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Impact of prospective payment systems: An umbrella review of systematic reviews

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ABSTRACT

Background: Prospective payment systems are widely used in OECD countries and beyond to reimburse hospital care.
Objective: To evaluate the impact of prospective payments systems on the quality of patient care, healthcare efficiency, volume of activity, and hospital costs.
Methods: Umbrella review by searching three electronic databases for systematic reviews with or without meta-analyses published between 2014 and July 2025. The quality of the included studies was assessed with AMSTAR 2, and tables were constructed to display the characteristics and results of the retrieved publications.
Results: Ten systematic reviews were identified that evaluated the impact of prospective payment systems on healthcare efficiency, quality of care, volume of activity and costs. Most of the included reviews drew upon relatively recent primary studies and were of moderate to high methodological quality. Regarding efficiency, most reviews demonstrated that the implementation of prospective payment systems leads to a reduction in hospital length of stay. The umbrella review did not identify substantial evidence of a negative impact on the quality of care. The impact on healthcare costs was less consistently reported, and findings were inconclusive. The evidence on activity volume is also mixed.
Conclusions: This review supports the theoretical assumption that prospective payment systems incentivise greater efficiency in healthcare delivery, without detrimental effects on quality of care. However, these conclusions are limited by the heterogeneity of the included payment programmes, contexts, and accompanying interventions, that make it challenging to attribute observed impacts directly to the payment system.

Research in context

What is already known about the topic?

Prospective payment systems (PPS) are widely used to reimburse hospital care. Advocates argue that PPS controls healthcare costs and promotes efficiency. It might also enhance quality of care, as hospitals are incentivised to invest in quality improvement that could reduce costs. However, efficiency gains may also come at the expense of quality. In addition, hospitals are incentivised to increase activity volume, which can be challenging in the context of tight budgets.

What does this study add to the literature?

This review supports the theoretical assumption that PPS incentivise greater efficiency in healthcare delivery, without damaging care quality. The impact on healthcare costs was less consistently reported, and findings were inconclusive. Evidence on activity volume is mixed.

What are the policy implications?

This review provides a thorough understanding of PPS impacts, that will be of value in facilitating the implementation or reforms of such payment systems. If the policy objective is to enhance efficiency – like reducing the length of stay – adopting PPS can be a viable option. However, it is crucial to implement complementary measures to safeguard quality (e.g. monitoring systems) and ensure effective cost control (e.g. volume caps).

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1. Background

Hospital expenditures represent about 40 % of total health spending in OECD countries [1]. Consequently, the design of hospital payment mechanisms and their impact on how care is delivered are of crucial importance. Some form of prospective payment system (PPS) is commonly used in OECD countries and beyond [2]. In this reimbursement approach, healthcare providers receive a predetermined payment for the services they deliver to patients, regardless of the individual costs incurred. Such system is often based on Diagnosis Related Groups (DRGs) or similar classifications such as Diagnosis-treatment combinations (DBC) in the Netherlands, Hospital Resource Groups (HRGs) in England, or Homogeneous groups of patients (GHMs) in France [3]. These groups are designed to be clinically homogeneous and consistent in terms of resource utilisation, with each group assigned a fixed reimbursement rate per case.

Prospective payment systems aim to control healthcare costs and promote efficiency in service delivery [3]. Other common objectives for introducing PPS include improving transparency and accountability of hospital activities and achieving a fairer allocation of resources, depending on the payment system in place before the introduction of PPS. However, these systems can have potential side effects such as quality reduction, cost-shifting, patient selection, or up-coding. Additionally, hospitals are incentivised to increase their volume of activity, which can be challenging in the context of tight financial budgets.

In response to these challenges, many countries are exploring reforms in hospital payment methods to better align payment system incentives with the shift towards value-based care. One of these reform trends involves decreasing the overall proportion of PPS in inpatient payments [4].

This umbrella review comprehensively analyses the literature on the effects of prospective payment systems on the quality of patient care, healthcare efficiency, volume of activity, and hospital costs. The aim of an umbrella review is to consolidate evidence from multiple systematic reviews and meta-analyses into a single, cohesive summary [5]. By doing so, this review seeks to provide a thorough understanding of the impact of PPS and inform policymakers and healthcare providers about the potential benefits and challenges associated with this payment model.

2. Methods

2.1. Search strategy

A search for published systematic reviews with or without meta-analyses that included primary studies with designs such as pre/post, interrupted time series, experimental, and cohort designs, was conducted in September 2024 and updated in August 2025 using the electronic databases Medline, EconLit and Scopus. Systematic reviews published between 2014 and July 2025 were searched. Additionally, reference lists of studies included in the reviews were screened after the initial title and abstract sift to identify further studies. The complete search strategies are detailed in the Supplementary material. The protocol was not registered but is available upon request.

Table 1 shows inclusion and exclusion criteria, using the PICO framework.

- P: population (humans admitted in acute, general, or academic hospitals as inpatient). Reviews focusing on specific procedures or medical conditions were identified and a decision to include them was made after the identification of the number of general systematic reviews. As this number was below 10, pathology-specific reviews were added to the study selection. Reviews focusing on specific geographical regions or on low- and middle-income countries were excluded. In particular, when more than 85 % of the included primary studies focused on low- or middle-income countries, the review was excluded.
- I: intervention (any prospective payment system intervention). A PPS is a payment system where payment rates are determined ex ante and there is no link with the individual costs of a provider or case. These systems often rely on Diagnosis Related Groups (DRGs) or other similar patient classification systems.
- C: comparison (other payment systems). Examples of alternative payment systems are retrospective payment; cost-based reimbursement of hospitals; payment per service as the unit of payment.
- O: the outcomes of interest are quality of healthcare (unscheduled readmissions within 30 days, in-hospital mortality, all-cause mortality, 30-day mortality, etc.), efficiency (e.g. length of stay), volume of activity (e.g. number of admissions) and costs. Secondary outcomes are complications, symptom relief, change in discharge destination (e.g. from home to nursing home), patient satisfaction.

Table 1
In- and exclusion criteria.

	Inclusion	Exclusion
Population	Humans	Pathology specific reviews (e.g. cholecystectomy) will be excluded depending on the availability of general reviews Reviews focusing on low- and middle-income countries or on specific geographical regions
Healthcare setting	• General hospitals • Acute hospitals • Academic hospitals	• Nursing homes • Day cases (without inpatient care included in the review) • Outpatient care • Skilled nursing facilities • Psychiatric hospitals
Intervention	Introduction of prospective payment (e.g. DRG)	Other interventions including per diem payment
Comparator	Inpatients treated under alternative systems	
Outcome	Primary: • Length of stay • Mortality • Readmissions • Complications • Activity (Hospital discharges) • Costs Secondary: • Symptom relief • Satisfaction • Discharge destination	
Design	Systematic reviews including primary studies with following designs: before-after design; interrupted time series; experimental studies; cohort designs	Primary studies and narrative reviews, realist reviews, (non-systematic) scoping reviews, integrative reviews, meta-syntheses, systematic reviews published by one author or based on one database, letters to the editor, case reports, conference abstracts, editorial reports, etc.
Time		Systematic reviews published before 2014
Language	Dutch, French, English	Other

Language restrictions were set to English, Dutch and French. The study settings were limited to reviews focusing on studies conducted in acute inpatient hospital settings, while excluding those carried out in psychiatric hospitals, nursing homes, skilled nursing facilities, day cases, and outpatient care.

In addition, a search for recent primary studies (published between 30 December 2022 and 31 July 2025) was conducted in August 2025 using the same electronic databases and similar inclusion and exclusion

criteria. The starting date for this search corresponds to the most recent date searched in selected general systematic reviews. As the results from these primary studies fall outside the scope of the umbrella review, they are available as Supplementary material.

