



# The Effect of Network-Level Payment Models on Care Network Performance: A Scoping Review of the Empirical Literature

RESEARCH AND THEORY

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## ABSTRACT

**Introduction:** Traditional payment models reward volume rather than value. Moving away from reimbursing separate providers to network-level reimbursement is assumed to support structural changes in health care organizations that are necessary to improve patient care. This scoping review evaluates the performance of care networks that have adopted network-level payment models.

**Methods:** A scoping review of the empirical literature was conducted according to the five-step York framework. We identified indicators of performance, categorized them in four categories (quality, utilization, spending and other consequences) and scored whether performance increased, decreased, or remained stable due to the payment model.

**Results:** The 76 included studies investigated network-level capitation, disease-based bundled payments, pay-for-performance and blended global payments. The majority of studies stem from the USA. Studies generally concluded that performance in terms of quality and utilization increased or remained stable. Most payment models were associated with improved spending performance. Overall, our review shows that network-level payment models are moderately successful in improving network performance.

**Discussion/conclusion:** As health care networks are increasingly common, it seems fruitful to continue experimenting with reimbursement models for health care networks. It is also important to broaden the scope to not only scrutinize outcomes, but also the contexts and mechanisms that lead to certain outcomes.

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KEYWORDS:

health care networks;  
alternative payment  
models; performance;  
global payments; network  
reimbursement

TO CITE THIS ARTICLE:

Reindersma T, Sülz S, Ahaus K, Fabbricotti I. The Effect of Network-Level Payment Models on Care Network Performance: A Scoping Review of the Empirical Literature. *International Journal of Integrated Care*, 2022; 22(2): 3, 1–61. DOI: <https://doi.org/10.5334/ijic.6002>

## INTRODUCTION

Fragmented health care leads to poor system and patient outcomes. Fragmentation manifests itself in a myriad of ways, such as duplication of services and lack of involvement, ownership, or communication [1]. Ageing populations and multi-morbidity amplify these issues, making it more relevant to address fragmentation. In order to do so, governments and policymakers increasingly rely on networks of health care organizations [2, 3]. As an alternative to market or quasi-market structures, networks enable separate health care entities to work together and coordinate care [4, 5]. However, the current ways of paying for care seem to impede coordination within networks. Providers are predominantly reimbursed separately, through traditional payment models such as fee-for-service (FFS) or diagnosis-related-groups (DRGs), leaving the paywalls between organizations intact [6]. It is widely assumed that most traditional models reward volume [7], discourage prevention [8], impede care coordination [7], and stimulate delivering the most profitable services [9]. In essence, traditional models are perceived as not being able to create the right incentives for the integration of care, leading instead to an array of misaligned incentives [10]. Moving away from separate provider reimbursement to network-level reimbursement would support interorganizational coordination, flexible use of resources between organizations, and innovation in delivery design and IT [11–13]. Subsequently, it is assumed that developing adequate network-level payment models is essential to achieving high-quality patient care. Health care purchasers, policymakers and providers have correspondingly initiated demonstrations and experiments with novel network-level payment models. However, to date, how these payment models contribute to network performance has not been systematically investigated.

The current study adds to previous research by considering all payment models that are aimed specifically at joint reimbursement of networks. Although previous reviews have focused on various subsets of payment models, these reviews have not made a primary distinction between disbursement to a network and to separate providers. For example, Cattell and Eijkenaar [8] focused on key design features of value-based payment (VBP) initiatives and included 24 papers that shed light on VBP effects, but on the initiative level rather than payment model level. Vlaanderen et al. [14] conducted an analysis of the characteristics of outcome-based payment (OBP) models and their effects in terms of structure, process, and outcome indicators. Kaufman et al. [15] provide an overview of utilization, care, and outcomes associated with accountable care organizations (ACOs) in the USA. Thus, VBP, OBP, and ACO models have been systematically reviewed separately, but an overview of all network-level

payment models, transcending definitions of VBP, OBP, and ACO models, and their performance, is lacking. Our aim is to study how such network-level payment models affect the performance of networks. We summarize this in the following research question: what is the effect of network-level payment models on the performance of care networks? From the resulting comprehensive overview of performance indicators, policymakers and health care professionals can, depending on what performance indicators they deem important, make a more informed decision when implementing a network-level payment model.

## THEORETICAL FRAMEWORK PAYMENT MODELS, NETWORKS, AND PERFORMANCE

Payment models refer to the funding mechanisms that health care purchasers adopt in order to financially reimburse providers of care or, in this case, care networks. The term network-level payment model is used to indicate a payment model in which a set of providers or facilities are jointly reimbursed through a contracting entity (i.e., the network or one network provider), which in turn can then disburse the money received to the providers in the care network. Care networks are defined as sets of two or more legally autonomous providers [see 16] that are tasked with the coordination of care pathways and the execution of clinical interventions across providers [5]. The term provider is used to denote a practice, hospital, or other setting, and not an individual physician, unless otherwise noted. Network performance is defined as the ability of the network to satisfy the payment model's objectives as made explicit in the included studies. In our study, the taxonomy of payment models by Tsiachristas [17] has been used to identify and categorize network-level payment models (henceforth referred to as payment models). Non-network-level models have been excluded from this taxonomy (see [Table 1](#)) as they are not the focus of our study.

## INTENDED AND UNINTENDED CONSEQUENCES OF PAYMENT MODELS

How payment models incentivize structural change will depend on the payment model. It is assumed that, given the appropriate incentives, providers will be able to deliver the right care at the right time in the right way, and at the right place [18, 19]. Under a capitation system, providers receive a periodic lump sum per enrolled patient for a defined set of services. This incentivizes providers to minimize costs, thereby encouraging them to innovate in cost-reducing technologies, select lower-cost alternative treatments, and invest in prevention. The downsides are increased financial risk for providers, and the temptation to stint on care and avoid high-risk patients, often referred

PAYMENT MODEL	DEFINITION
<b>Base payment</b>	
Capitation	Periodic lump sum per enrolled patient for a range of services
Episode-based bundled payment	Payment for medical services delivered during an episode of care
Disease-based bundled payment	Payment for all the care required by a patient for a particular disease over a predefined period
Global payment	Payment for all the services offered to cover the medical needs of a defined population for a specific period of time
<b>Add-on payment</b>	
Pay-for-performance (P4P)	Payments to providers for meeting predetermined performance indicators
Pay-for-coordination (P4C)	Payment for taking responsibility for coordinating a patient's care along parts of, or complete, care pathways for a specific period
Risk and gain sharing/Shared savings	Payments are increased if financial targets are met for the wider system/Providers share in savings and losses if financial or quality targets are (not) met

**Table 1** Taxonomy of network-level payment models, adapted from Tsiachristas [17].

to as ‘cherry picking’ [13, 20]. Episode-based bundled payments cover medical services delivered during an episode of care. Providers are thereby encouraged to coordinate and organize care activities within an episodic bundle to eliminate unnecessary and expensive care and reduce costs [7]. However, there is little incentive to avoid unnecessary episodes [12] since more care episodes implies more revenue. Disease-based bundled payments have a broader scope, covering all the care required for a patient with a particular disease during a predefined period. As with episode-based bundled payments, coordination between providers is encouraged. Providers are incentivized to improve quality since they bear the financial burden of complications and avoidable services, such as hospital readmissions. For both bundled payment types, costs incurred that exceed the pre-agreed payment are at the expense of the provider and similarly if the costs are less than the payment, providers retain the difference. This approach may lead to stinting on care and cherry picking if adequate quality monitoring is not in place, and patient choice might be limited due to a limited and fixed provider set [12]. In another approach, a global payment is made to cover all medical services for a defined population during a period of time. In the literature, this term is used interchangeably with population-based payment and global budgets. A global payment model shares some properties with bundled payments and capitation but can offer greater managerial flexibility in allocating resources and enables innovation in delivery design [12, 13]. A specific downside of global payments is that population health might be prioritized above individual health [12].

These basic payment models are often enhanced with additional payment formula: pay-for-performance (P4P), pay-for-coordination (P4C), risk and gain sharing and shared savings. Risk sharing arrangements, such as risk-and-gain-sharing and shared savings, are intended to increase efficiency in care delivery [20]. In part, this works

through weakening the providers’ tendencies to overtreat patients [21]. Payers or providers can decide whether to agree to one-sided risk only (upside risk) or two-sided risk (upside and downside risk) and can also tweak the percentages of savings and losses that are shared [22]. In a one-sided risk arrangement, providers share only in gains, whereas in a two-sided risk arrangement gains and losses are both shared. Loss aversion theory argues that losses have a stronger psychological effect than have gains [23]. This implies that a two-sided risk arrangement will more strongly incentivize providers, and so have the potential to enhance performance. Providers that want to benefit from shared savings will have to improve in terms of quality and cost measures [24]. All the above payment models are risk-based, except for P4P and P4C. If employing P4P, providers receive a payment for meeting predetermined performance indicators, with the main goal being to improve patient outcomes. Newhouse [25, p.203] cautions however that “payment on specific process measures of quality [...] can distort resource allocation to the measured areas and away from unmeasured areas”. Hence, a disproportionate focus on measured aspects can be detrimental to aspects of care that are not incentivized [26]. Via P4C, a designated provider receives a payment to coordinate patient care across a set of services. This is intended to provide financial leeway for patient-provider and provider-provider communication, and to limit unnecessary services, and may furthermore increase “flexibility in how, where, and by whom care is provided” [12, p.5].

