-based care
Stock et al. (2010) [39]	Germany	RCT	4	Routine care	Disease management
Dall et al. (2010) [32]	United States	Prospective study	1		Disease management
Rosenzweig et al. (2010) [33]	United States	Prospective study	1		Disease management
Ko et al. (2011) [40]	China	RCT	2	Usual care	Team-based care
Drabik et al. (2012) [34]	Germany	Retrospective study	3		Disease management
Dall et al. (2011) [35]	United States	Retrospective study	1		Disease management
Ostermann et al. (2012) [36]	Austria	Retrospective study	3		Disease management
Adepoju et al. (2014) [45]	United States	RCT	1	Usual care	Disease management
Tan et al. (2014) [37]	Singapore	Before-after study	3		Disease management
		Schizophrenia			
Reynolds and Hoult (1984) [46]	New Zealand	RCT	1	Hospital care	Community care
Wiersma et al. (1995) [47]	The Netherlands	RCT	2	Hospital care	Community care
Burns and Raftery (1991) [48]	United Kingdom	RCT	1	Hospital care	Home-based care
Gater et al. (1997) [49]	United Kingdom	RCT	1	Hospital care	Community care
Tzeng et al. (2007) [41]	Taiwan	RCT	1	Hospital care	Integrated care
Schmidt-Kraepelin et al. (2009) [50]	Germany	RCT	1	Hospital care	Integrated care
		Multiple sclerosis			
Tan et al. (2010) [38]	United States	Retrospective study	1		Care management
Pozzilli et al. (2002) [42]	Italy	RCT	1	Hospital care	Home-based care

RCT, randomized controlled trial.

for labeling the particular integrated care model (see Table 2) were "disease management" (n = 13), followed by "community care" (n = 3), "integrated care" (n = 3), "home-based care" (n = 2), and "team-based care" (n = 2). The other alternative terms were "managed care," "chronic care clinics," and "care management" (n = 1). Disease management was mainly used for type 2 diabetes mellitus (n = 13). For schizophrenia, most articles focused on community care or home-based care. In all studies, the economic effects of integrated care were compared with usual care (see inclusion criteria). The provided information about the usual care conditions was mostly limited to the descriptions "usual care," "(conventional) hospital care," and "routine care."

Components of the CCM

Table 3 presents the included CCM components in all the articles. As mentioned previously, all studies had to include at least two components of the CCM to be defined as "integrated care." Eight articles [26–29,33,34,39,46] enclosed three elements, and four articles [30,31,41,44] included four elements. With the exception of five articles [42,43,47–49], all integrated care models included the component "self-management support." The components "delivery system design" and "decision support" were also frequently enclosed in the integrated care models. In all but one article [43], the integrated care models for type 2 diabetes mellitus included the component "self-management support" through educational materials and equipment for self-monitoring. Furthermore, most studies also used the clinical American Diabetes Guidelines. Seven studies [28,30,31,34,43–45] used a clinical information system. All studies for schizophrenia emphasized the component "community resources and policies." Three articles [41,46,50] included the component "self-management support," and no study used a clinical information system. For multiple sclerosis, one study [38] included "self-management support" and "delivery system design." The other study [42] also included "community resources and policies."

Characteristics of the Cost Analysis

Table 4 presents the characteristics of the cost analysis. In all but one study [45], direct health care costs (i.e., costs of hospitalization, medication, and consultation) were included. Three studies [30,45,49] considered indirect costs (productivity losses due to morbidity and mortality). Two articles [30,49] considered both cost aspects. Out of eight articles [26–29,32,42,43,46] that included implementation and operational costs of the integrated care model, three articles [26–28] also reported the ROI. Ten studies [30,36,40,42,43,45,47–50] reported the viewpoint for the analysis. For type 2 diabetes mellitus, two articles [30,45] considered indirect costs and six studies [26–29,32,43] considered implementation and operational costs. Out of those six studies, three [26–28] calculated the ROI. Two studies [30,36] performed the cost analysis from the third-party payer perspective and one from the patient [43], professional organization [40], and employer perspective [45]. For schizophrenia, one article [49] considered indirect costs and another [46] implementation and operational costs. Two studies [47,49] performed the cost analysis from the third-party payer perspective and two [48,50] from the patient perspective. Only direct costs were considered in the studies for multiple sclerosis. One study [42] considered implementation and operational costs. Finally, one study [42] performed the cost analysis from the third-party payer perspective.