2.2. Selection

After exporting the search results from the consulted databases into a single Rayyan folder, duplicates were removed. Systematic reviews, with or without meta-analyses, were retained for inclusion. The inclusion process was conducted independently and in parallel by two authors (ML reviewed all articles, KV and CV each reviewed part of them), beginning with a review of titles and abstracts. Subsequently, the full texts of any relevant or unclear studies identified through our search were independently examined by two authors (ML and KV). Reasons for excluding full texts were documented and categorised according to predefined inclusion and exclusion criteria (see Table 1). In cases of differing outcomes during the sifting process (both after reviewing titles and abstracts and after full-text inspection), the authors consulted each other to determine eligibility or reasons for exclusion.

For recent primary studies, a similar process was followed. The review of title and abstracts was conducted independently and in parallel by two authors (ML and KV), then the full texts of any relevant or unclear studies identified through this process were independently reviewed by two authors (ML and CV). In cases of differing outcomes, the authors consulted each other.

2.3. Quality appraisal

The quality of each identified relevant systematic review was evaluated using AMSTAR 2. The appraisal was performed independently by two authors (ML and CV). In cases of disagreement, the authors discussed the outcomes to reach consensus. The critical appraisals of the primary studies, as conducted by the authors of the included reviews, were extracted as part of the data extraction process. As the recent primary studies presented in the Supplementary material are not a formal part of the umbrella review, no quality assessment of the retrieved studies was performed.

2.4. Data extraction and synthesis

Data from the included systematic reviews were extracted and organised into a data extraction form. A template for pilot testing data extraction, with two reviews analysed by two authors (ML and KV), was created, discussed within the research team, and refined. One author (ML) handled the data extraction for the remaining reviews. Tables were then constructed to display, for each included systematic review, the quality assessment, the study characteristics, and the study results.

The following data were extracted from all included systematic reviews: searched databases, searched years, number and type of included studies, countries analysed in included studies and risk of bias analysis methods. Additionally, from each systematic review, details about the target population and interventions were gathered, along with the types of study designs and reported results for the respective outcomes. The conclusions from each review, as stated by their authors, were also extracted.

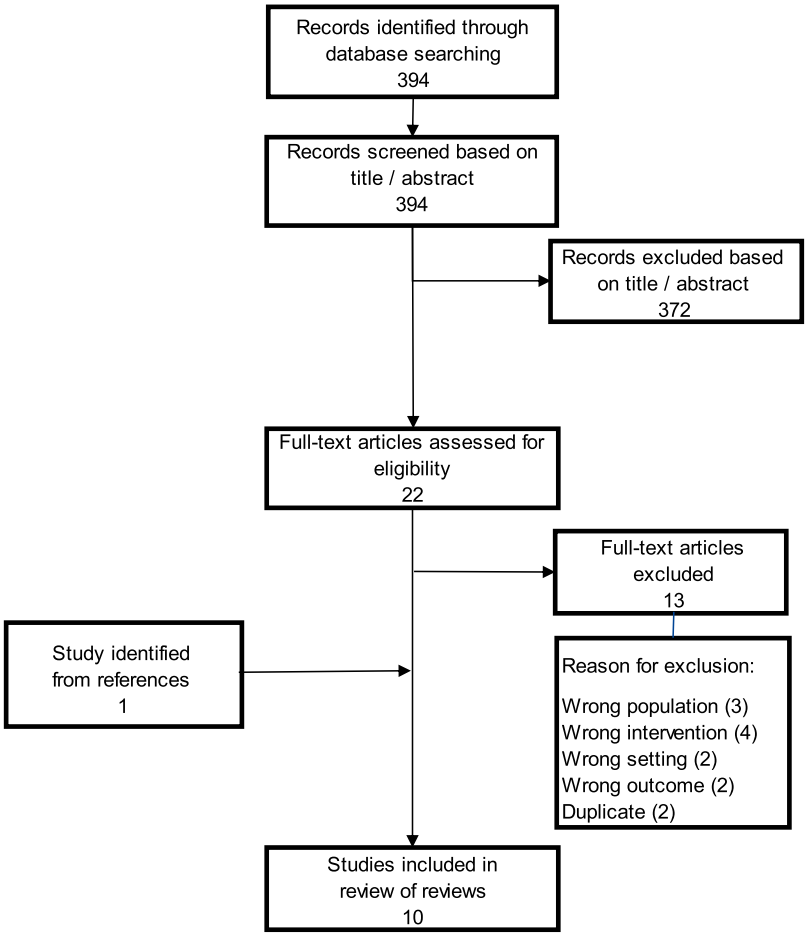

Fig. 1. Study flow of selection.

A similar process was followed for the included recent primary studies although no quality assessment was performed.

3. Results

3.1. Study selection

The study selection process for systematic reviews is presented in Fig. 1. From the electronic database search, 394 potentially relevant references were identified, of which 372 references were excluded based on the title and abstract. Of the remaining 22 systematic reviews, 9 were included based on full-text evaluation and 13 were excluded. Screening of the reference lists identified one additional relevant systematic review. In total, 10 systematic reviews were included.

The study selection process for recent primary studies is presented in the Supplementary material. In total, 4 primary studies were included.

3.2. Characteristics of included reviews

Details about the number and type of included studies, settings, and databases searched for each of the ten selected systematic reviews are provided in the Supplementary material. Six reviews examined mixed populations of hospitalised patients while four reviews focused on specific target groups: one on appendectomy [6]; one on cholecystectomy [7]; one on stroke [8] and one on patients with multimorbidity [9]. However, even in reviews of mixed populations, many primary studies targeted specific groups.

The scope of included payment mechanisms varied. Several reviews [6,10–13] focused only on one payment type (i.e. DRG-like based prospective payment) while other reviews [7–9,14] included several payment systems. For the latter, only sections and results related to prospective payment systems in hospital settings were included. One review [15] covered several prospective payment systems with most primary studies (58/64) focusing on per-case or per-episode PPS, but three investigated per diem PPS, two looked at forms of capitation and one analysed the introduction of a global budget. Although the vast majority of included primary studies (58/64) examined the introduction of a PPS, six investigated a price change within an existing PPS. Additionally, while most primary studies (60/64) focused on acute healthcare settings, four investigated post-acute care settings. As individual primary studies could not always be isolated in the results of the systematic review, all results were included in the analysis.

The umbrella review includes a total of 146 primary studies. Of these, 96 appear in only one of the selected systematic reviews, while 32 are included in two distinct reviews, 15 in three, and 3 in four. The number of primary studies per systematic review varies largely, ranging from 2 to 65. However, none of the systematic reviews include exactly the same set of primary studies, highlighting the absence of complete overlap across reviews.

The studied outcomes also varied across reviews, with most analysing efficiency (length of stay) [6–12,14,15] and/or quality of care (mortality [7–11,13–15], readmission rates [6–15] and/or complications/severity of illness [6,13–15]). Seven reviews analysed costs-related outcomes [6–10,12,14] and seven examined the impact on other settings (outpatient, post-acute and/or emergency department) [6,8–10,13–15]. Only three reviews [7,10,13] looked at volume or

Table 2
AMSTAR 2 evaluation of systematic reviews.

	Agarwal et al. (2020)	Barouni et al. (2021)	Brown et al. (2022)	Chen et al. (2023)	Lino et al. (2023)	Meng et al. (2020)	Palmer et al. (2014)	Pott et al. (2023)	Remers et al. (2022)	Zhao et al. (2024)
1. Research question and inclusion criteria include components of PICO	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Explicit statement on protocol prior to conduct of review	No	No	Yes	Partial yes	Partial yes	Partial yes	Yes	No	No	Yes
3. Explain selection study design (RCT and/or observational)	No	No	Yes	Yes	No	Yes	Yes	No	Yes	No
4. Comprehensive literature search strategy	Partial yes	Partial yes	Partial yes	Partial yes	Partial yes	Partial yes	Yes	Partial yes	Partial yes	Partial yes
5. Study selection in duplicate	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6. Data extraction in duplicate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7. List of excluded studies	No	No	No	No	No	Partial yes	No	No	No	No
8. Details included studies	Yes	No	Partial yes	Yes	Yes	Yes	Yes	Yes	Partial yes	Yes
9. Satisfactory technique to assess Risk of Bias included studies	No	Yes	Partial yes	Yes	Yes	Yes	No	Yes	Yes	Yes
10. Source of funding included studies	No	No	No	No	No	No	No	Yes	No	No
11. Appropriate methods for statistical combination of results (meta-analysis)	NA	NA	NA	Yes	Yes	Yes	Yes	NA	NA	Yes
12. Assess potential impact of risk of bias individual studies on the results of meta-analysis	NA	NA	NA	No	No	Yes	No	NA	NA	Yes
13. Account for risk of bias individual studies when interpreting/discussing results of the review	No	No	No	No	No	Yes	No	Yes	Yes	Yes
14. Satisfactory explanation for heterogeneity observed	No	No	No	Yes	No	Yes	Yes	No	Yes	No
15. Adequate investigation of publication bias	No	No	No	No	No	Yes	Yes	No	No	Yes
16. Report potential sources of conflict of interest including funding	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of items with yes or partial yes	**5**	**5**	**8**	**11**	**9**	**15**	**11**	**9**	**10**	**12**

admissions and one [15] at users' satisfaction.