### NETWORK INCENTIVES

Theoretically, all payment models in the taxonomy can provide incentives at the network level. Group-level or network-level payments or ‘rewards’ stimulate structural changes that are seen as preconditions for optimized patient care [11]. A switch from provider-level to network-level reimbursement implies a switch from individual

(i.e., provider or organizational) incentives to network incentives. The terms network and groups are used interchangeably in the literature on monetary incentives that underpin payment models. In general, network-level incentives seem to be most effective when the delivery of health care services encompasses “significant interdependencies between group members” [27]. This presumes that, between network providers, high levels of clinical, professional, and organizational integration are present [28]. The intensity of network incentives might be attenuated by an increase in the number of providers working under the same target [29]. That is, an increase in network size leads to a weakening of incentives. Similarly, evidence from systematic reviews indicates that individual-level rewards are more powerful than network-level or group-level rewards [21]. In addition to the properties of the specific payment models discussed in the previous paragraph, such idiosyncrasies of network incentives might also influence performance.

## RESEARCH METHODS

Given the broad nature of the research question [30], the polysemous nature of networks in health care, and the lack of uniform terminology of payment models [10], a scoping review was conducted. Scoping reviews are appropriate for topics where the field of literature is large, complex, ambiguous, and lacking in conceptual boundaries [31]. In our review, we complied with PRISMA-ScR reporting guidelines [32] and followed the five steps specified in the York framework, thereby allowing an iterative process. The process framework consists of (i) identifying the research question (see Introduction), (ii) identifying relevant studies, (iii) study selection, (iv) data charting, and (v) reporting on results [33]. In order to assess the evidence quality of studies, the Effective Practice and Organization of Care (EPOC) criteria table was adapted from Minkman et al. [34]. Evidence levels range from A (systematic reviews and RCTs), through B (controlled studies) and C (non-controlled studies), to D (descriptive, non-analytical studies).

### IDENTIFYING RELEVANT STUDIES

To identify relevant studies, a broad systematic search was conducted in six bibliographical databases. An information specialist with expertise in improving literature retrieval for systematic reviews [see 35] was consulted to draft the search strings. The initial string consisted of terms similar to ‘payment model’ and ‘interorganizational network’. A first search of four databases (Embase, Medline Ovid, Cochrane Central Register of Controlled Trials, and Web of Science Core Collection) yielded 3892 hits. Author 1 perused a sample of the identified studies to gain familiarity with concepts

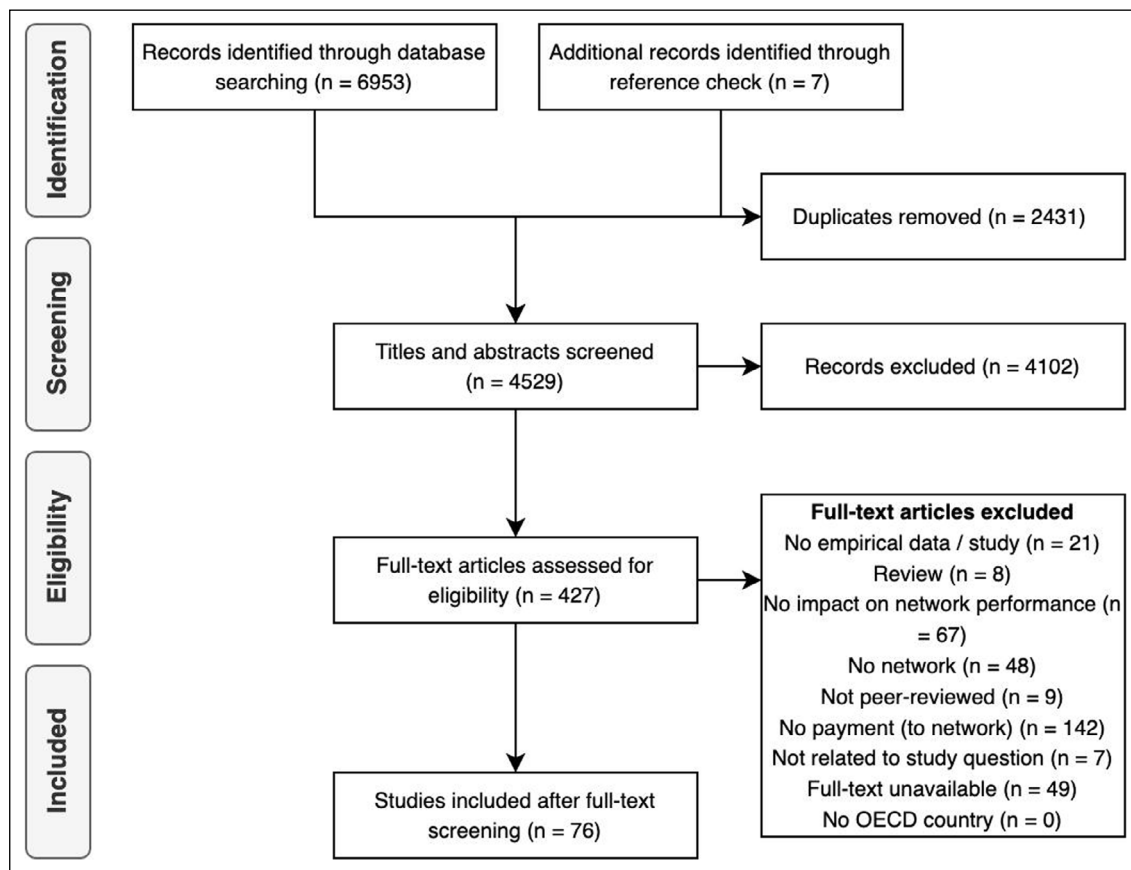
and identify additional terms that could serve as input for refining the search string [30]. This modified string was used for the second search in October 2019 and yielded 6069 hits including duplicates. For this search, two additional databases were consulted (EconLit ProQuest and CINAHL EBSCOhost) to further broaden the scope. The literature search was updated in November 2021, eventually yielding a total of 6953 studies including duplicates. Studies up to that date have been included with no earliest cut-off date set. Both the initial and final search strings are presented in the supplementary file. Alongside this bibliographical database search, reference lists were consulted to identify further studies that were eligible for inclusion.

### STUDY SELECTION

Studies were included if they were of an empirical nature, peer-reviewed, reported an impact on network performance, described a network-level payment model intervention, and were from an OECD country. OECD countries were chosen since the social and health challenges in these countries call for a well-coordinated system approach [36] that networks can contribute to. Systematic reviews were excluded (although their reference lists were scanned for studies eligible for inclusion) as well as articles where the full text could not be retrieved and where the contents were evidently not related to our research question. A concise list of the exclusion criteria can be found in *Figure 1*, in which the screening process following the PRISMA guidelines is also illustrated [37]. All potential abstracts and titles were imported into EndNote X9 [38]. After deduplication, the remaining titles and abstracts were exported to an MS Excel workbook for further manual screening. All four authors were involved in the process. Before actual screening began, a sample of 90 papers was discussed to align the team members’ interpretations of the exclusion criteria. For each potential inclusion, title and abstract screening was conducted by at least two reviewers independently in a double-blind fashion. Author 1 screened all titles and abstracts, and Author 2, 3, and 4 each screened one-third of the total. Inconsistencies were resolved between the two reviewers who had screened the specific title and abstract. Once this filtering process was completed, the full texts of the still potentially relevant papers were screened by Author 1, and another reviewer was consulted if there were doubts as to whether to include an article.

### DATA CHARTING

First, each study was analysed to identify its year, author, country, methodology, intervention program, network configuration, payment model, payment flow, study population, sample size, the investigated indicators of performance, and if the performance on each indicator



**Figure 1** Flow diagram of screening process.

increased (+), decreased (-) or if there was no (statistically significant) effect (0) under the use of the payment model. The taxonomy discussed in the theoretical framework section was used to code payment models. A distinction is made between payment flows from payer-to-network (i.e., to the network) and network-to-provider (i.e., in the network). As a final step, all the indicators were inductively placed in one of four categories [39]: (i) quality of care, (ii) utilization, (iii) spending, and (iv) other consequences. The fourth category is used for indicators that cannot be assigned to any of the first three categories. These tend to be more abstract measures such as ‘level of collaboration’ or ‘level of integration’. A narrative synthesis of the evidence was conducted.

## RESULTS

In total, 6960 studies were identified, including seven additional studies that were identified through reference list checks (see [Figure 1](#)). Of those, 427 were found eligible for full-text screening. This screening eventually reduced the number of studies to include in the qualitative synthesis to 76.

## STUDY CHARACTERISTICS

A comprehensive overview of all the included studies can be found in [Table 4](#) (see below). Most articles

stem from the most recent decade ( $N = 71$ ), and only two of the older five studies were published before 2000. Studies mainly employed quantitative research designs, and, if not, mixed-method designs were employed (see [Table 2](#)). Most studies were performed in the USA ( $N = 70$ ), the others coming from Germany ( $N = 2$ ) and the Netherlands ( $N = 4$ ). This might explain the dominance of payments to ACOs as the networks under investigation. Capitation-based payments ( $N = 4$ ), disease-based bundled payments ( $N = 5$ ) and P4Ps ( $N = 8$ ) were addressed in a total of 17 studies, while the remaining studies focused on global payments. The latter were often combined with additional components such as shared savings ( $N = 45$ ), shared savings plus P4P ( $N = 13$ ), and pay-for-coordination ( $N = 1$ ). Most studies lacked precise network configuration descriptions and payment flows to a network ( $N = 68$ ) were far more common than payment flows in a network ( $N = 8$ ). The studied populations ranged from disease-specific groups to entire populations served by a network. The quality of evidence was mixed, but consisted predominantly of controlled studies ( $N = 65$ ) (see [Table 3](#)). For studies with evidence level B, the results presented in [Table 4](#) are statistically significant. For evidence C level studies, significance was only reported in two studies [40, 41]. Given the exclusion criteria we had set, no studies were graded A (RCTs) or D (descriptive studies).