Study Outcomes

Figure 2 displays the incremental cost per patient per year for all studies. Each bar represents a study. Across the three disease groups, the incremental cost ranged from − €3860 to + €613.91 ($\bar{x}$ = − €533.61 ± + €902.96). Four articles [38,40,41,43] concluded a positive incremental cost. The incremental cost for type 2 diabetes mellitus varied from − €1507.49 to + €299.20 ($\bar{x}$ = − €518.22 ± + €604.75). Two studies [40,43] published positive incremental costs of + €42.42 and + €299.49, respectively. Five studies [30,31,37,44,45] found no difference in health care costs between integrated care and usual care. The other 11 studies reported a negative incremental cost of − €98.21 up to − €1507.49. Six studies [26–29,32,43] considered implementation and operational costs of integrated care. With the exception of one article [43], the incremental cost remained negative. Three studies [26–28] calculated the ROI as 2.30, 4.34, and 3.37, respectively. Four studies [27,28,34,40] also reported significant improvements in clinical outcomes, such as lower glycemia, blood pressure, and cholesterol level. The incremental cost for schizophrenia varied from − €3860 to + €613.91 ($\bar{x}$ = − €677.21 ± + €1624.35). Three articles [47–49] found no significant difference in health care costs between integrated care and usual care. Two articles [46,50] concluded a negative incremental cost of − €817.18 and − €3860. One article [41] reported a positive incremental cost of + €613.91. Finally, one article [46] considered implementation and operational costs. The ROI could not be calculated because the amounts of those costs were not reported. The incremental cost for multiple sclerosis was − €822 and + €339.43 ($\bar{x}$ = − €241.29 ± + €821.26). One study [42] considered implementation and operational costs. The ROI could not be calculated because the amounts of those costs were not reported. Figures 3 and 4 display the association between the number of CCM components in the integrated care model and the incremental cost as well as the association between the study period and the incremental cost. Figure 3 suggests that integrated care models implementing four CCM components do not result in higher cost savings compared with those implementing two or three CCM components. Figure 4 illustrates that the incremental cost does not decrease when the follow-up period extends.

Discussion

In the context of the increasing prevalence of chronic diseases, policymakers are constantly searching for structural alternatives that can ensure qualitative, including financial, sustainability of health care systems. This systematic review presents the results of cost analyses studying the impact of integrated care models for type 2 diabetes mellitus, schizophrenia, and multiple sclerosis. Twenty-six studies were included: 18 for type 2 diabetes mellitus, 6 for schizophrenia, and 2 for multiple sclerosis. In more than half the included studies (14 of 26 [53.8%]), integrated care models were found to be associated with lower health care expenditures: 11 articles for type 2 diabetes mellitus, 2 for schizophrenia, and 1 for multiple sclerosis. It should be noticed that an incremental cost of 0 is also considered a favorable outcome. After all, Hisashige [51] showed considerable evidence in the effectiveness and efficiency of integrated care models in process, health services, and quality of life. Therefore, implementing these models without an additional cost must be seen as a positive phenomenon. From this point of view, most of the studies (22 of 26 [84.6%]) reported a positive economic impact of integrated care models: for type 2 diabetes mellitus (16 of 18 [88.9%]), for schizophrenia (4 of 6 [66.7%]), and for multiple sclerosis (1 of 2 [50%]). Another favorable outcome was that seven out of eight articles that considered implementation and operational costs reported a negative incremental cost and, as a consequence, the cost savings were higher than the investment of the integrated care model. Five studies [26,28,29,46,50] found that the observed savings were accompanied by significantly fewer admissions and fewer inpatients days. No explanations were reported in case of

Table 3 – Components of the chronic care model included in the studies.