The characteristics and results of the recent primary studies can be found in the Supplementary material.

3.3. Quality appraisal

Table 2 displays the number of AMSTAR 2 criteria met by each included systematic review, along with the score for each criterion. The number of criteria met ranged from 5 to 15. With the exception of two reviews [10,14], the included reviews can be considered as moderately or well-performed systematic reviews.

3.4. Effect on outcomes

Table 3 provides an overview of the results of the selected systematic reviews. More details are provided in Table 4.

3.4.1. Length of stay

In three meta-analyses the introduction of prospective payment systems significantly reduced length of stay (LOS), although this was not always observed in sub-analyses [6,11,12]. Meng et al. (2020) conducted a meta-analysis of 13 pooled studies, which showed a significant decrease in LOS, but the meta-analysis focusing on eight CBA studies yielded a non-significant result [12]. Similarly, Chen et al. (2023) found a significant decrease in LOS in a meta-analysis of 17 pooled studies, but the meta-analysis focusing on five CBA studies yielded a non-significant result [11]. Subgroup analyses revealed a reduction in LOS for appendectomy, but not for pneumonia, heart failure or COPD. Lino et al. (2023) also found a significant reduction in LOS for appendectomy patients [6]. Zhao et al. (2024) performed a meta-analysis that found a non-significant LOS reduction for cholecystectomy patients, although this analysis included only three studies [7].

Systematic reviews without meta-analysis also identified a reduction in LOS associated with the introduction of a prospective payment system. Agarwal et al. (2020) referenced a pre/post study where the mean LOS significantly decreased following the introduction of the Acute Care Episode demonstration in the US [14]. Barouni et al. (2021) found that LOS was reduced in 15 of the included studies and unaffected in the remaining three [10]. Similarly, twelve of the studies included in Pott et al. (2023) that studied in-hospital mortality, also investigated LOS [15]. In ten of them, a decrease in LOS was identified. In the review of Brown et al. (2022) which focused on stroke patients, only one study evaluated the impact of prospective payment on hospital LOS [8]. This study did not detect any change in acute LOS.

Subgroup analyses indicated that LOS results varied based on the length of implementation of the DRG-like prospective payment system [11,12]. It seems that DRG-payments are associated with a rapid significant reduction of LOS, but that the effects may diminish over time.

3.4.2. Mortality

Prospective payment does not appear to be associated with changes in mortality, as shown by non-significant results in the meta-analyses carried out by Chen et al. (2023), Zhao et. al (2024) and Palmer et al. (2014) as well as in the pre/post study identified in Agarwal et al. (2020) and the three studies identified in Remers et al. (2022) [7,9,11,13,14]. In a non-pooled analysis, two of the studies included in Palmer et al. (2014) showed an increase in acute care mortality soon (maximum two years) after the adoption of activity-based funding [13]. However, no effect on acute care mortality was found when analysing periods more than two years post-implementation, nor was there any effect on post-acute mortality.

Two reviews identified a possible reduction of mortality associated with the introduction of a prospective payment system. This finding was based on a limited number of studies [8,10]. In Barouni et al. (2021), only four studies reported a significant decrease in mortality associated with DRG-based payment, while ten studies found non-significant results [10]. Among the two relevant studies in Brown et al. (2022), one showed a significant decrease in 30-day stroke mortality, while the other showed a non-significant impact [8].

Pott et al. (2023) also detected a potential reduction of mortality when focusing on the five high quality studies included in their review [15]. Otherwise, most studies included in the review either showed a non-significant impact, did not test for significance, or had mixed results. Four studies found a significant decrease in mortality, while five found a significant increase. Results indicate that in-hospital mortality decreased, while out-of-hospital and post-acute mortality increased. One possible explanation for the decrease of in-hospital mortality might be the decrease in length of stay: as patients are discharged earlier, they are less likely to die during their (shorter) hospital stay.

3.4.3. Readmissions

All included reviews assessed the impact of prospective payment

Table 3
Overview of results of systematic reviews.

	Argarwal et al. (2020)	Barouni et al. (2021)	Brown et al. (2022)	Chen et al. (2023)	Lino et al. (2023)	Meng et al. (2020)	Palmer et al. (2014)	Pott et al. (2023)	Remers et al. (2022)	Zhao et al. (2024)
Number of studies	2**	21	4**	29	6	18	65	64	4**	4**
Period	- to 2019	1983 to 2018	- to 2020	- to 2022	2012 to 2022	- to 2018	1980 to 2012	1983 to 2020	2000 to 2020	- to 2023
Length of stay	↓	(↓)	=	↓	↓	↓		(↓)	=	=
Mortality	=	(↓)	(↓)	=			↓↑	↓↑	=	=
Readmissions	(↓)	↓↑	↓	=	↑	↑	↓↑	↓↑	=	↑
Other quality of care outcomes*	=				=		↓↑	↓↑		
Costs or spending	=	↓↑	↑		=	↓			=	↓↑
Post-acute care utilisation	↓		↑				↓↑			
ED or outpatients visits	=	(↓)			=			=	=	
Cost shifting		(↑)								
Admissions or volume		↓↑					↓↑			(↑)
Users' satisfaction								(↓)		

* Complications, severity of illness and condition at discharge; ** only studies selected for the analysis; ↓ = significant decrease in pooled meta-analyses or decrease in all considered non-pooled studies; (↓) = decrease in some non-pooled studies with non-significant change in other non-pooled studies; = = non-significant impact in pooled meta-analyses or no change in all considered non-pooled studies; ↓↑ = mixed results; ↑ = significant increase in pooled meta-analyses or increase in all considered non-pooled studies; (↑) = increase in some non-pooled studies with non-significant change in other non-pooled studies.

Table 4
Characteristics and results of systematic reviews.