COUNTRY	MAIN PAYMENT MODEL	RESEARCH DESIGN	PAYMENT FLOW
United States (N = 70)	Capitation (N = 4)	Quantitative (N = 66)	To network (N = 68)
Netherlands (N = 4)	Disease-based bundled payment (N = 5)	Mixed (N = 10)	In network (N = 8)
Germany (N = 2)	P4P (N = 8)		
	Global payment (N = 59)		

**Table 2** Summary of empirical research.

LEVEL	DESCRIPTION	#
<b>A1</b>	<b>Systematic review</b>	
	Review of data from multiple RCT studies	0
<b>A2</b>	<b>Randomized trial</b>	
	Comparative study with (random) intervention and control group design	0
<b>B</b>	<b>Controlled study</b>	
	Trial with intervention and control group and comparisons on outcome	
	B1 Multiple measurement points	60
	B2 One measurement point	5
<b>C</b>	<b>Non-controlled study</b>	
	C1 Multiple case, multiple measurement points	4
	C2 Multiple case, one measurement point	1
	C3 Single case, multiple measurement points	4
	C4 Single case, one measurement point	2
<b>D</b>	<b>Descriptive, non-analytical</b>	0
	D1 Multiple projects	0
	D2 Single project	0
	D3 Literature review	0

**Table 3** Evidence quality of included studies.

## PERFORMANCE OF CARE NETWORKS

In general, the results of the studies show that payment models have diverse effects on the performance of a network.

### Capitation

From the studies, it can be concluded that a capitation approach, both stand-alone or in combination with elements of risk-and-gain-sharing or P4P, is an effective payment model to reduce spending [42] and improve most types of health care utilization [42–45], without affecting the quality of care [45]. With regard to utilization, both timely discharge and the length of home health episodes showed the desired increase, and inpatient hospital admissions decreased as was anticipated [42, 44, 45]. Most visit types were positively impacted for home health beneficiaries and community-dwelling elderly: emergency department (ED) hospital visits and home health visits decreased, whereas office-based and preventive visits increased [42, 45]. However, HMO enrollees experienced an unwanted decrease in physician visits [43]. No effects were found for one prevention activity (colonoscopy screening) and hospital readmission rates [45].

### Disease-based Bundled Payments

Four out of five of the studies that considered disease-based bundled payments to the network, had a focus on

diabetes management programs [46–49]. In terms of utilization, use of specialist care decreased as expected and hoped for, but eye testing also decreased, and this had not been an intended outcome. All other measures of medical testing increased as was envisioned [47]. Furthermore, the use of institutional postdischarge facilities was successfully reduced [50]. The model negatively impacted performance on total spending, medical specialist and medication spending, but post discharge spending and primary care spending were curbed [46, 47, 49, 50]. One qualitative study [48] mapped other consequences and found some positive effects (better collaboration, greater transparency, and better process quality) but also some negative ones (increased administrative burden, greater price variations, and unwanted dominance by GP care groups). Quality indicators were identified in one study, indicating no significant effect on mortality and a desired decrease in readmissions, with the exception that readmissions for medical episodes were not significantly affected if the bundled payment was not in the setting of an ACO [50].

### Pay-for-performance

Of the eight studies on P4P, one described P4P as a means to reimburse on the network level [51], one focused on payment flows both within and to the network [52], while, in the rest of the studies, P4P was

**Table 4** Summary of included articles. Abbreviations: HMO, Health Maintenance Organization; GP, general practitioner; ED, emergency department; HbA1C, average blood glucose levels for last two to three months; LDL(-C), low-density lipoprotein (cholesterol); SUD, substance use disorder; P4P, Pay-for-performance; SNF, skilled nursing facility; AMI, acute myocardial infarction; COPD, chronic obstructive pulmonary disease; CHF, congestive heart failure; ICU, intensive care unit; IRF, inpatient rehabilitation facility; HHA, home health agency; LTC, long-term care; AAA, abdominal aortic aneurysm; CABG, coronary artery bypass grafting; ACO, Accountable Care Organization; FFS, fee-for-service; DMP, disease management program. SB1, Screening and Brief Intervention (for SUD); PDC, proportion of days covered; ESRD, end stage renal disease; AVR, aortic valve replacement; MSSP, Medicare Shared Savings Program; AQC, Alternative Quality Contract; PGPD, Physician Group Practice Demonstration.

REFER ENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PRO GRAM	NETWORK CONFIGU RATION	PAYMENT MODEL(S)	FLOW	STUDY POPULATION	INTERVEN TION N	CONTROL N	INDICATOR	QUALITY OF CARE	UTILI ZATION	SPENDING	OTHER	EPOC
42	1995	Sch lenker	QN	USA	HMO	Not specified	Capitation	To	Medicare home health beneficiaries	181 patients	1,079 patients	Patient discharge	+				C2
												Home health visits	+				
												Cost per patient	+				
												Episode length	+				
43	1995	Robinson	Mixed	USA	HMO	Integrated physician medical groups in California	Capitation	To	Capitated HMO enrollees in six integrated physician medical groups	Not reported	Not reported	Physician visits	-				C1
44	2014	Marton	QN	USA	Passport (P) and Kentucky Health Select Plan (K)	Primary care practices in regional managed care networks	Capitation + P4P (P) P4P (K)	In	Children enrolled in Medicaid	1,890 patients (P) and 4,273 patients (K)	2,816 patients (P) and 9,317 patients (K)	Outpatient utilization (P/K) Professional utilization (P/K)	+/-				B1
45	2017	Mandal	QN	USA	HMO	Provider group with 7 clinic locations and 25 primary care specialists	Capitation + risk- and-gain sharing	To	Community- dwelling Medicare Advantage enrollees ≥ 65 years	1,230 patients	1,230 patients	Office-based visits ED hospital visits Inpatient hospital admissions 30-day readmission	+				B1

(Contd.)

REFER ENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PRO GRAM	NETWORK CONFIGU RATION	PAYMENT MODEL(\$)	FLOW	STUDY POPULATION	INTERVEN TION N	CONTROL N	INDICATOR	QUALITY OF CARE	UTILI ZATION	SPENDING	OTHER	EPOC
														0			
														0			
														+			
														+			
														0			
														0			
48	2011	DeBakker	Mixed	NL	DMP for diabetes	Care groups, consisting of health care providers such as GPs, laboratories, dietitians and medical specialists	Disease-based bundled payment	To	Diabetes patients assigned to care group	Not reported (10 care groups)	Not reported	Collaboration				+	C4
												Process quality				+	
												Transparency				+	
												GP domination of care groups				-	
												Administrative burden				-	
												Price variations				-	
47	2014	Busse	Mixed	NL	DMP for diabetes	Care groups, consisting of health care providers such as GPs, laboratories, dietitians and medical specialists	Disease-based bundled payment	To	Diabetes patients assigned to care group	Not reported	Not reported	Specialist care use		+			B1
												Control of blood pressure and cholesterol		+			
												HbA1C		+			
												Regular check-ups		+			
												Foot exams		+			
												Kidney exams		+			
												Eye testing		-			
												Total medical spending		-			

(Contd.)



REFER ENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PRO GRAM	NETWORK CONFIGU RATION	PAYMENT MODEL(s)	FLOW	STUDY POPULATION	INTERVEN TION N	CONTROL N	INDICATOR	QUALITY OF CARE	UTILI ZATION	SPENDING	OTHER	EPOC
46	2015	Mohnen	QN	NL	DMP for diabetes	Care groups, consisting of health care providers such as GPs, laboratories, dietitians and medical specialists	Disease-based bundled payment	To	Diabetes patients assigned to care group	20,257 patients	43,754 patients	Curative health care spending		-			B1
49	2021	Karimi	QN	NL	DMP for diabetes, COPD and vascular risk management (VRM)	Care groups, consisting of health care providers such as GPs, laboratories, dietitians and medical specialists	Disease-based bundled payment	To	Patients enrolled in a bundled payment for diabetes, COPD, or increased vascular risk	807,197 patients (diabetes), 1,039,406 (VRM), 267,843 (COPD)	988,480 patients	Diabetes total cost Diabetes medical specialist cost Diabetes primary care cost Diabetes medication cost Diabetes bundled payment cost VRM total cost VRM medical specialist cost VRM primary care cost VRM medication cost VRM bundled payment cost COPD total cost		- - + - - - - + - - - -			B1

(Contd.)

REFERENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PROGRAM	NETWORK CONFIGURATION	PAYMENT MODEL(s)	FLOW	STUDY POPULATION	INTERVENTION	CONTROL	INDICATOR	QUALITY OF CARE	UTILIZATION	SPENDING	OTHER	EPOC
													COPD medical specialist cost		-		
													COPD primary care cost		+		
													COPD medication cost		-		
													COPD bundled payment cost		-		
50	2021	Navathe	QN	USA	MSSP	Not specified	Disease-based bundled payment	In	Medicare fee-for-service beneficiaries	24,884 patients	70,208 patients	Post discharge institutional spending medical episode (non-ACO/ACO)		+/-			B1
													Medical episode mortality (non-ACO/ACO)		0/0		
													Medical episode 90-day readmissions (non-ACO/ACO)		0/+		
													Medical episode discharge to SNF/IRF (non-ACO/ACO)		0/0		
													Medical episode discharge to HH (non-ACO/ACO)		+/+		
													Medical episode length of stay SNF (non-ACO/ACO)		+/+		

(Contd.)