Author (year)	Community resources and policies	Health care organization	Self-management support	Delivery system design	Decision support	Clinical information system
			Type 2 diabetes mellitus			
Naji (1994) [43]					Clinical guidelines for testing	Electronic registration system
Berger et al. (2001) [25]			Patient education through telephone and mailing		American Diabetes Guidelines	
Sidorov et al. (2002) [26]			Patient education and self-monitoring	Nurse as case manager	Promoting clinical guidelines	
Wagner et al. (2001) [44]			Patient education through individual and group sessions	Multidisciplinary team of diabetologists and diabetes specialist nurse	Clinical guidelines for testing	Electronic registration system
Berg and Wadhwa (2002) [27]			Patient education and self-monitoring	Multidisciplinary team with nurse as case manager	American Diabetes Guidelines	
Snyder et al. (2003) [28]			Patient education through telephone and group sessions	Making individual care goals		Digitizing medical records, test results, and prescriptions
Villagra and Ahmed (2004) [29]			Patient education through mailing, telephone, educational material, and equipment for self-monitoring	Making individual care goals	American Diabetes Guidelines	
Boyer et al. (2008) [30]			Patient education	Optimizing coordination and communication between professionals	Clinical guidelines	Digitizing medical records
Scanlon et al. (2008) [31]			Self-management is important	Multidisciplinary team with nurse as care manager, doctor, medical assistant, and social worker	Evidence-based treatment protocols	Primary-health-care–provided patient evaluation and care system
Stock et al. (2010) [39]			Patient education is important	Making individual care goals	Evidence-based guidelines	
Dall et al. (2010) [32]			Patient education through newsletters and online educational material	Making individual care goals		
Rosenzweig et al. (2010) [33]			Patient education (Joslin Diabetes Center and newsletters) and self-monitoring	Nurse as care manager and making individual care goals	Protocols for discharge	
Ko et al. (2011) [40]			Patient education is important	Multidisciplinary team with diabetes specialist nurse as case manager		
Drabik et al. (2012) [34]			Patient education is important		Clinical guidelines	Technological support
Dall et al. (2011) [35]			Patient education is important	Multidisciplinary team with case manager		

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Table 3 – *continued*

Author (year)	Community resources and policies	Health care organization	Self-management support	Delivery system design	Decision support	Clinical information system
Ostermann et al. (2012) [36]			Patient education is important		Evidence-based pathways and clinical guidelines	
Adepoju et al. (2014) [45]			Patient education and self-monitoring are important			Diabetes pilot software
Tan et al. (2014) [37]			Patient education (tool kits) and self-monitoring are important		Clinical guidelines for referral	
			Schizophrenia			
Reynolds and Hoult (1984) [46]	Community care		Patient education is important	Community treatment team and making individual care goals		
Wiersma et al. (1995) [47]	Home visits			Multidisciplinary team		
Burns and Raftery (1991) [48]	Home visits			Multidisciplinary team with psychiatrist, social worker, and psychiatric nurse		
Gater et al. (1997) [49]	Home visits and close collaboration with community services			Multidisciplinary team		
Tzeng et al. (2007) [41]	Close collaboration with community services		Patient education is important	Multidisciplinary team	Decision support system based on therapeutic protocols	
Schmidt-Kraepelin et al. (2009) [50]	Home visits and support for family member		Patient education through individual and group sessions			
			Multiple sclerosis			
Tan et al. (2010) [38]			Patient education is important	Nurse as case manager		
Pozzilli et al. (2002) [42]	Home visits and close collaboration with community services			Multidisciplinary team and making individual care goals		

Table 4 – Characteristics and outcomes of the cost analyses.

Author (year)	Costs	Viewpoint	Incremental cost (€) per patient per year	Return on investment	Clinical outcomes
			Type 2 diabetes mellitus		
Naji (1994) [43]	Direct costs	Patient	+42.42		
Berger et al. (2001) [25]	Direct costs		−423.52		
Wagner et al. (2001) [44]	Direct costs		0		
Sidorov et al. (2002) [26]	Direct costs		−1153.50	2.30:1	
Berg and Wadhwa (2002) [27]	Direct costs		−1507.49	4.34:1	Lower blood sugar level and blood pressure
Snyder et al. (2003) [28]	Direct costs		−1425.76	3.37:1	Lower HbA_{1c} level
Villagra and Ahmed (2004) [29]	Direct costs		−1471.11		
Boyer et al. (2008) [30]	Direct and indirect costs	Third-party payer	0		
Scanlon et al. (2008) [31]	Direct costs		0		
Stock et al. (2010) [39]	Direct costs		−98.21		
Dall et al. (2010) [32]	Direct costs		−722.12		
Rosenzweig et al. (2010) [33]	Direct costs		−908.30		
Ko et al. (2011) [40]	Direct costs	Professional organization	+299.20		Lower blood pressure and HbA_{1c} level
Drabik et al. (2012) [34]	Direct costs		−204.4		Lower blood sugar level, blood pressure, and cholesterol level
Dall et al. (2011) [35]	Direct costs		−732.13		
Ostermann et al. (2012) [36]	Direct costs	Third-party payer	−1023		
Adepoju et al. (2014) [45]	Indirect costs	Employer	0		
Tan et al. (2014) [37]	Direct costs		0		
			Schizophrenia		
Reynolds and Hoult (1984) [46]	Direct costs		−817.18		
Wiersma et al. (1995) [47]	Direct costs	Third-party payer	0		
Burns and Raftery (1991) [48]	Direct costs	Patient	0		
Gater et al. (1997) [49]	Direct and indirect costs	Third-party payer	0		
Tzeng et al. (2007) [41]	Direct costs		+613.91		
Schmidt-Kraepelin et al. (2009) [50]	Direct costs	Patient	−3860		
			Multiple sclerosis		
Tan et al. (2010) [38]	Direct costs		+339.43		
Pozzilli et al. (2002) [42]	Direct costs	Third-party payer	–822		