Reference	Population	Intervention and comparator	Outcome of interest	Included studies in meta-analysis/SR	Impact	Remarks	Author conclusions
Agarwal et al. (2020) [restricted]	Medicare patients who underwent a cardiac or orthopaedic surgical procedure included in the ACE demonstration	ACE versus FFS	**Length of stay**	1 pre/post study (n=3 942)	Significant decrease in the mean LOS		Not applicable
			Mortality *Within 30 days*	1 CBA study (n=67 408)	ACE not associated with differences in mortality		
			Readmission *All causes, within 30 days*	2 non-pooled studies: 1 CBA and 1 pre/post (n=71 350)	In 1 study, significant reduction in readmission rates with ACE for orthopaedic surgery but not for cardiac surgery; in 1 study NS impact		
			Complications *Within 30 days*	1 CBA study (n=67 408)	ACE not associated with differences in complication rates		
			Episode payments	2 non-pooled studies: 1 CBA and 1 pre-post (n=71 350)	NS effect on episode payments	In 1 study, a NS increase in episode payments for cardiac surgery and a NS decrease for orthopaedic surgery	
			Spendings for inpatient hospitalisation	2 non-pooled studies: 1 CBA and 1 pre-post (n=71 350)	NS difference in 1 study; no test for significance in 1 study		
			Spendings in post-acute care period	1 CBA study (n=67 408)	Significant reduction in spendings		
			Emergency department visits *Within 30 days*	1 pre/post study (n=3 942)	ACE not associated with differences in emergency department visits		
Barouni et al. (2021)	Hospitalised patients	DRG-based payment implementation	**Length of stay**	18 non-pooled studies: 1 RCT, 5 cohort, 12 pre/post	15 studies with reduced LOS, 3 studies (2 cohort and 1 pre/post) with no change		*"The reimbursement system based on DRGs has different outcomes in different types of health care systems. On the one hand, it reduces the average hospital stay and reduces health costs; on the other hand, due to limiting the services and providing inadequate services, it may have a negative effect on the quality of care and capacity utilization."*
			Mortality	14 non-pooled studies (1 RCT; 4 cohort; 9 pre/post)	4 studies (2 cohort and 2 pre-post) with reduced mortality and 10 studies with NS results		
			Readmission	12 non-pooled studies (3 cohort, 9 pre/post)	5 studies NS result; 4 pre-post studies with reduced readmission rates; 3 pre-post with increased readmission rates		
			Costs	7 non-pooled studies: 1 cohort and 6 pre/post	Mixed results: 4 with reduced and 3 with increased costs		
			Cost shifting to other centres	7 non-pooled studies: 3 cohort and 4 pre/post	5 studies showed cost shifting, 2 studies showed that referral rates of patients with high expense did not change		
			Patient consultations	2 cohort studies	Constant results (before-after DRG implementation) for patient consultations		
			Emergency department use	3 pre/post studies	2 studies showed a decrease and 1 no change in ED use		
			Capacity utilisation and other healthcare use	3 studies on ICU (2 cohort, 1 pre/post) / CCU use; 4 pre/post studies on medication prescription/ administration; 2 pre/post studies on surgery rates; 1 cohort study on	Mixed results for ICU; 2 studies with no change in medication use, 2 with a reduction after implementation; Reduced surgery rates in all 3 studies; Reduction in use laboratory and imaging tests; 2 studies with reduced hospital services;		

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Table 4 (*continued*)

Reference	Population	Intervention and comparator	Outcome of interest	Included studies in meta-analysis/SR	Impact	Remarks	Author conclusions
				use of lab tests and imaging; 2 pre/post studies on use of hospital services; 1 pre/post study on number of physician and nurses	The number of nurses was decreased, the number of physicians increased		
			Admission or hospitalisation rates	7 non-pooled studies: 3 cohort and 4 pre/post	Mixed results: reduced (3 studies) and increased (3 studies) admission rates, 1 study with decreased rates for <70 years – increased rates for 70 years or older		
Brown et al. (2022) [restricted]	Haemorrhagic or ischemic stroke; TIA plus stroke	DRG-based PPS versus FFS	**Length of stay** **Mortality** *30-day stroke mortality* **Readmission** *Within 30 days* **Total inpatient rehabilitation spending**	1 CBA study 2 non-pooled cross-section studies 2 non-pooled cross-section studies 1 pre/post study	No change in acute LOS 1 study showed reduced mortality, 1 study showed no effects on mortality Reduced readmission rates in both studies Increase in total inpatient rehabilitation spending		Not applicable
			Post-acute care utilisation	2 non-pooled studies: 1 CBA and 1 pre/post	In 1 study, increased likelihood of discharge to post-acute care; in 1 study increase in post-acute LOS from pre-intervention to base year, then decreased slightly from base-year to post-intervention years (overall increase)		
Chen et al. (2023)	Inpatients of all gender, age, disease groups	DRG-based versus cost-based payment	**Length of stay**	12 pooled cohort studies (n=2 753 305)	SMD=-0.25 (95 %CI: -0.38 to -0.11); p<0.01; I^2=99.7 %	Association DRG and LOS in implementation group <2 years but not for ≥2 years. No difference in age-sub groups; Sign. association for appendectomy subgroup but not for pneumonia, heart failure, COPD	"The results of this meta-analysis indicated that Diagnosis related group (DRG) based payment has a positive effect on length of stay but no effect on inpatient mortality and readmission rates. Current knowledge on the effects of DRG payment on quality of medical care is primarily based on studies in patients with mixed diagnoses. Furthermore, owing to limitations in the quantity and quality of the included studies, future studies with larger sample size and well-controlled confounding factors are required to confirm the presented findings."
				5 pooled CBA studies (n=80 493)	SMD=-0.19 (95 %CI: -0.72 to 0.33); p=0.474; I^2=99.8 %		
				17 pooled studies – overall results (cohort + CBA) (n=2 833 798)	SMD=-0.25 (95 %CI: -0.37 to -0.12); p<0.01; I^2=99.7 %		
				5 pooled pre/post studies (n=32 933 862)	RDC= -10.76 (95 %CI: -18.54 to -2.98); p=0.007		
			Mortality *In-hospital mortality*	3 pooled cohort studies (n=2 427 138)	RR 0.91 (95 %CI: 0.72 to 1.15); p=0.4117; I^2=14.6 %		
			Readmission *within 30 days*	7 pooled cohort studies (n=2 750 556)	RR 0.79 (95 %CI: 0.62 to 1.01); p=0.058; I^2=96.1 %	No significant increase for subgroup analyses diagnostic groups (pneumonia, heart failure, COPD); age, length of DRG implementation	
Lino et al. (2023)	Patients submitted to appendectomy	DRG model versus FFS model	**Length of stay**	5 pooled cohort studies (n=281 346)	SMD=0.39 (95 %CI: 0.38 to 0.40); z=76.60; p<0.00001; I^2=0 %		"This systematic review assessed the fixed remuneration model's effectiveness for appendectomy compared to the traditional pay-per-service model. Through a review of
			Readmission	4 pooled cohort studies (n=281 685)	OR=1.57 (95 %CI: 1.02 to 2.44); z=2.04; p=0.04; I^2=90 %		

(*continued on next page*)

Table 4 (*continued*)

Reference	Population	Intervention and comparator	Outcome of interest	Included studies in meta-analysis/SR	Impact	Remarks	Author conclusions
			Complication	4 pooled cohort studies (n=1 683)	OR=1.38 (95 %CI: 0.92 to 2.06); z=1.55; p=0.12; I^2=0 %		the medical literature, only appendectomy data was included. Our meta-analysis revealed no significant differences in final costs, complication rates, and post-surgery outpatient visits. However, the fixed payment model had a shorter hospital stay, but at a cost of a higher hospital readmission rate."
			Costs *Associated with appendectomy*	3 pooled cohort studies (n=281 078)	SMD=6.70 (95 %CI: -5.34 to 18.74); z=1.09; p=0.28; I^2=100 %		
			Outpatient visits	2 pooled cohort studies (n=1 016)	SMD=-0.88 (95 %CI: -2.85 to 1.09); z=0.88; p=0.38; I^2=97 %		
Meng et al. (2020)	Hospitalised patients	DRG-based versus cost-based payment	**Length of stay**	5 pooled pre/post studies (n=32 933 862)*	RDC=-10.76 (95 %CI: -18.54 to -2.98); z=2.71; p=0.007; I^2=81.9 %	No subsequent effect on LOS change over time.	"Although it is difficult to draw unequivocal conclusions about the links between DRGs-based payment systems and inpatient health utilization from our review, the findings suggested that DRGs-based payment had potential cost-saving implications by lowering LOS, but was associated with higher readmission rates .Policy-makers considering adopting DRGs-based payment should pay more attention to monitoring the hospital readmission rates, compared with cost-based payment."
				8 pooled CBA studies in meta-analysis (n=407 532)* [13 studies (n= 613 442)* in SR]	RDC=-5.92 (95 %CI: -13.66 to 1.81); z=1.50; p=0.134; I^2=92.9 %		
				13 pooled studies – overall results (pre/post + CBA) (n=33 341 394)*	RDC=-8.07 (95 %CI: -13.05 to -3.10); z=3.18; p=0.001; I^2=91.4 %	Still significant after exclusion of one study having a combined intervention with DRG-payment (RDC=-7.86 (95 %CI: -13.06 to -2.66); z = 2.96; p = 0.003)	
			Readmission *within 14, 30 or 90 days*	2 pooled pre/post studies (n=51 365 090)	RDC=3.43 (95 %CI: -0.63 to 7.49); z=1.65; p=0.098; I^2=0.0 %	No subsequent effect on readmission rates change over time.	
				3 pooled CBA studies in meta-analysis (n=332 367) [5 studies (n=378 382)* in SR]	RDC=1.25 (95 %CI: 0.32 to 2.18); z=2.63; p=0.009; I^2=0.0 %		
				5 pooled studies – overall results (pre/post + CBA) (n=51 697 457)	RDC=1.36 (95 %CI: 0.45 to 2.27); z=2.93; p=0.003; I^2=0.0 %		
			Total inpatient spending per admission *Only direct hospital costs Excluding significant costs of new treatment*	7 non-pooled studies (6 CBA and 1 pre/post) (n=513 805)* DID analysis in 3 of the CBA studies (n=307 128)	DID analysis in 3 CBA : lower inpatient spending associated with DRG-payment in 2 studies; no significant effect in 1 study. ITS analysis in pre/post study: non-significant result	One study calculates the costs from the hospital point of view, the others from individual patient point of view. No meta-analysis because of lack of quantitative data and variation in costs calculation methods.	
Palmer et al. (2014)	Patients in acute care settings (hospitals and non-hospital medical or surgical facilities)	Activity-based funding versus alternative funding system	**Acute care mortality** *Within time period after admission or surgery (7 days, 30 days, 180 days, 6 weeks, 6 months, 1 year)*	8 pooled studies: 7 pre/post and 1 cohort study (n=63 656)	OR=1.03 (95 %CI: 0.93 to 1.15); p=0.54; I^2=57 %	I^2 relatively large but results of the large studies very consistent in showing no difference in acute care mortality. None of the pre-specified sub-group analyses explained heterogeneity in findings.	"Inferences regarding the impact of ABF are limited both by inevitable study design constraints (randomized trials of ABF are unlikely to be feasible) and by avoidable weaknesses in methodology of many studies. Further, the variation in