REFER ENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PRO GRAM	NETWORK CONFIGU RATION	PAYMENT MODEL(s)	FLOW	STUDY POPULATION	INTERVEN TION N	CONTROL N	INDICATOR	QUALITY OF CARE	UTILI ZATION	SPENDING	OTHER	EPOC
												Post discharge institutional spending surgical episode (non-ACO/ACO)		+/+			
												Surgical episode mortality (non-ACO/ACO)	0/0				
												Surgical episode 90-day readmissions (non-ACO/ACO)	+/+				
												Surgical episode discharge to SNF/IRF (non-ACO/ACO)	+/+				
												Surgical episode discharge to HH (non-ACO/ACO)	+/+				
												Surgical episode length of stay SNF (non-ACO/ACO)	+/+				
52	2007	Mandel	QN	USA	Not specified	Physician-hospital organization consisting of primary care practices (PCPs)	P4P	To/in	Children with asthma	13,380 patients in 44 PCPs	Not reported	Perfect care delivery	+				C3
												Influenza vaccination rates	+				

REFER ENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PRO GRAM	NETWORK CONFIGU RATION	PAYMENT MODEL(s)	FLOW	STUDY POPULATION	INTERVEN TION N	CONTROL N	INDICATOR	QUALITY OF CARE	UTILI ZATION	SPENDING	OTHER	EPOC
51	2006	Levin-Scherz	QN	USA	Partners Community Health Care (PCHI)	Network composed of 15 regional service organi zations	P4P	To	PCHI patients	Varied per measure	Varied per measure	HbA1C screening  Diabetic LDL screening  Nephropathy screening  Diabetic eye exams  Paediatric asthma controller use	+  +  +  +  0	+  +  +  +			B1
53	2010	Atkinson	QN	USA	Long Island Health Network	Clinically integrated network of 10 hospital facilities	P4P	In	Not specified	Not reported	Not reported	Quality (overall composite measure)  Hospital average length of stay	+  +				C3
54	2018	Rieckmann	Mixed	USA	Coordi nated Care Organi zation	Integrated financing and service delivery for medical, behavioural, and dental health	P4P	In	Members enrolled in CCO	Not specified	Not specified	SUD screening  SUD treatment initiation  SUD treatment engagement	+  -  -				C1
55	2015	Hibbard	Mixed	USA	Fairview Pioneer ACO	PCPs working in a Pioneer accountable care organization	P4P	In	Fairview PCPs	85 respon dents	Not applicable	Efforts into increasing patient activation and patient self- management			0		C3
												Becoming more patient- centred		0			

(Contd.)

REFERENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PROGRAM	NETWORK CONFIGURATION	PAYMENT MODEL(s)	FLOW	STUDY POPULATION	INTERVENTION	CONTROL	INDICATOR	QUALITY OF CARE	UTILIZATION	SPENDING	OTHER	EPOC
56	2016	Gleeson	QN	USA	Partner for Kids	Physicians in a paediatric accountable care organization	P4P	In	Community physicians who received P4P incentives	203 physicians across 50 practices	2763 physicians across 82 practices	Adolescent well care visits Well child visits at 3-6 years! Asthma at 12-18 years Asthma at 5-11 years Immunizations (adolescents) Meningococcal immunizations (adolescents) Td/Tdap immunizations (adolescents) Immunizations (children) DTP immunizations (children) Hepatitis A immunizations (children) IPV immunizations (children) MMR immunizations (children) Pneumococcal conjugate immunizations (children)	+ +/- 0/0 0/0 0/- 0/- 0/- 0/- +/- 0/- +/- 0/0 +/-				B1

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												Varicella immunizations (children)	0/-				
												Pharyngitis	0/0				
												Upper respiratory infection	0/0				
												ADHD maintenance	0/0				
												ADHD initiation	0/0				
												Lead screening	+/0				
												Influenza	0/0				
												Rotavirus	+/-				
57	2020	Ganguli	QN	USA	MSSP	Not specified	P4P	In	ACOs using cost reduction-based specialist compensation (P4P)	41 ACOs	119 ACOs	Shared savings	0	0			B2
												Outpatient spending	0				
												Specialist visits	0				
115	2017	Afenidis	Mixed	USA	Total Cost and Care Improvement (TCCI)	Primary care physician panels, consisting of at least 5-15 physicians and 1000 patients	Global payment + shared savings + pay-for-coordination	To	CareFirst BlueCross BlueShield Total Care and Cost Improvement Program enrollees	298,463 patients	537,778 patients	Outpatient spending	0	0			B1
												Specialist visits	0				
												Primary care visits	0				
												Inpatient spending	0				
												Outpatient spending	0				
												Total spending	0	0			

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103	2017	Stuart	QN	USA	AQC	Not reported	Global payment + P4P + shared savings	To	BCBSMA HMO and POS (point of service) plan enrollees	10,817 patients	50,576 patients	SUD service utilization ?	0/+	0/+			B1
												SUD spending	0/0				
												SUD identification	0/+				
												SUD initiation	0/+				
												SUD engagement	0/0				
106	2013	McWilliams	QN	USA	AQC	Not reported	Global payment + P4P + shared savings	To	Elderly FFS Medicare beneficiaries in Massachusetts treated by AQC-affiliated providers	417,182 person-years	1,344,143 person-years	Total spending	0	+			B1
												Admission rate for ambulatory care-sensitive conditions related to cardiovascular disease or diabetes	0				
												30-day readmission	0				
												Mammography screening	0				
												LDL-C testing (diabetes and cardiovascular)	+				
												HbA1C testing	0				
												Diabetes retinal examination	0				

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107	2011	Song	QN	USA	AQC	Not reported	Global payment + P4P + shared savings	To	Enrollees whose PCPs were in the AQC system	380,142 enrollees	1,351,446 enrollees	Medical spending	Paediatric care quality +	+			B1
												Adult preventive care quality	0				
												Chronic care management quality	+				
108	2012	Song	QN	USA	AQC	Not reported	Global payment + P4P + shared savings	To	BCBSMA enrollees	612,547 enrollees	1,339,798 enrollees	Medical spending	Paediatric care quality +	+			B1
												Adult preventive care quality	+				
												Chronic care management quality	+				
109	2014	Song	QN	USA	AQC	Not reported	Global payment + P4P + shared savings	To	Persons in four cohorts of AQC organizations, defined by first contract year: 2009, 2010, 2011, 2012	1,348,235 enrollees	966,813 enrollees	Medical spending	Chronic disease management quality +	+			B1
												Adult preventive care quality	+				
												Paediatric care quality	+				

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104	2016	Husk amp	QN	USA	AQC	Not reported	Global payment + P4P + shared savings	To	Adults between 18–64 years enrolled in BCBSMA HMO or POS (point of service) plans	533,568 person-years	2,999,221 person- years	Any tobacco cessation treatment use	+				B1	
												Varenicline or bupropion use	+					
												Nicotine replacement therapy use	0					
												Tobacco cessation counselling visit use	+					
												Combination therapy (pharma cotherapy plus counselling) use	+					
												≥90-day supply of tobacco cessation	+					
112	2014	Afen dulis	QN	USA	AQC	Not reported	Global payment + P4P + shared savings	To	BCBSMA HMO and POS (point of service) plan enrollees	332,624 enrollees	1,296,399 enrollees	Drug utilization	0				B1	
												Drug spending	0					
113	2018	Dono hue	QN	USA	AQC	Not reported	Global payment + P4P + shared savings	To	Individuals with alcohol use disorders (AUD) and/ or opioid use disorders (OUD)	8,956 person-years	40,884 person- years	Medication treatment use	0				B1	

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110	2014	Chien	QN	USA	AQC	Not reported	Global payment + P4P + shared savings	To	BCBSMA HMO enrollees 0-21 years with and without special health care needs (CSHCN)	126,975 enrollees	415,331 enrollees	Quality measures tied to P4P	+				B1
												Quality measures not tied to P4P	0				
												Medical spending	0				
111	2017	Pimperl	QN	DE	Gesundes Kinzigtal	Not reported	Global payment + P4P + shared savings	To	Gesundes Kinzigtal enrollees	Varied per measure	Varied per measure	Mortality rate	0				B1
												Average age at time of death	+				
												Years of potential life lost	+				
105	2012	Hildebrandt	QN	DE	Gesundes Kinzigtal	Population-wide integrated care system that covers all sectors and indications of care with a group of providers	Global payment + P4P + shared savings	To	Gesundes Kinzigtal enrollees	Varied per measure	Varied per measure	Hospitalization	+				B1
												Medical spending	+				
114	2017	Blewett	Mixed	USA	Integrated Health Partnership Minnesota	Integrated health partner ships deliver the full scope of primary care services, and coordinate access to specialty providers and hospitals	Global payment + P4P + shared savings	To	Minnesota Health Care Program enrollees	Not reported	Not reported	Forging of community partnerships				+	C4
												Service integration					

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58	2014	Sandberg	Mixed	USA	Hennepin Health	Hennepin County Human Services and Public Health Department; Hennepin County Medical Center, NorthPoint Health and Wellness Center, Metropolitan Health Plan (HMO), all covering physical, behavioural and social services.	Global payment + shared savings	To	Adults without dependent children	Not reported	Not reported	ED visits Outpatient visits Hospitalization	+ + 0					C3
41	2017	Narayan	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Medicare beneficiaries in ACOs	5,329,831 beneficiaries	Not reported	Mammography screening use	+ +					C1
40	2018	Fraze	QN	USA	MSSP	Not reported	Global payment + shared savings	To	MSSP ACOs	162 ACOs	Not reported	All-or-nothing diabetes composite HbA1C controlled LDL controlled Blood pressure <140/90 Tobacco non-use Aspirin use	+ + + + + +				C1	