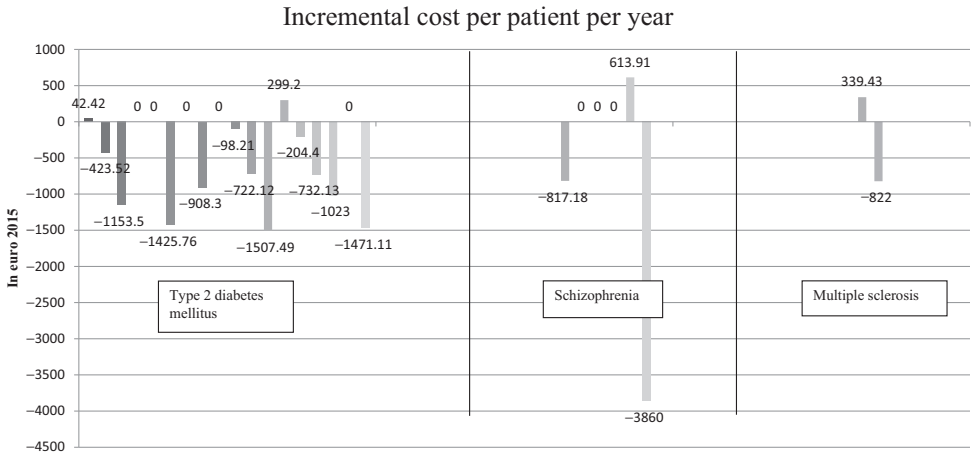

Fig. 2 – Incremental cost per patient per year of integrated care models for type 2 diabetes mellitus, schizophrenia, and multiple sclerosis.

positive incremental costs. Compared with previous reviews [15–17], the present systematic review showed that the economic impact of integrated care models might be positive. Specifically for type 2 diabetes mellitus, the results of this systematic review were more favorable. It should, however, be noticed that de Bruin et al. [17] applied a time limit (2007–2009) and also included studies that did not compare integrated care with standard or usual care.

This systematic review identified a wide range of integrated care models. For type 2 diabetes mellitus, disease management was primarily used. Disease management is a programmatic approach of a chronic disease for which early detection and self-management are central. Especially self-management and self-monitoring are very important in the treatment of type 2 diabetes mellitus [52]. This is also highlighted in the included articles: with the exception of one article [43], all studies on type 2 diabetes mellitus included the component "self-management support" of the CCM. Articles on schizophrenia focused especially on community care or home-based care. In 1960, a policy was introduced as per which patients with mental disorders should be treated in their community instead of in a conventional psychiatric hospital [53]. This community approach can also be identified in the articles: all studies included the component "community" of the CCM. Finally, it is hard to establish how many CCM components an integrated care model should include to obtain cost savings. Consequently, no association could be found between the number of CCM components targeted and the (potential negative) incremental cost. Furthermore, no trend could be found between the follow-up period of a study and the (potential negative) incremental cost.

This systematic review had several limitations. Although the definition of integrated care in this review is based on the CCM of Wagner, the term is still very broad and definitional challenges remain. Therefore, results might depend on the operational definition. The lack of a clear definition forms a barrier to evaluating and promoting integrated care overall. Because of the differences among populations, evaluation tools, and the content of the integrated care models, it is also probable that some models might be more effective than others. Many instruments have been created for assessing the methodological quality of Non randomized studies (NRS). None, however, was suitable for different study designs. This systematic review used the Cochrane Collaboration Tool for Assessing Risk of Bias because it could also be used for cohort studies. Associated with the previous, another persistent limitation is the methodological design that is used in the articles. Fourteen studies that used a nonrandomized design might, as a result, increase the risk of potential selection bias. The use of a historical control group or