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Table 4 (*continued*)

Reference	Population	Intervention and comparator	Outcome of interest	Included studies in meta-analysis/SR	Impact	Remarks	Author conclusions
				4 non-pooled studies: 3 pre/post and 1 CBA (n=21 888)*	After period: ≤ 2 years after implementation: increase (2 studies, consistent) After period: > 2 years after implementation: no difference (2 studies, mixed)		results across studies suggests that the impact of ABF may vary across settings, though the evidence does not provide strong clues of the determinants of differential effects. The ABF story thus provides testimony to how modifications in health policy without adequate evaluation leave their impact open to great uncertainty. The most compelling evidence of any impact on ABF is on an initial, but likely not sustained, decrease in hospital length of stay following introduction of ABF, a possible increase in readmissions, and an increase in discharges to post-acute care. The latter impact may be restricted to the introduction of ABF in the US. Other effects are likely absent, or restricted to specific settings, and possibly manifest in different directions depending on the setting. Thus, the evidence on the variables we studied does not support either strong advocacy for, or strong rejection of, a change to ABF from other hospital funding methods. Those considering adoption of ABF should be aware of the probable increase in admissions to post-acute care and other possible unintended adverse consequences that may arise. A paucity of consistent and conclusive evidence on the outcomes we studied, however, does not allow a jurisdiction to predict if ABF would be harmless. To this extent, despite the long and extensive experience, changing to an ABF system represents a leap of faith.”
			Post-acute care mortality *Within 2 weeks, 30 days or 31 days*	3 pooled pre/post studies (n=5 204) 1 pre/post non-pooled study (n=329)	RR =0.80 (95 %CI: 0.52 to 1.24); p=0.32; I^2=34 % No difference		
			Readmission *Within 7, 14, 28, 30, 60, 90 days or 1 year*	12 pooled pre/post studies (n=64 003)*	RR=1.04 (95 %CI: 0.93 to 1.16); p=0.48; I^2=73 %	None of the pre-specified sub-group analyses explained the high variability in findings across studies (some studies showing a significant increase and others a significant decrease in readmission rates)	
				13 non-pooled studies: 11 pre/post and 2 CBA (n=953 674)*	After period: ≤ 2 years after implementation: increase (modest variability) After period: > 2 years after implementation: no difference in US studies (high variability); increase in 2 international studies; decrease in 1 international study		
			Severity of illness	30 non-pooled studies: 29 pre/post and 1 cohort (n=944 326)*	Increase (high variability). After period: ≤ 2 years after implementation: increase in 9 studies, decrease in 3 studies, no difference in 3 studies and mixed results in 3 studies. After period: > 2 years after implementation: increase in 9 studies, decrease in 3 studies, no difference in 1 study and mixed results in 4 studies.	No difference between US and international studies.	
			Discharge to post-acute care	22 pooled studies: 21 pre/post and 1 cohort (n=954 228)*	RR=1.24 (95 %CI: 1.18 to 1.31); p<0.0001; I^2=99.7 %	In a sub-group analysis, 28 % relative increase in discharge to post-acute care in the 19 US studies (RR=1.28 (95 %CI: 1.22 to 1.36); I^2=100 %), but no difference in the 3 international studies (RR =1.01 (95 %CI: 0.94 to 1.09); I^2=86 %). None of the other pre-specified sub-groups explain the remaining heterogeneity.	
				14 non-pooled studies: 12 pre/post and 2 CBA (n=69 979)*	Increase (modest variability). After period: ≤ 2 years after implementation: increase in 7 studies, decrease in 1 study, mixed results in 1 study. After period: > 2 years after implementation: increase in 5 studies, decrease in 1 study, mixed results in 2 studies		

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Table 4 (*continued*)

Reference	Population	Intervention and comparator	Outcome of interest	Included studies in meta-analysis/SR	Impact	Remarks	Author conclusions
			Volume of care	26 non-pooled studies: 24 pre/post, 1 CBA and 1 cohort (n=954 556)*	No difference (high variability). After period: ≤ 2 years after implementation: increase in 6 studies, decrease in 8 studies, no difference in 3 studies and mixed results in 2 studies. After period: > 2 years after implementation: increase in 6 studies, decrease in 4 studies, no difference in 1 study and mixed results in 1 study.	No difference between US and international studies.	
Pott et al. (2023)	Human subjects; any age; all ethnicities; all geographical areas	PPS versus other PPS or alternate system	**Length of stay**	12 non-pooled studies	Ten out of 12 studies identified a decrease in length of stay	One possible explanation [for a decrease in in-hospital mortality] is a decrease in length of stay. Hospitals might discharge patients earlier and shift them to post-acute care. Twelve of the studies that present results on in-hospital mortality also investigate length of stay.	"In this systematic review, we synthesized evidence of 64 studies examining the impact of the introduction of PPS and price changes within PPS on key outcome quality indicators operationalizing patients' health status and user evaluation. Based on our results, we do not find strong evidence in favor of one of the argumentations described above. Claims that PPS either cause great harm or significantly improve the quality of care are not supported by our findings. However, results also suggest that there may have occurred a shift towards discharges to post-acute care settings. Thus, decision makers that aim to implement PPS in an inpatient setting should consider their post-acute care capacities. *To evaluate outcome quality of care a guideline-based approach as proposed by Campbell et al. (2002) is desirable. In the future, literature should evaluate quality in response to PPS incentives by quality indicators, which are developed based on medical guidelines. This is not the case in the presented studies.* Moreover, evaluations reporting on user evaluation and symptom relief are rare and future research should also focus on these indicators, as they might substantially contribute to the understanding of the impact of PPS on quality of care. Also, there not many studies exist that evaluate price changes within a PPS. High quality studies in this field would increase the understanding on marginal and average reimbursement effects, which might help policy makers to improve PPS based reimbursement systems."
			Mortality	35 non-pooled studies: 21 pre/post, 12 CBA and 2 cohort (n=24 101 927)	The majority of studies (31 studies, 47 analyses) does not find a statistically significant effect, does not test for significance or finds mixed evidence on mortality outcomes following the introduction of PPS. Significant decrease is found in 4 studies (6 analyses) and significant increase is found in 5 studies (5 analyses).	There seems to be a tendency for the five high quality studies to show a reduction in mortality, while the 22 low quality studies tend to show an increase. Results for the eight studies with a moderate quality are mixed. Results indicate that in-hospital mortality decreased, while out-of-hospital and post-acute mortality increased.	
			Readmission	33 non-pooled studies: 20 pre/post, 12 CBA and 1 cohort (n=74 698 964)*	8 analyses (7 studies) identify a statistically significant decrease in readmission; 5 analyses (5 studies) identify a statistically significant increase. 38 of the readmission analyses do not yield a significant change in readmission rates or showed mixed evidence.	All of the studies identifying an increase in readmission rates investigate readmission between 30 and 42 days. None of the analyses showing a statistically significant increase in readmission rates use data from the US.	
			Complications	7 non-pooled studies: 6 pre/post and 1 CBA (n=82 140)	Most of the analyses (18 analyses) suggest that the introduction of a PPS did not have a significant effect on complication rates; 1 study identifies a significant increase in the percentage of patients without any complications; 1 study finds a significant reduction in inpatient complications; 1 study provides evidence for an increase in complication rates	The evidence for an increase in complication rates should be interpreted with caution as the risk of bias is high (no control for the severity of the underlying disease and the presence of comorbidities)	
			Condition at discharge	9 non-pooled studies: 7 pre/post, 1 cohort and 1 undetermined (n=70 456)*	The majority of studies tends to show a negative effect on discharge ambulation outcomes. 1 study finds significant decrease, 1 study finds significant increase.	A possible explanation [for the negative impact] is that almost all of the studies, which also investigate changes in length of stay, find that patients are	