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59	2014	Pope	Mixed	USA	PGPD	Not reported	Global payment + shared savings	To	Beneficiaries assigned to PGPs	1,776,387 person-years	1,579,080 person-years	Medical spending Hospitalizations ED visits HbA1C testing LDL-C testing Medical attention for nephropathy Diabetes eye exam	+ + + + + + +	+ + + + + + +			B1
90	2019	Kim	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Medicare FFS beneficiaries with a cancer diagnosis who were 66 years or older and died in 2013-2014	9,033 beneficiaries	9,033 beneficiaries	≥1 ICU admission (Aggressive end-of-life care) ≥2 Hospitalizations (Aggressive end-of-life care) ≥2 ED visits (Aggressive end-of-life care)	- + 0				B2

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												Chemotherapy ≤2 weeks (Aggressive end-of-life care)	0				
												No hospice or enrolment ≤3 days (Aggressive end-of-life care)	0				
91	2014	Colla	QN	USA	PGPD	Not reported	Global payment + shared savings	To	FFS Medicare patients assigned to PGPs	819,779 patients	934,621 patients	Discretionary carotid imaging use	0				B1
												Discretionary coronary imaging use	0				
												Discretionary carotid procedures use	0				
												Discretionary coronary procedures use	0				
												Non- discretionary carotid procedures use	0				
												Non- discretionary coronary procedures use	0				
60	2019	Rutledge	Mixed	USA	Medicaid ACO	Not reported	Global payment + P4P + shared savings	To	ACOs in Maine, 3 ACOs Minnesota and Vermont	3 ACOs	Not specified	Primary care provider visits (Maine, Minnesota, Vermont)	-/-/0				B1

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												Acute inpatient hospitalizations (Maine, Minnesota, Vermont)	+/-/+				
												ED visits (Maine, Minnesota, Vermont)	+ /+ /+				
												30-day readmissions (Maine, Minnesota, Vermont)	0/+ /0				
												HbA1C testing (Maine, Minnesota)	0/+				
												Medication adherence for depression (Maine, Minnesota)	0/-				
												Developmental screening (Vermont)	+				
												Total spending (Maine, Minnesota, Vermont)	0/0/+				
												Inpatient spending (Maine, Minnesota, Vermont)	0/0/+				
												Professional spending (Maine, Minnesota, Vermont)	0/+ /+				

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61	2019	Borza	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Patients undergoing common surgical procedures at ACO-affiliated hospitals	80,501 patients	348,774 patients	Pharmaceutical spending (Maine, Vermont) Overall 30-day readmission Readmission after AAA repair Readmission after colectomy Readmission after cystectomy Readmission after Prostatectomy Readmission after lung resection Readmission after total knee arthroplasty Readmission after total hip arthroplasty	+	0	0	0	0/+	B1
101	2019	Diana	QN	USA	Pioneer, MSSP	Not reported	Global payment + shared savings	To	ACO-affiliated hospitals	615 hospitals	2,847 hospitals	Communication with nurses (patient experience) (Pioneer/MSSP) Communication with doctors (patient experience) (Pioneer/MSSP)	+	0	+ /0	+ /0		B2

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												Responsiveness of hospital staff (patient experience) (Pioneer/MSSP)						0/0
												Pain management (patient experience) (Pioneer/MSSP)						0/0
												Communication about medications (patient experience) (Pioneer/MSSP)						0/0
												Cleanliness of hospital environment (patient experience) (Pioneer/MSSP)						0/0
												Quietness of hospital environment (patient experience) (Pioneer/MSSP)						0/0
												Discharge information (patient experience) (Pioneer/MSSP)						0/0

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											30-day all-cause readmissions	0				
											Hospital length of stay	0				
											Days in the community	0				
											Mortality	0				
											Recurrent stroke within 1 year of hospitalization	0				
64	2019	Bain	QN	USA	MSSP	Not reported	Global payment + shared savings	To MSSP hospitals	233 hospitals	3,100 hospitals	Probability of discharge to one-star (low-rated) SNFs	0				B1
											Probability of discharge to five-star (high-rated) SNFs	+				
93	2018	Resnick	QN	USA	MSSP	Not reported	Global payment + shared savings	To Medicare Part A and B beneficiaries > 65 years	4,989,210 beneficiary-years	12,263,135 beneficiary-years	Breast cancer screening use	-				B1
											Colorectal cancer screening use	+				
											Prostate cancer screening use	+				
65	2018	Kim	QN	USA	MSSP	Not reported	Global payment + shared savings	To MSSP hospitals	Varied per measure	Varied per measure	30-day hospital-wide all-cause readmission rates	+				B1
											30-day readmissions rates for AMI	0				
											30-day readmissions rates for heart failure	+				

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												30-day readmissions rates for pneumonia	+				
77	2019	Cole	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Medicare Part A and B beneficiaries ≥ 67 years with prostate cancer	3,297 beneficiaries	24,088 beneficiaries	Radical prostatectomy spending	0	0			B1
												Radiation therapy (EBRT, IMRT, Brachytherapy) spending	0				
												Expectant management (no surgery, radiation treatment within the first 180 days after diagnosis) spending	0				
66	2016	Busch	QN	USA	Pioneer, MSSP	Not reported	Global payment + shared savings	To	Medicare beneficiaries ≥ 18 years with mental health illness	Not specified	Not specified	All mental health care spending (Pioneer 2012 performance year/ Pioneer 2013 performance year/MSSP 2012 entry cohort/MSSP 2013 entry cohort)	+/0/0/0				B1

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												Outpatient mental health care spending (Pioneer 2012 performance year/ Pioneer 2013 performance year/MSSP 2012 entry cohort/ MSSP 2013 entry cohort)		0/0/0/0				
												ED visits with mental health diagnosis spending (Pioneer 2012 performance year/ Pioneer 2013 performance year/MSSP 2012 entry cohort/ MSSP 2013 entry cohort)		+0/0/0/0				
												Inpatient admissions with mental health diagnosis spending (Pioneer 2012 performance year/ Pioneer 2013 performance year/MSSP 2012 entry cohort/ MSSP 2013 entry cohort)		+0/0/0/0				

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												30-day mental health readmissions (Pioneer 2012 performance year/ Pioneer 2013 performance year/MSSP 2012 entry cohort/MSSP 2013 entry cohort)	0/0/0/0					
												Outpatient mental health follow-up within 7 days of discharge (Pioneer 2012 performance year/ Pioneer 2013 performance year/MSSP 2012 entry cohort/ MSSP 2013 entry cohort)	0/0/0/0					
												Identified as having a depressive disorder (Pioneer 2012 performance year/ Pioneer 2013 performance year/MSSP 2012 entry cohort/ MSSP 2013 entry cohort)	0/0/-/0					

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67	2015	Mc Williams	QN	USA	Pioneer	Not reported	Global payment + shared savings	To	Fee-for-service Medicare beneficiaries	768,054 beneficiary-years	19,152,460 beneficiary-years	Total spending 30-day readmissions	0	+			B1
												Hospitalizations for ambulatory-care sensitive conditions	0				
												CHF hospitalizations	0				
												COPD or asthma hospitalizations	0				
												Cardiovascular disease or diabetes hospitalizations	0				
												Screening mammography (for women 65-69 years)	0				
												HbA1C testing	+				
												LDL-C testing	+				
												Diabetic retinal examination	+				
68	2016	Mc Williams	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Fee-for-service Medicare beneficiaries	884,810 (2012 cohort) and 1,015,722 beneficiary-years (2013 cohort)	10,924,440 (2012 cohort) and 14,587,259 beneficiary-years (2013 cohort)	Total spending (2012/2013 entry cohort) 30-day readmissions	0	+/0			B1
												Hospitalizations for ambulatory-care sensitive conditions	0				

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												CHF hospitalizations	0				
												COPD or asthma hospitalizations (2012/2013 entry cohort)	+/0				
												Cardiovascular disease or diabetes hospitalizations	0				
												Screening mammography (for women 65-69 years)	0				
												HbA1C testing	0				
												LDL-C testing (2012/2013 entry cohort)	+/0				
												Diabetic retinal examination (2012/2013 entry cohort)	0/+				
												Low-value services provided	0				
79	2018	Lam	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Medicare FFS beneficiaries ≥ 65 years with cancer	388,784 patients	233,296 patients	Lung cancer spending	0	0			B1
												Hematologic cancer spending	0				
												Gastrointestinal cancer spending	0				

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												Breast cancer spending	0			
												Genitourinary cancer spending	0			
												Gynaecologic cancer spending	0			
												Head and neck cancer spending	0			
												Sarcoma spending	0			
												Melanoma spending	0			
												Central nervous system cancer spending	0			
												Metastatic disease (primary unknown) spending	0			
												Total spending	0			
												Inpatient spending	0			
												Outpatient cancer spending	0			
												Physician services spending	0			
												SNF spending	0			

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												HHA spending	0				
												Hospice spending	0				
												Radiation therapy spending	0				
												Chemotherapy spending	0				
69	2018	Duggal	QN	USA	Pioneer, MSSP	Not reported	Global payment + shared savings	To ACO-affiliated hospitals	129 Pioneer-affiliated hospitals and 342 MSSP-affiliated hospitals	3,907 hospitals		Heart failure 30-day readmission rate (MSSP/Pioneer)	+/0				B1
												AMI 30-day readmission rate (MSSP/Pioneer)	0/0				
												Pneumonia 30-day readmission rate (MSSP/Pioneer)	0/0				
81	2018	Mc Williams	QN	USA	MSSP	Physician-group ACOs (narrow scope of provided services) and hospital-integrated ACOs (wider scope of provided services)	Global payment + shared savings	To Fee-for-service Medicare beneficiaries	Hospital-integrated ACOs (132) and physician-group ACOs (203)	Not specified		Physician group ACO spending (2012/13/14 entry cohort)	+ / + / +				B1
												Hospital-integrated ACO spending (2012/13/14 entry cohort)	+ / 0 / 0				