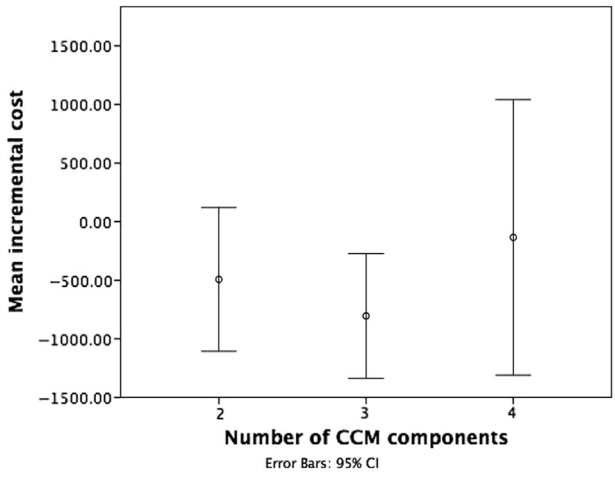

Fig. 3 – Association number of CCM components. CCM, chronic care model; CI, confidence interval.

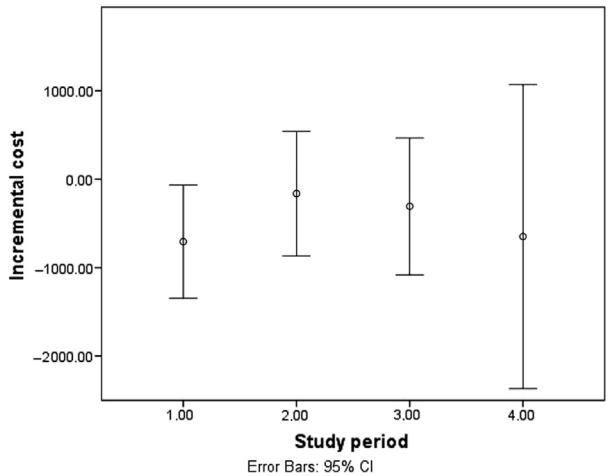

Fig. 4 – Association study period. CI, confidence interval.

administrative data may also influence the results, when data are incorrect or incomplete. Furthermore, as with all systematic reviews, publication bias may be present, whereby certain types of studies may be more likely to be published. This systematic review yielded few studies with a follow-up period of more than 1 year. Therefore, the evidence on the long-term effect of integrated care models is limited. In addition, it is at present unknown whether the integrated care models were correctly implemented and fully adopted by patients and care professionals. Therefore, the results might depend on the level of implementation of integrated care models. Although this systematic review could allow a meta-analysis to be conducted, only few studies (even after personal contact with the authors) provided the necessary statistical data that are needed for this type of analysis. As such, a meta-analysis was therefore not possible. Finally, the present study focused only on costs. To be labeled as a full economic evaluation, health care effects (i.e., clinical and non-clinical outcomes) must also be considered because the preservation of health remains the main goal of health care systems. Therefore, all dimensions of quality of care (IOM) should be assessed.

The strength of the present study is that new information about the circumstances in which integrated care models might be most effective is provided. First, future research should more thoroughly describe the definition and content of integrated and usual care, the level of implementation, and the components of the interventions so as to understand, compare, and evaluate integrated care models. Second, randomized controlled trials and/or mixed-method designs are needed to enhance the empirical evidence on the potential effects of integrated care in daily practice with particular focus on the health economic impact, assessing costs and health consequences of integrated care models. Third, studies comparing the economic effects of integrated care models with usual care are particularly recommended because the findings of such studies provide payers and governments with better insights on how to spend the available resources in the most efficient way. Finally, future research must also better describe the point of view from which the economic evaluation is performed and has to include indirect costs.

Conclusions

Health care systems worldwide are facing the rising prevalence of chronic diseases and their financial burden. Although there is a widespread belief that integrated care might reduce health care expenditures, relatively few studies have evaluated the economic impact of integrated care models. This systematic review presented the results of cost analyses of integrated care models for type 2 diabetes mellitus, schizophrenia, and multiple sclerosis. Most of the studies reported a beneficial economic impact of integrated care models. Nevertheless, to support well-considered decision making, there is still a great need for well-designed health economic evaluations of integrated care models, also from the quality-of-care perspective.

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Supplemental Materials

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