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Table 4 (*continued*)

Reference	Population	Intervention and comparator	Outcome of interest	Included studies in meta-analysis/SR	Impact	Remarks	Author conclusions
						discharged from hospital earlier. When excluding studies with low quality, no statistically significant effect was identified. Both studies detecting statistically significant effects did not control for any confounders, resulting in a high risk of bias.	
			Discharge destination	15 non-pooled studies: 10 pre/post, 4 cohort, 1 undetermined (n=21 320 937)*	Three analyses (three studies) find a significant reduction in the proportion of patients being admitted to their home and being able to care for themselves. Of the 6 analyses (5 studies) investigating changes in the proportion of patients discharged to home with the help of a home health care agency, 1 finds a significant increase and 1 a significant decrease. The others do not report statistical significance or results are not statistically significantly different from zero. 5 studies investigate outcomes of changes in discharges to nursing homes. 2 of them find a statistically significant increase in nursing home discharges, 1 found a significant increase in discharges to skilled nursing home however, only on a 10 % significance level.		
			Emergency department visits	2 non-pooled studies: 1 pre/post and 1 cohort (n=79 880)	None of the studies finds an overall significantly positive or negative effect.		
			User evaluation	4 non-pooled studies: 2 pre/post, 1CBA and 1 cohort (n=40 105)	3 studies find NS reduction in satisfaction. 1 study detected a significant reduction in one of the 17 satisfaction outcomes considered (satisfaction with treatment on arrival by nurses)		
Remers et al. (2022) [restricted]	Patients with at least one of the selected chronic illnesses (COPD, diabetes, depression, CHF, chronic kidney disease, or dementia) or patients with multimorbidity	DRG payment vs alternative payment system	**Length of stay**	2 non-pooled studies 1 pre/post and 1 CBA (n=49 810)*	No significant effect or no significance reported		Not applicable
			Mortality	3 non-pooled studies 1 pre/post and 2 CBA (n=139 824)*	No significant effect or no significance reported		
			Readmissions *All-cause*	4 non-pooled studies 2 pre/post and 2 CBA (n=140 423)*	No significant effect or no significance reported		

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Table 4 (*continued*)

Reference	Population	Intervention and comparator	Outcome of interest	Included studies in meta-analysis/SR	Impact	Remarks	Author conclusions
			Emergency department visits *All-cause*	2 non-pooled CBA studies (n=90 014)*	No significant effect or no significance reported		
			Healthcare costs *All-cause*	2 non-pooled studies 1 pre/post and 1 CBA (n=599)*	No significant effect or no significance reported	Serious or critical risk of bias	
Zhao et al. (2024) [restricted]	Inpatients of any gender and age undergoing cholecystectomy	Prospective vs traditional payment system	**Length of stay**	3 pooled pre/post studies (n=73 214)*	SMD=0.62 (95 %CI: -1.54 to 2.79); I^2=100 %		"Transitioning from FFS to PPS resulted in no significant changes in LOS and mortality. However, there were minor increases in admission and readmission rates and a decline in financial margins. Specifically, switching from FFS to DRG-case payment demonstrated contrasting outcomes for different cholecystectomy procedures. For [laparoscopic cholecystectomy], this switch led to a reduction in LOS without impacting mortality rates, alongside an increase in financial margins. For [open cholecystectomy], there was an observed increase in LOS, which was also accompanied by a rise in financial margins. Moving from FFS to EBP revealed no significant alteration in admission rates but a slight increase in financial margins."
			Mortality *Postoperative mortality following cholecystectomy*	2 pooled pre/post studies (n=47 705)	OR=0.96 (95 %CI: 0.66 to 1.42); I^2=0 %		
			Readmissions	1 pre/post study (n=1 698)	4.7 % increase in readmission rates for cholecystectomy		
			Hospital costs	1 pre/post study (n=46 015)	Significant reduction in costs for laparoscopic cholecystectomy; significant increase in costs for open cholecystectomy.		
			Financial margin	3 non-pooled pre/post studies (n=28 704)*	Decrease in actual hospital income in 1 study; increase in financial margins in 2 studies		
			Admissions *For cholecystectomy*	3 non-pooled pre/post studies (n=27 199)*	Slight increase in 2 studies, no difference in 1 study		

* Number of patients not reported in some studies. DRG = Diagnosis related group; PPS = prospective payment system; COPD = Chronic obstructive pulmonary disease; FFS = fee-for-service; CBA = controlled before-after; SMD = standard mean difference; RDC = relative difference change; DID = difference in differences; RR = relative risk; NS = non-significant; LOS = length of stay; ACE = Acute Care Episode, EBP = episode-based payment, CHF = Chronic heart failure.

systems on readmissions. Overall, our review of reviews reveals mixed results, similar to many of the individual reviews [10,13,15].

Two meta-analyses found no significant effect [11,13]. Also, in the four relevant studies identified in Remers et al. (2022), no significant impact was shown [9]. In the two relevant studies from Brown et al. (2022) focusing on stroke patients, reduced readmission rates were identified [8]. Also in one of the relevant studies identified in Agarwal et al. (2020), a significant reduction of readmission rates was associated with the Acute Care Episode demonstration for orthopaedic surgery patients [14].

However, several reviews suggested that readmission rates might have increased under prospective payment systems. Specifically, in a meta-analysis of four studies, Lino et al. (2023) found a significant increase in readmissions for cholecystectomy patients under the DRG model compared to the fee-for-service model [6]. Similarly, Meng et al. (2020) reported a significant increase in readmissions in their meta-analysis of five studies [12]. The relevant study selected from the Zhao et al. (2024) also indicated an increase in readmissions for cholecystectomy patients [7].

3.4.4. Other quality of care outcomes

In addition to mortality and readmission rates, several other outcomes, such as complications and disposition at discharge, are measured to assess the impact of prospective payment systems on the quality of care.

Three reviews investigated the impact of PPS on complication rates [6,14,15]. Only one study included in the review of Pott et al. (2023) suggested an increased complication rate, but this study was considered to have a high risk of bias due to the lack of control for disease severity and comorbidities [15]. In this review also, two studies indicated a significant decrease in complications, but most of the included studies found no significant effect.