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94	2019	Modi	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Medicare part A and B FFS beneficiaries ≥ 66 years under going meniscotomy, vertebroplasty or hip fracture procedure	21,486 meniscotomy, 12,521 vertebroplasty and 13,930 hip fracture patients	54,770 meniscotomy, 32,018 vertebroplasty and 36,830 hip fracture patients	Arthroscopic partial meniscotomy (low-value procedure) use Vertebroplasty (low-value procedure) use	0	0			B1
70	2016	Herrel	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Patients aged 66 to 99 years that underwent major cancer surgery for nine solid organ cancers	19,439 patients	365,080 patients	30-day mortality 30-day readmissions 30-day major complications Hospital length of stay	0 0 0 0				B1
76	2018	Borza	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Medicare part A and B FFS beneficiaries ≥ 66 years with prostate cancer	5,065 patients	27,946 patients	Treatment rate in highest mortality risk (overtreatment) Overall payments Payments in highest mortality risk	+	0	0		B1
78	2016	Colla	QN	USA	Pioneer, MSSP	Not reported	Global payment + shared savings	To	(1) Medicare part A and B FFS beneficiaries and (2) Medicare part A and B FFS beneficiaries ≥ 66 years with multiple clinical conditions (clinically vulnerable)	Not specified	Not specified	Total spending (Pioneer 2012 entry cohort/ MSSP 2012 entry cohort/ MSSP 2013 entry cohort)			+ / + / +		B1

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95	2018	Resnick	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Medicare Part A and B beneficiaries > 65 years	13,460,798 person-years	40,010,199 person-years	Breast cancer screening use among appropriate candidates	+				B1
												Colorectal cancer screening use among appropriate candidates	+				
												Prostate cancer screening use among appropriate candidates	0				
82	2015	Schwartz	QN	USA	Pioneer	Not reported	Global payment + shared savings	To	Medicare Part A and B beneficiaries	693,218 person-years	17,453,423 person-years	Total low-value services use	+				B1
												Total low-value services spending		+			
												Cancer screening use	+				
												Testing use	+				

+/+/+

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0

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													Preoperative services use	0			
													Imaging use	+			
													Cardiovascular tests and procedures use	+			
													Other invasive procedures use	0			
													Higher-priced low-value services use	0			
													Lower-priced low-value services use	+			
													More patient sensitive low-value services use	+			
													Less patient sensitive low-value services use	+			
80	2017	Mc Williams	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Medicare Part A and B beneficiaries	Not specified	Not specified	SNF spending (2012/2013/2014 entry cohort)			+/+0		B1
71	2019	Markovitz	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Medicare beneficiaries	835,100 beneficiaries	Not reported	Total spending	0				B1
												HbA1C testing (% meeting quality indicator)	0				
													LDL-C testing (% meeting quality indicator)	-			

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												Diabetic retinal examination (% meeting quality indicator)	0				
												All 3 diabetes measures (% meeting quality indicator)	0				
												Mammography (% meeting quality indicator)	0				
96	2018	Barnett	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Medicare FFS Part A and B beneficiaries	Not specified	Not specified	All specialist visits in primary care oriented ACOs (2012/2013/2014 entry cohort)	+0/0				B1
												All specialist visits in specialty oriented ACOs (2012/2013/2014 entry cohort)	0/0/0				
												New specialist visits in primary care oriented ACOs (2012/2013/2014 entry cohort)	+0/+				

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97	2017	McWilliams	QN	USA	MSSP	Not reported	Global payment + shared savings	To	Medicare FFS Part A, B and D beneficiaries with cardiovascular disease or diabetes	Not specified	Not specified	Statin use (2012/2013/2014 entry cohort)	0/0/0	0/0/0			B1
												Statin PDC (2012/2013/2014 entry cohort)	0/0/0				
												ACE inhibitor/ARB use (2012/2013/2014 entry cohort)	0/0/0				
												ACE inhibitor/ARB PDC (2012/2013/2014 entry cohort)	0/0/0				
												β-Blockers use (2012/2013/2014 entry cohort)	0/0/0				
												β-Blockers PDC (2012/2013/2014 entry cohort)	+0/0/0				
												Thiazide diuretics use (2012/2013/2014 entry cohort)	0/+0/0				

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												Thiazide diuretics PDC (2012/2013/2014 entry cohort)	0/0/0					
												Calcium channel blockers use (2012/2013/2014 entry cohort)	0/0/0					
												Calcium channel blockers PDC (2012/2013/2014 entry cohort)	0/0/0					
												Metformin use (2012/2013/2014 entry cohort)	0/0/0					
												Metformin PDC (2012/2013/2014 entry cohort)	+/+0					
72	2015	Nyweide	QN	USA	Pioneer	Not reported	Global payment + shared savings	To	Medicare FFS beneficiaries	675,712 beneficiaries in 2012 and 806,258 beneficiaries in 2013	13,203,694 beneficiaries in 2012 and 12,134,154 beneficiaries in 2013	Total Medicare spending (2012/2013 performance year)		+/+				B1
												All inpatient hospital (Part A) spending (2012/2013 performance year)		+/+				

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												Physician (Part B) spending (2012/2013 performance year)	+/+			
												Hospital outpatient spending (2012/2013 performance year)	+/0			
												SNF spending (2012/2013 performance year)	+/0			
												Home health spending (2012/2013 performance year)	+/0			
												Hospice spending (2012/2013 performance year)	+/0			
												Durable medical equipment spending (2012/2013 performance year)	+/+			
												Acute care inpatient days (2012/2013 performance year)	+/+			

(Contd.)



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												Inpatient admissions through ED (2012/2013 performance year)		+/+				
												IRF or LTC facility days (2012/2013 performance year)		0/+				
												All-cause 30-day readmissions (2012/2013 performance year)	0/0					
												Post discharge physician visits within 7 days (2012/2013 performance year)	+/+					
												Post discharge physician visits within 14 days (2012/2013 performance year)	0/+					
												Post discharge physician visits within 30 days (2012/2013 performance year)	0/0					

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												Primary care evaluation and management visits (2012/2013 performance year)	+/+				
												Procedures use (2012/2013 performance year)	+/+				
												Imaging services use (2012/2013 performance year)	+/+				
												Tests use (2012/2013 performance year)	+/+				
												ED visits (2012/2013 performance year)	+/+				
												Observation stays (2012/2013 performance year)	0/-				
												SNF days (2012/2013 performance year)	+/0				
												Home health visits (2012/2013 performance year)	+/0				

(Contd.)

REFERENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PROGRAM	NETWORK CONFIGURATION	PAYMENT MODEL(S)	FLOW	STUDY POPULATION	INTERVENTION	CONTROL	INDICATOR	QUALITY OF CARE	UTILIZATION	SPENDING	OTHER	EPOC
												Hospice days (2012/2013 performance year)	+/0				
98	2018	Lin	QN	USA	MSSP	Not reported	Global payment + shared savings	To	ACO-affiliated rural health clinics (RHCs)	19 RHCs	484 RHCs	Risk-adjusted diabetes hospitalization rate	0				B2
73	2013	Colla	QN	USA	PGPD	Not reported	Global payment + shared savings	To	Medicare FFS beneficiaries with cancer	123,249 beneficiaries	865,532 beneficiaries	Acute care spending	+				B1
												Imaging spending	0				
												Deaths occurring in hospital	0				
84	2019	Lam	QN	USA	MSSP	Not specified	Global payment + shared savings	To	ACO cancer decedents	12,248 patients	12,248 patients	Total spending	0				B1
												Inpatient spending	0				
												Outpatient spending	0				
												Physician services spending	0				
												SNF spending	0				
												Home health spending	0				
												Hospice spending	0				
												Radiation therapy spending	0				
												Chemotherapy spending	0				

(Contd.)

REFER ENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PRO GRAM	NETWORK CONFIGU RATION	PAYMENT MODEL(s)	FLOW	STUDY POPULATION	INTERVEN TION N	CONTROL N	INDICATOR	QUALITY UTILI OF CARE ZATION	SPENDING	OTHER	EPOC	
												≥1 Emergency room visits (180 days/30 days prior to death) 0/0					
												≥1 Inpatient hospitalizations (180 days/30 days prior to death) -/0					
												≥1 ICU admission (180 days/30 days prior to death) 0/0					
85	2020	Bakre	QN	USA	MSSP	Not specified	Global payment + shared savings	To Medicare fee-for-service beneficiaries on long-term dialysis	26,694 patients	167,817 patients	Total spending	+				B1	
99	2021	Modi	QN	USA	MSSP	Not specified	Global payment + shared savings	To ACO hospitals	707 hospitals	1,770 hospitals	AAA treatment rate	0					B1
												AVR treatment rate	0				
												Carotid endarterectomy/stent treatment rate	0				
												Colectomy treatment rate	0				
												Lung lobectomy treatment rate	0				
												Prostatectomy treatment rate	0				

(Contd.)

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												Proportion of AAA surgery using EVAR	0			
												Proportion of AVR using TAVR	0			
												Proportion of carotid surgery using stenting	0			
												Proportion of colectomy surgery using minimally invasive approach	0			
												Proportion of lobectomy surgery using minimally invasive approach	0			
												Proportion of prostatectomy using minimally invasive approach	0			
86	2021	Chang	QN	USA	MSSP	Not specified	Global payment + shared savings	To	Long-term nursing home Medicare fee-for-service beneficiaries	121,690 patients	121,690 patients	Evaluation & management visits	0			B2
												Proportion of evaluation & management visits to primary care physicians	+			
												Total admissions	+			

(Contd.)

