Health Economics Review

RESEARCH

Open Access

Paying for hospital care in seven central and Eastern European countries – a comparative analysis

Katarzyna Dubas-Jakóbczyk[1*], Krisztina Davidovics[4], Antoniya Dimova[2], Triin Habicht[3], Pavel Hroboň[5], Laszlo Imre[4], Kaija Kasekamp[6], Mincho Minev[2], Liubove Murauskienė[7], Martin Smatana[8], Gyoergy Rethazi[9], Angelika Szalayova[10], Artur Szetela[1], Lenka Šlegerová[11] and Roman Topór-Mądry[12]

Abstract

Background The systems for paying health care providers consist of a complex set of arrangements, including payment methods and supporting elements. A diversity of payment methods exists, and for each of them the administrative process of setting prices (tariffs) plays a pivotal role. It defines the exact amount of money that a purchaser pays a health care provider for delivering a given service, unit of activity, or specific outcome. This study aimed to provide a structured comparison of the systems for setting prices for hospital care services in the public health insurance systems of seven Central and Eastern European countries (Bulgaria, Estonia, Czechia, Hungary, Lithuania, Poland, and Slovakia), as well as identify major challenges.

Methods The methods involved three consecutive steps: (1) a conceptual framework and data collection form were developed based on existing literature; (2) national experts identified through purposive, snow-ball sampling were asked to complete the data collection form; and (3) a comparative analysis was performed.

Results All analysed CEE countries use mixed payment methods, with a dominant role of diagnose-related groups, in paying for hospital care provision. The price-setting process follows similar general steps: collecting costing data; calculating tariff weights; setting the price by using a dedicated base rate; conducting negotiations with providers; and applying price adjustments. However, the scope and details of each element may vary significantly between the countries. In Hungary and Bulgaria, there is no structured costs data collection process (historical weights are adjusted). The analysed countries face similar challenges in building effective price-setting systems: (1) incomplete and/or low quality hospital cost data, (2) insufficient institutional capacity; (3) methodological challenges of the costing model; and (4) barriers driven by the overall health system context. These challenges can lead to both under- and over-pricing of hospital services and generate system-level inefficiencies.

Conclusions There is a strong need to support investments in data infrastructure and improvements in system governance across all analysed countries. Digital solutions could enhance the efficiency of the process by limiting the potential trade-off between the timeliness (and accuracy) of reporting cost data and the feasibility constraints.

*Correspondence:
Katarzyna Dubas-Jakóbczyk
katarzyna.dubas@uj.edu.pl

Full list of author information is available at the end of the article

Keywords Hospital, Pricing, Tariffication, Hospital's costs, Central and eastern europe

Background

The systems for paying health care providers consist of a complex set of arrangements. These include different payment methods together with supporting elements such as contracting rules (e.g., volume thresholds), and management information systems [1, 2]. The main objective of payment systems is to compensate providers for the services delivered while at the same time steer their behavior towards the realization of pre-defined health policy objectives (e.g., improving efficiency and quality of care) [1–3]. Consequently, payment systems are considered one of the most important levers through which policymakers can influence health system performance [4].

A diversity of payment methods exists and each of them provides a specific set of incentives [2–4]. For example, among commonly used in hospital settings activity-based methods: fee-for-service (FFS) promotes increased production (a higher number of services and, thus, may improve access to care) [2, 4], while case-based diagnosis related-groups (DRGs) incentivise an increased number of patients and shorter length of stay, thereby promoting efficiency [4, 5]. In contrast, outcome- or value-based payment methods (e.g., pay for performance) focus on rewarding improvements in health outcomes and quality of care [6–8]. To balance diverse, sometimes conflicting incentives within a payment system, blended (mixed) payment methods are commonly used [4, 9].

Regardless the differences in intended incentives, each payment method includes three technical dimensions: (1) the base or unit of activity/outcome upon which prices/tariffs are defined (tariff base), (2) the value of the payment per unit of the chosen tariff base, and (3) the administrative and economic process by which that price/tariff value is determined [3, 10]. Consequently, pricing (setting tariffs) constitutes a core element of health care providers' payment process. It defines the exact amount of money that a purchaser pays a health care provider for delivering a given service/unit of activity [3, 10]. When the price is not appropriate (too high or too low), it can easily overshadow the intended incentives and prompt undesired provider behaviour [3].