Pott et al. (2023) also explored the impact on health condition at discharge [15]. Most studies indicated a negative impact of prospective payment systems on outcomes such as ambulation at discharge and maximum distance walked, but this might be explained by earlier discharge earlier (reduced LOS). Also, when excluding low-quality studies, no significant impact was found.

Palmer et al. (2014) reviewed older studies (1980-2012) on the introduction of activity-based funding and found mixed results regarding the impact on severity of illness, both within two years of implementation and beyond [13]. They also found no difference between the US and other countries included in their review.

3.4.5. Costs

Seven reviews examined costs-related outcomes, showing mixed results. Except for Barouni et al. (2021) [10] and Meng et al. (2020) [12], the number of studies included in the reviews was generally limited (one or two studies). In Barouni et al. (2021), seven studies were included, with four indicating reduced costs and three pointing to increased costs [10]. In Meng et al. (2020), only four studies reported statistical significance, two showed a decrease in total inpatient spendings per admission associated with DRG-payment, while the other two found no significant impact [12].

In Brown et al. (2022), one pre/post study reported an increase in total inpatient spending, but concerned rehabilitation hospitals [8]. Among the two relevant studies in Agarwal et al. (2020), one found no significant difference in spending for inpatient hospitalisation associated with the Acute Care Episode demonstration in the US, while the other did not test for significance [14]. In the two relevant studies included in Remers et al. (2022) regarding patients with multimorbidity, no significant effect was found or no significance was reported [9].

Zhao et al. (2024) found a significant reduction in hospital costs for laparoscopic cholecystectomy and a significant increase for open cholecystectomy [7]. Lino et al. (2023) found no significant impact of the DRG model on costs associated with appendectomy [6].

3.4.6. Impact on other settings

In response to a reduced length of stay under case-based payment systems, hospitals may increase outpatient visits or consultations to maintain quality of care. Patients themselves may seek more follow-up contacts after an early discharge. However, no significant impact of prospective payment systems was found on outpatient visits or consultations [6,10].

Similarly, the impact on emergency department visits was evaluated in four reviews, with three showing no significant effect [9,14,15]. Barouni et al. (2021) identified three studies that examined the impact of DRG reimbursement on emergency admissions: two showed a reduced rate of emergency admissions post-implementation while one showed no change [10].

The use of ICU and CCU services was analysed in three studies identified by Barouni et al. (2021), with mixed results: one study reported an increase, one reported no change, and one reported a decrease in ICU and CCU use [10].

Hospitals, incentivised to discharge patients earlier under per-case payments may discharge patients to other post-acute care facilities. Palmer et al. (2014), in a meta-analysis of 22 studies published before 2013, showed a significant increase in the proportion of patients discharged alive to post-acute care (intermediate care facilities, nursing homes, skilled nursing facilities, in-patient rehabilitation facilities, long-term care hospitals, home health agencies and similar facilities in other countries) rather than home [13]. A subgroup analysis found a significant increase in the 19 US studies but no significant impact in the three international studies. In a non-pooled analysis of nine US studies, seven reported a large increase in discharge to post-acute care early after implementation of activity-based payment, but only one reported statistical significance. One study reported a large decrease in discharge to post-acute care without reporting an associated p-value and one study reported mixed results. In a non-pooled analysis of eight US studies looking further after implementation, five reported an increase in discharges to post-acute care (all without statistical significance), one reported a large significant decrease and two reported mixed results.

In Brown et al. (2022), one study on stroke patients found an increased likelihood of discharge to post-acute care in the DRG model while another showed an increase in post-acute care length of stay [8]. However, one study selected in Agarwal et al. (2020) reported a significant reduction in post-acute care spending after the introduction of the Acute Care Episode demonstration [14].

Barouni et al. (2021) identified five studies reporting a shift of costs to other centres after the implementation of the DRG payment [10]. In two other studies the referral rate of high expenses patients did not significantly change.

3.4.7. Volume

Studies regarding the impact of prospective payment systems on volume of care yielded mixed results. In Palmer et al. (2014), approximately the same number of studies reported increases and decreases in activity volume both shortly after and long after the implementation of activity-based financing [13]. No difference was identified between US and international studies. Most of the included studies did not report statistical significance. Among those that did, one study found a significant increase in volume shortly after the implementation, one found a significant decrease shortly after, and a third found a significant decrease long after implementation. Barouni et al. (2021) also reported mixed results, with three studies showing that the implementation of a DRG-payment mechanism reduced the admission rate and three reporting an increased admission rate [10]. One study noted different effects based on age groups, with a decrease for patients under 70 years and an increase for those aged 70 and older. For cholecystectomy admissions, Zhao et al. (2024) identified two studies that indicated a slight increase following the implementation of a prospective payment system and one study showing no significant impact [7].

3.4.8. Users' satisfaction

The impact of prospective payment systems on users' satisfaction was only explored in the review by Pott et al. (2023) [15]. They identified four studies investigating this outcome, all of which were of moderate or low quality. One study looked at the shift from fee-for-service to capitation payment and found no statistically significant effect on patient satisfaction. Another study investigated whether the introduction of a DRG-payment system instead of fee-for-service had an influence on the satisfaction with doctors and found no significant effect. Among the 17 satisfaction outcomes considered in another study, only one (satisfaction with treatment on arrival by nurses) showed a significant decline after the introduction of DRG payment. Finally, one study reported that the implementation of a DRG-based payment system had no noticeable impact on patients' perceived quality of life at one and six weeks post-discharge.

3.4.9. Other outcomes

Other outcomes were also investigated (not shown in Table 3). In particular, Barouni et al. (2021) examined the impact of DRG payments on capacity utilisation using indicators related to medication use, diagnostic or therapeutic methods, the number of physicians and nurses per hospitalised patient, etc. [10]. Two studies found that the rate of medication prescribing or administration remained constant while two others reported a decrease after DRG-payment implementation. The rate of surgery was investigated in three studies, all of which showed a reduction following DRG-payment implementation. One study also reported a reduction in laboratory and imaging tests rates. Another study found that the number of nurses decreased after the implementation of a DRG mechanism, while the number of physicians increased. Zhao et al. (2024) explored the impact of a prospective payment system for cholecystectomy on hospital income, with mixed results: two studies reported an increase in financial margins, while one study showed a decrease in actual hospital income [7].

4. Discussion

The vast majority of included reviews found that the introduction of prospective payment systems results in shorter hospital stays which aligns with theoretical incentives of case-based payments. As providers receive the same payment independently of the patient's length of stay, they are encouraged to discharge patients earlier to reduce costs and improve efficiency.

However, the generalisability of these findings should be interpreted with caution. A substantial proportion of the primary studies included in the reviewed literature were conducted in the US. This may not be surprising, as the US was the first country to introduce a national DRG-based payment system and has accumulated several decades of empirical evidence. Therefore, the most studied intervention is the introduction of the US Medicare PPS. Yet, the dominance of US evidence can shape overall conclusions, as the US healthcare system differs from the system of many other countries in terms of financing structure, insurance coverage, and the organisation of post-acute care. While this abundance of US data provides valuable insight into mature PPS systems, it might limit the applicability of findings to contexts where hospital payment reforms occurred under different institutional or organisational conditions.

Furthermore, the starting point for the introduction of prospective payment systems varies significantly across countries. In the US, PPS replaced a fee-for-service system that reimbursed providers for each service delivered, whereas in many European countries, PPS replaced global budgets or cost reimbursement schemes. These differences in baseline payment mechanisms might influence the magnitude and direction of the effects observed after the introduction of a PPS. For instance, the incentive to reduce length of stay may be stronger when transitioning from fee-for-service to case-based payment than when moving from a global budget [16,17]. This contextual diversity should be kept in mind when interpreting the comparative effects reported across countries.

A potential downside of prospective payment systems is a decline in quality of care. In their efforts to reduce costs, providers might discharge patients prematurely or in uncertain conditions, or reduce the number of tests and procedures during the patient's stay. Several studies used mortality rates (during or shortly after the patient's stay) as a proxy for quality of care. According to the included reviews, prospective payment systems do not seem to be associated with an increased mortality.