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												ACSC admissions	+				
												30-day readmissions	0				
												Observation stays	0				
												ED visits	+				
												Total spending	0				
87	2021	Erfani	QN	USA	Medicare ACO	Not specified	Global payment + shared savings	To	Medicare fee- for-service beneficiaries aged 65 years or older with cancer	517,623 patients	348,909 patients	Lung cancer spending	0				B1
												Hematologic cancer spending	0				
												Gastroin testinal cancer spending	0				
												Breast cancer spending	0				
												Genitourinary cancer spending	0				
												Gynaecologic cancer spending	0				
												Head and neck cancer spending	0				
												Sarcoma spending	0				
												Melanoma spending	0				

REFER ENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PRO GRAM	NETWORK CONFIGU RATION	PAYMENT MODEL(s)	FLOW	STUDY POPULATION	INTERVEN TION N	CONTROL N	INDICATOR	QUALITY OF CARE	UTILI ZATION	SPENDING	OTHER	EPOC
												Central nervous system cancer spending		0			
												Metastatic disease (primary unknown) spending		0			
100	2021	Acevedo	QN	USA	MSSP	Not specified	Global payment + shared savings	To	Medicare beneficiaries	853,953 patients with disability (D) and 2,917, 299 patients aged 65 years or older <sup>3</sup> (65)	1,675,928 and 5,492,387 patients	Any outpatient mental health visits (D/65) Any outpatient substance use visits (D/65) Any inpatient mental health stays (D/65) Any inpatient substance use stays (D/65) Number of inpatient mental health visits (D/65) Number of inpatient substance use visits (D/65) Adequate care for patients with depression (D/65)	+/- +0 +/ +0 +/ 0/-			B1	

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102	2020	Lee	QN	USA	MSSP	Not specified	Global payment + shared savings	To	Vulnerable ACO beneficiaries in physician group panels	1,024,833 patients	2,912,043 patients	Proportion of black patients	0	0	0		B1
												Proportion of patients that are dually enrolled in Medicare and Medicaid	0				
												Proportion of patients that live in areas with higher poverty rates	0				
												Proportion of patients that live in areas with higher unemployment rates	0				
89	2020	McWilliams	QN	USA	MSSP	Not specified	Global payment + shared savings	To	ACOs across different entry cohorts	114 ACOs (2012 entry cohort), 106 (2013), 115 (2014)	Not specified	Spending (2012 entry cohort) (2013/14/15)	0/+	0/+			B1
												Spending (2013 entry cohort) (2013/14/15)	0/+				
												Spending (2014 entry cohort) (2014/15)	0/0				
75	2019	Zhang	QN	USA	Commercial ACO	HMO, large independent practice association of physicians and hospital system	Global payment + shared savings	To	Enrolled members of commercial HMO	40,483 patients	20,275 patients	Inpatient and outpatient payments (2010/11/12/13/14)	-/-	0/0/0			
												PCP visits (2010/11/12/13/14)	0/0/0/-				

(Contd.)



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												Specialist visits (2010/11/12/ 13/14)		-/-/-/-			
												ED visits (2010/11/12/ 13/14)		0/0/ /0/0			
												Inpatient admissions (2010/11/12/ 13/14)		0/0/0/0/ -			
												30-day readmissions (2010/11/12/ 13/14)		0/0/0/0/0			
												Breast cancer screening (2010/11/12/ 13/14)		0/0/0/+/ +			
												Cervical cancer screening (2010/11/12/ 13/14)		0/0/0/+/ +			
												Colorectal cancer screening (2010/11/12/ 13/14)		0/0/0/+/ +			
												HPV vaccine (2010/11/12/ 13/14)		0/0/0/0/+			
												Immunizations (combination 1) (2010/11/12/ 13/14)		+/0/+/0/+			
												Meningococcal immunizations		+/0/+/0/+			

(Contd.)

REFER ENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PRO GRAM	NETWORK CONFIGU RATION	PAYMENT MODEL(s)	FLOW	STUDY POPULATION	INTERVEN TION N	CONTROL N	INDICATOR	QUALITY OF CARE	UTILI ZATION	SPENDING	OTHER	EPOC
												Td/Tdap immunizations	0/0/0/0/0				
												HbA1c testing	0/0/0/0/ 0				
												Medical attention for nephropathy	0/0/0/0/ +				
88	2021	Zhang	QN	USA	Commer cial ACO	HMO, large independent practice association of physicians and hospital system	Global payment + shared savings	To	Enrolled members of commercial HMO	11,958 patients	20,275 patients	Generic drug use (2010/11/12/ 13/14)	0/0/0/0/ 0				
												Generic drug spending (2010/11/12/ 13/14)	0/+0/0/0/0				
												Brand drug use (2010/11/12/ 13/14)	0/0/0/0/ 0				
												Brand drug spending (2010/11/12/ 13/14)	0/0/0/0/0				
												Total prescription drug use (2010/11/12/ 13/14)	0/0/+0/0/ 0				
												Total prescription drug spending (2010/11/12/ 13/14)	0/0/0/0/0				
												Medication adherence (2010/11/12/ 13/14)	-/-/-/0/0				

(Contd.)

REFER ENCE #	YEAR	FIRST AUTHOR	METHOD	COUNTRY	PRO GRAM	NETWORK CONFIGU RATION	PAYMENT MODEL(s)	FLOW	STUDY POPULATION	INTERVEN TION N	CONTROL N	INDICATOR	QUALITY OF CARE	UTILI ZATION	SPENDING	OTHER	EPOC
74	2020	Marrufo	QN	USA	ESRD Seamless Care Organi zation (ESCO)	Dialysis facilities, nephro logists, and other providers	Global payment + shared savings	To	Medicare fee- for-service beneficiaries	73,094 bene ficiaries	60,464 bene ficiaries	Radiation therapy use (180 days/30 days prior to death)  Chemotherapy use (180 days/30 days prior to death)  Hospice use (180 days/30 days prior to death)  ESRD hospitalization complications payment  Total dialysis payment  Hospitali zations  Readmissions  ED visits  Emergency dialysis  Dialysis sessions  Catheter placement  Vascular access complications	0/0  0/0  0/0  +  -  +  0  0  0  +  +  0			B1	

used to make disbursements to individual providers in the network. Levin-Scherz et al. [51] only studied the utilization of diabetes-related services: screening and testing were successfully intensified, but a form of asthma therapy was unaffected. The results from the seven other studies are mixed in terms of both quality and utilization [44, 52–57]. Marton et al. [44] observed an unsought increase in the utilization of health care professionals, whereas utilization of outpatient clinics and length of stay were successfully reduced. Substance use disorder (SUD) screening, blood lead level screening and visits that focus on prevention (well care visits) increased as hoped. However, treatments for ADHD and SUD were not affected [54, 56]. An overall composite measure of quality showed desired improvements [53], but a more detailed look reveals that the prevalence of asthma, pharyngitis, upper respiratory infection, and rotavirus were not affected, and the performance related to several types of immunizations varied widely [56]. Spending was investigated in one study, which found no significant effects on shared savings or outpatient spending [57].

### **Global payment with shared savings**

Under this payment model, quality tended to improve and, if not, to remain stable [40, 58–75]. The same was true for spending [59–61, 66–68, 72–89], whereas the effects on utilization were more diverse [41, 58–61, 63, 67, 68, 72, 74–76, 82–84, 86, 88, 90–100]. Although quality improved overall, some negative outcomes could be observed. For instance, the percentage of patients that met the quality indicator for LDL-cholesterol testing and the number of people identified as having a depressive disorder had not improved, the latter hinting at an under-detection of depressive disorders [66, 71]. Furthermore, medication adherence deteriorated in the first three years after payment model implementation, and adequate care for patients with depression was also negatively affected [88, 100].

Findings related to spending performance were clearly mixed. Some studies indicated that spending was successfully curbed overall [59, 73, 74, 85], whereas other studies showed no improvements in general [66, 71, 77, 79, 84, 86–88]. McWilliams et al. [68] found a more nuanced situation: declining spending rates for networks adopting this payment model in 2012 but not in those starting in 2013. These effects of the timing when a network adopts the model are visible specifically in the spending trends of hospital-integrated ACOs (as opposed to physician group ACOs) and for skilled nursing facilities [80, 81]. Overall, shared savings arrangements with increased risk exposure show a more positive effect on spending than arrangements with less provider risk [67, 72, 82]. For arrangements with increased risk exposure, the differences in spending performance could be explained by the number of years using, and

hence experience with, the model [66, 72] and also by spending category (Medicare part D or A/B spending) [83].

Performance in terms of utilization varied widely, especially for visits and hospitalizations [58–60, 72, 96]. Some differences in visit rates seem to be explained by location and ACO-orientation (primary care or specialty-oriented) [60, 96]. Furthermore, use of low-value care (i.e., care that does not or only minimally benefits patients) was not affected according to Modi et al. [94] whereas Schwartz et al. [82] did show favourable reductions. Heightened levels of provider risk did seem to play an important role in increasing testing: some studies showed that the amount of testing was successfully increased [59, 67], although others contradicted this [68]. Findings on performance in terms of screening for breast cancer are contradictory. One study [93] observed an unwanted decrease in mammography screening, whereas other studies demonstrate desirable increases in screening [75] or appropriate screening (which refers to the practice of increasing screening rates for patients likely to benefit and decreasing screening rates for those unlikely to benefit) [41, 95]. Rates for other types of cancer screening (cervical, prostate and colorectal) were successfully increased [75, 93, 95].

For all three categories (quality, utilization, and spending), indicator-level differences are in part attributable to geographical state [60], entry cohort [66, 68, 80, 81, 89, 96, 97], and performance year [66, 72, 75, 88, 89]. It was observed that performance does not necessarily improve with time, the effects may slip back from one year to the next. In terms of utilization, the type of disease that is being screened for [93, 95] or the type of low-value service [82] seem to explain indicator-specific differences. Differences in quality at the indicator level (e.g., the number of readmissions) can be linked to the type of surgical procedure [61] or to the level of risk [66, 69]. In shared savings arrangements with little provider risk, two of the ten measures of patient experience improved whereas, when there were higher levels of risk, improvements in patient experience were lacking [101]. Concerning other consequences, the proportion of vulnerable patients served by physician groups was not significantly changed, neither was the adoption of novel technologies for six surgical procedures [99, 102].