Advocates of a prospective payment system argue that this payment system might actually enhance quality of care, as hospitals are incentivised to invest in quality improvement that could lead to cost reductions [18]. Detecting such improvements using mortality as an indicator can be challenging, especially for conditions already associated with low mortality rates. Nevertheless, our review identified partial evidence of a possible reduction of mortality. But the included reviews did not clarify whether any accompanying measures were implemented to maintain the quality of care when introducing the prospective payment systems, which could have mitigated any potential negative impacts.

Readmission rates are also commonly used as an indicator of quality of care, although this measure has been criticised to be insufficiently sensitive to changes in quality of care [19]. Our review showed mixed results regarding readmission rates, as did many of the included reviews. Also, for some conditions, planned readmissions may be part of the scheduled follow-up care that is set up in response to early discharge [12]. In such cases, readmissions are not an indication of reduced quality of care, but rather of changes aimed at improving quality. Unfortunately, none of the included reviews explicitly distinguished planned readmissions from unplanned ones.

The impact on readmission rates may depend on the organisation of post-acute care in the specific context. In situations where the supply for post-acute care is scattered, the introduction of prospective payment systems may lead to more acute care readmissions than in situations where patients can be discharged to post-acute care settings rather than home [13,15]. Pott et al. (2023) noted that among the included studies that reported a significant increase of readmission rates, none took place in the US, where activity-based financing has been shown to increase discharges to a post-acute care setting [15].

Additionally, the impact on readmission rates may be difficult to detect in studies using claims or official data [15]. Prospective payment systems often include a 'case consolidation' when patients are readmitted shortly after discharge, so that the readmission is incorporated in the initial case and does not lead to a new case-based payment. Case consolidations are not always identifiable in claims or official data, making short-term readmissions difficult to pinpoint.

It is also worth noting that readmission rates are not independent of mortality rates, although both are used to measure quality of care. An increase in mortality rates could lead to a decrease in readmission rates [15].

In response to a decreased length of stay under case-based payment systems, quality of care may be maintained by relying on other services (outpatient consultations, emergency services, etc.) but our review did not identify a significant increase in the use of these services. Also, as hospitals are incentivised to discharge patients earlier, they are also incentivised to discharge those who are not ready to be discharged home to other post-acute care facilities. Our review identified some evidence of this effect, particularly in the US. Earlier discharge to post-acute care facilities is not necessarily detrimental to the quality of care, especially in regions with sufficient post-acute care capacity to meet demand [13]. A more intensive use of post-acute care capacity may also prevent readmissions to acute care settings [13].

Ultimately, prospective payment systems might encourage hospitals to increase their activity volume in order to boost revenues. This can be seen as positive in situations where the system is characterised by long waiting lists. However, there is a concern that it might lead to inappropriate treatments, potentially compromising the quality of patient

care. Our review showed mixed evidence regarding the impact of prospective payment systems on hospital admissions. One possible reason for this is that these systems often come with control mechanisms designed to curb the incentive to increase volume. However, these mechanisms, such as volume or tariff caps, were not specifically discussed in the included reviews.

5. Limitations

Our review of reviews, along with the included studies, presents several limitations. Firstly, prospective payment systems are complex mechanisms with details that vary across different programmes and countries. Hospital funding reforms are rarely implemented in isolation and are often accompanied by other mechanisms, for instance to ensure quality of care or to prevent budget overrun. The primary studies included in the selected reviews were conducted in diverse contexts, making it challenging to determine whether the observed results are due to the payment system as a whole or specific aspects of the programme.

Secondly, many studies focused on the US context, which has unique characteristics regarding the organisation of post-acute care (e.g. availability of post-acute services). Moreover, we did not systematically quantify the number of primary studies per country for each analysed outcome. As a result, it was not possible to determine the relative weight of evidence contributed by different national contexts. Some reviews may have been dominated by data from one or two countries, while others included a broader international mix. This lack of detailed geographic mapping limits our ability to assess how strongly specific country contexts influenced the overall conclusions of the evidence base.

Thirdly, most reviews did not clearly distinguish whether the analysed reforms represented the initial introduction of a prospective payment system or subsequent modifications of an existing scheme (e.g., changes in DRG classification). These different types of reforms may have distinct effects on provider behaviour and health system outcomes. Consequently, attributing observed impacts solely to the introduction of PPS may be misleading when some studies actually assess later-stage adjustments within already established payment frameworks.

Fourthly, a large proportion of the included studies are before-after studies, without control group. Therefore, the impact on the identified outcome may be the result of temporal trends independent of the payment system. Furthermore, the included reviews, and the studies within each review, cover different time periods. Comparison might be affected by general trends in improved quality of care and reduced length of stay that are unrelated to the payment system.

Fifthly, among the ten systematic reviews included in this review, only five conducted meta-analyses, and not for all studied outcomes. Moreover, these meta-analyses sometimes combined very heterogeneous studies which can compromise the validity and reliability of the results.

Another methodological consideration is that the included reviews show only limited overlap in their sets of primary studies. While this broadens the overall evidence base and suggests that each review contributes additional, complementary insights, it also complicates direct comparison between reviews. The lack of overlap implies that findings summarised across reviews may reflect different populations, time periods, or health system contexts, which in turn may increase heterogeneity and make it more difficult to identify consistent patterns across the literature.

Finally, although an extensive literature search was conducted, unpublished reviews or reviews published in grey literature were not included. Consequently, relevant policy reports and evaluation studies that were not published in scientific journals may have been overlooked. Also, each included review potentially suffers from publication bias, as only published evidence could be included. Reviews published in languages other than English, French or Dutch were excluded. Similarly, within selected reviews, exclusion criteria based on language applied.

For all but one review, the last year searched is 2018 or later. One review included studies from 1980 to 2012 [13]. Another review spans a decade from 2012 to 2022 [6]. The remaining eight reviews cover an extended period of time starting from either inception or 1983 (corresponding to the introduction of first DRG-like payment systems) to 2018 or later. Six reviews include the most recent period (2020 or after) [6–9,11,15]. Notably, four recent primary studies [20–23] have been added to these reviews; however, the overall conclusions and observed trends remain unchanged.

The selected reviews, apart from one, all include studies from the US. In Lino et al. (2023)'s review about appendectomy patients, only studies from Korea and China are included, despite no geographical exclusion criteria being defined [6]. The number of represented countries also varies across reviews, ranging from 1 to 13 different countries in the included primary studies.

6. Conclusions

This umbrella review identified ten systematic reviews that explored the impact of prospective payment systems on healthcare efficiency, quality of care, volume of activity and costs. Most of the included reviews drew upon relatively recent primary studies, and, except for two, were of moderate to high methodological quality. The studies included in the reviews are often limited by the heterogeneity of the included payment programmes, contexts, and accompanying interventions, making it challenging to attribute observed impacts directly to the payment system. In addition, many of them are before-after studies, without control group.

Nonetheless, the analysis yields several insights. The vast majority of reviews concluded that the introduction of prospective payment systems leads to a reduction in hospital length of stay, supporting the theoretical assumption that prospective payment systems incentivise greater efficiency in healthcare delivery. While theoretical concerns exist that efficiency gains may come at the expense of quality, this review did not find substantial evidence to support these concerns. Regarding the effects of prospective payment systems on healthcare costs, they were consistently reported across the reviews, and findings were inconclusive. The evidence on volume of activity is also mixed.

Therefore, a prospective payment system can be an effective strategy to enhance efficiency, including shortening hospital stays. However, when introducing such payment systems, it is crucial to focus on monitoring quality indicators, including unplanned readmissions and mortality rates, maintaining an adequate supply of post-acute care, and ensuring cost control through measures like volume caps.

Declaration of generative AI and AI-assisted technologies in the writing process

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CRediT authorship contribution statement

Mélanie Lefèvre: Writing – review & editing, Writing – original draft, Investigation. **Koen Van den Heede:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Carine Van de Voorde:** Writing – review & editing, Supervision, Conceptualization.

Competing interest

The authors declare no conflict of interest.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.healthpol.2025.105552.

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