### **Global payment with shared savings and pay-for-performance**

This payment model led to some improvement in utilization rates [103–105], in quality [103, 106–111], and in spending [105–109]. Utilization did improve for tobacco cessation treatment with increased use of related therapies and drug regimens [104]. In contrast, with the exception of LDL-cholesterol testing, this model had no effect on testing and screening, overall drug utilization, and admission rates for ambulatory-care-sensitive

conditions (ACSCs) [103, 106, 112, 113]. The model's effects on substance use disorder services depended on the patient population [103]. The majority of quality indicators showed positive results. Adult preventive care quality (an aggregate indicator for several screening measures and antibiotic use) improved over time [107–109] and Chien et al. [110] revealed that quality in terms of measures linked to P4P improved but that no effects were observed for quality measures not tied to P4P. Except for patients up until 21 years of age, total medical spending was successfully contained under this payment model [110]. For specific spending indicators, the findings varied, with SUD spending and drug spending trends unaffected [103, 112]. Turning to other consequences, Blewett et al. [114] showed that adopting this payment model in the setting of the Integrated Health Partnership in Minnesota led to the forming of community partnerships and service integration.

### **Global payment with shared savings and pay-for-coordination**

Only one study, on the Total Cost and Care Improvement (TCCI) initiative, investigates a model that combined a global payment with shared savings and pay-for-coordination. Afendulis et al. [115] showed that this specific model had no effects on either utilization or spending, while quality was not investigated.

## **DISCUSSION**

This review compiles the current evidence on the effect of various network-level payment models on the performance of care networks. The empirical results on performance for a set of payment models are mixed. Overall, no single payment model was associated with consistent improvements in network performance on all three criteria categories (utilization, spending, and quality). However, a more detailed look at the individual categories reveals some insights. First concerning quality, the papers reviewed found that, depending on the quality indicator investigated, quality generally increased or at least remained stable under whichever payment model they were investigating. The same can be said for utilization. Furthermore, all but two payment models showed improved performance in terms of spending. A negative effect on spending performance was found when adopting the disease-based bundled payment model, which failed to curb spending in most instances. Looking at other consequences of these payment models for care networks, some had identified improvements in performance indicators related to collaboration. However, these conclusions were almost entirely related to the effect of making payments to the network, and the very few studies that investigated payments within the network only addressed the P4P model.

Our findings support most, but not all, of the theory-based expectations of the effects of payment models on network performance. The expectation is that, under risk-based payment models such as capitation, disease-based bundled payment, and global payment, providers will be incentivized to minimize costs, control their volume by proactively monitoring utilization and spending, and invest in prevention to curb downstream health care use [13, 20, 116]. However, our analysis indicates that only capitation proved able to improve performance in terms of both spending and utilization. When applying disease-based bundled payments, performance in terms of utilization improved as predicted, but spending was not contained. In their study, Mohnen et al. [46] suggest that these results could be due to the negotiated contract working out well for the provider (a high bundle price) and that the short length of their study following the introduction of the scheme might not reveal longer term effects. Turning to the global payment approach, performance in terms of spending and utilization in the various studies was found to generally improve or at least remain stable. In the studies where shared savings had been added to the basic global payment approach, we found that shared savings arrangements where there was a significant risk element showed somewhat better performance in terms of spending compared with arrangements with less risk. This finding corresponds with the view that risk sharing arrangements induce cost-conscious behaviour [117]. The payment models discussed above are, by their very nature, more focused on cost containment than on quality improvement [13, 118]. This focus has the associated risk of stinting on care [12]. However, our results do not reveal any adverse effects on the quality of care: quality improved or remained stable, with no clear differences between the models.

P4P has gained much attention in the scholarly literature as it is expected to enhance performance by financially incentivizing providers to deliver the best care. However, the evidence from our analysis is not consistently positive, a finding that is in line with earlier reviews of P4P [119, 120]. Further, our results do not convincingly demonstrate that P4P has added value over approaches based on a global payment plus shared savings. That is, no meaningful performance differences could be discerned between global payment plus shared savings arrangements with or without additional P4P. Cattel and Eijkenaar [8] offered a potential explanation for this: that P4P is only a small part of the total reimbursement received by a provider. Following this line of reasoning, the P4P incentive in relation to global payment plus shared savings might thus have been too small to have a significant impact on performance.

Also, our results show that the relation between payment models and effects is not necessarily stable but depends on several other factors. For instance, our results

suggest that the cohort entry year (starting year of the payment model), scope of services explain differences in performance, and timing of the performance assessment (years since implementation of a payment model). In terms of entry cohort, our review shows that early ACO entrants seem to do better overall in improving performance. Related to this, McWilliams et al. [81] found that, for ACOs offering a wide range of services (hospital-integrated ACOs) – but not for narrow-scoped ACOs – there were performance differences between early and late adopters. Others have also identified scope of services as one of eight organizational attributes that might possibly explain performance differences between early and late adopters, alongside other attributes such as prior experience with payment reform [121, 122]. In terms of changes in the years following the introduction of network payments, it seems that initial performance improvements tail off in later years. Thus, improvements might not continue and may even recede as time goes by. These studies that give insight in performance on the longer term, have a maximum span of three to five years. Other than this, evidence on the sustainability of incentives that derive from the payment models is lacking. More research on incentive sustainability and, accordingly, longer term impact on performance is warranted. Next to ‘how long’ performance is observed, it is important to emphasize ‘what’ performance is observed, or, neglected. Except for indicators of quality, patient-reported experience and outcome measures (PREMs and PROMs) have hardly been encountered in our study. As such, it can be argued whether the patient perspective is sufficiently covered in the indicators.

This review has several limitations. First, the insights are mainly drawn from studies in the USA. ACOs were formed after the passing of the Affordable Care Act in 2010 as an instrument to improve patient care but also to reduce costs, in order to tackle the ‘affordability crisis’ of the US health system [123]. This context might possibly explain the focus of the USA setting in our review, which limits generalizability. Another limitation is that the implementation of alternative payment models was generally part of a myriad of concurrent interventions, making it difficult to disentangle the effect of a payment model from those associated with other interventions. Additionally, the studies that investigated non-commercial ACOs (Medicare Shared Savings Program and Pioneer) were not explicit as to whether the risks associated with shared savings were one- or two-sided. Hence, we cannot draw any inferences on the relation between the sidedness of risk and performance.

It seemed that networks are generally able to improve their performance under the investigated payment models, it only occasionally remained unchanged and rarely deteriorated. It would be valuable to investigate

what circumstances are required to achieve a certain performance. This aspect was emphasized by Kaufman et al. [15, p.270] who state that “looking at outcomes alone misses important information regarding what it takes to produce those outcomes”. Here, further research could adopt a mixed-methods approach, combining qualitative research, to uncover contexts, mechanisms, and interpersonal dynamics within networks, with quantitative methods that measure quality, utilization, and spending outcomes on the network level. This contextual and interpersonal perspective would be a valuable addition to studies that have comprehensively investigated the more technical aspects of payment reform such as key design features of payment models [14, 124, 125]. Furthermore, although bundled payment evaluations are omnipresent in the literature, more research is needed into multi-provider bundled payments, as most evaluations focus on single provider bundled payments. Additionally, to date, provider participation in reformed payment methods is largely voluntary, although policymakers are exploring the possibilities of mandatory participation [126]. Developing a ‘theory-based understanding’ [127] of contexts and mechanisms – payment being one of many mechanisms [128] – under which certain outcomes are produced could help providers prepare for future, possibly mandatory, payment reform.

## CONCLUSION

The aim of this study was to unravel the effects that network-level payment models have on the multidimensional (quality, utilization, spending, *other*) performance concept in care networks. Although network-level reimbursement schemes are still in their infancy, our review shows that network-level payment has the potential to improve network performance. Given that health care networks are becoming increasingly common, it seems fruitful to continue experimenting with network-level payment models. In future studies, it will be important to broaden the scope beyond only outcomes and to also take contexts and the mechanisms through which networks adopt and implement payment models into account.

## NOTES

- 1 For this study, first symbol indicates results of comparison with control group that received exclusively fee-for-service payments, second symbol indicates results of comparison with control group that were salaried.
- 2 For this study, first symbol indicates results for patients facing behavioral health risks and second symbol indicates results for patients not facing behavioral health risks.
- 3 This study has also stratified post-hoc for ethnicity/disparity.

## ADDITIONAL FILE

The additional file for this article can be found as follows:

- **Supplementary File.** Search strings. DOI: <https://doi.org/10.5334/ijic.6002.s1>

## ACKNOWLEDGEMENTS

We would like to thank Wichor Bramer, biomedical information specialist at the Erasmus Medical Centre Rotterdam, for his invaluable advice on search strategies and his help in drafting the search strings.

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## COMPETING INTERESTS


The authors have no competing interests to declare.

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**TO CITE THIS ARTICLE:**

Reindersma T, Sülz S, Ahaus K, Fabbrocotti I. The Effect of Network-Level Payment Models on Care Network Performance: A Scoping Review of the Empirical Literature. *International Journal of Integrated Care*, 2022; 22(2): 3, 1–61. DOI: <https://doi.org/10.5334/ijic.6002>

Submitted: 17 June 2021

Accepted: 16 March 2022

Published: 01 April 2022

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*International Journal of Integrated Care* is a peer-reviewed open access journal published by Ubiquity Press.