International evidence indicates that the regulatory frameworks for price setting can vary significantly between countries, as well as within the same country, for different types of providers, regions, and/or payers [2,3]. To date, cross-county comparative evidence detailing the price setting process in health care has focused mostly on countries outside the Central and Eastern European (CEE) area and/or on one element of the process, e.g. costing approaches [3, 11–14]. Existing literature also indicates that health system around the world can be at different stages of advancement of their strategic purchasing structures, including health services pricing processes [3, 15–18]. Numerous high-income countries have established dedicated structures, including institutional arrangements, formalised communication and consumer information systems as well as procedures ensuring freedom from conflicts of interest [3, 17]. At the same time, many low- and middle-income countries struggle with highly fragmented financing systems, inadequate policy frameworks and lack of transparent pricing process, which negatively affect health system efficiency and access to care [15, 18, 19].

Health systems in CEE countries share many common characteristics in terms of overall system organization, financing and recent reform trends [20–23]. Among the 11 CEE countries (EU Member States) public health expenditure prevails, with a dominant role of social health insurance. In majority of these countries, a single, usually centralized, public payer operates. Many CEE countries are characterized by overcapacity in hospital care provision, a high share of current health expenditure allocated to hospitals, and relatively low hospital bed occupancy rates, pointing toward system-level inefficiencies [24, 25]. Public hospital care prevails in terms of both hospital bed ownership and sources of funding [24]. Many CEE countries struggle with the problem of financial debts generated by public hospitals driven, among many other factors, by inadequate (below the actual cost level) pricing of hospital services [26–29]. At the same time, a recent study has shown that among CEE countries, tariff system modifications are one of the most common changes within health care provider payment schemes [30]. Adjusting the rules and/or methods of the tariffication process for the price to better reflect the actual cost of services/units of activities was identified as a common reform objective across all provider types [30]. While the previous study mapped the current payment methods and main changes within payment schemes in nine CEE countries, in the present work we aim to provide a deeper analysis of the price setting arrangements for hospital care, including both the costing approach as well as process governance issues. The specific objectives of our study were to: (1) describe and compare the systems for setting prices (tariffs) for hospital care services in the public health insurance systems (paid by public payers) of seven CEE countries (Bulgaria, Estonia, Czechia, Hungary, Lithuania, Poland, and Slovakia); and (2) identify major current challenges and obstacles that may undermine system efficiency. Our study fills in an important research gap and helps to build a knowledge base around the topic.

Methods

The methods applied involved three consecutive steps: (1) defining a conceptual framework and developing a data collection form; (2) consultations with national experts, and (3) a comparative analysis.

Conceptual framework and data collection form

International literature indicates that, within publicly funded hospital care systems, the process of setting prices usually involves several consecutive stages [3, 17] (Fig. 1). First, the tariff base if defined by the chosen payment method, e.g., a service or DRG. Cost data are then collected from hospitals and analysed to calculate the average/reference cost for a given tariff base, expressed as relative cost weights/points. Different methodological approaches can be applied to calculate costs weights, including diverse costing standards (e.g., micro- versus gross costing, and top-down versus bottom-up approaches) [12, 13, 31–33]. Prices are subsequently set by multiplying the relative weights/points by a base rate (monetary value) reflecting the payer's budget capacities [3, 31]. This can be then followed by two additional stages: negotiations with providers (either individual or collective) and application of additional price adjustments (e.g., percentual increase of decrease of the price value aimed to incentivise specific provider behaviour) [1, 3, 34]. The institutional landscape of the overall process can vary across countries. In many cases, the technical task of cost calculation is carried out by independent agencies and is therefore separated from the more political task of carrying out negotiations with providers (carried out by the payers) [3, 35].

Consequently, final tariff values depend on a mix of factors, including the cost of delivering services, available resources, negotiation with providers, and specific health policy objectives [34].

Following this conceptual framework a standardised data collection form was developed. The form included five main sections, each with a list of questions to be answered. The sections focused on the following aspects of hospital characteristics: (1) overall sector capacities and current payment schemes, including payment methods for different type of care (inpatient, outpatient, and emergency care); (2) existence of costing standards (e.g. obligatory vs. voluntary guidelines); (3) the process of collecting cost data from hospitals (e.g. institutions involved, the scope and frequency of gathered cost data); (4) the process of price (tariff) setting (e.g. the tariff base, the scope of negotiations with providers, price adjustments); (5) the challenges of the price setting process. Table S1 in the Supplementary File presents an overview of the data collection form. An additional comparative analysis of the basic quantitative indicators characterizing the hospital sector in the selected countries was conducted based on Eurostat data [24].

Consultations with national experts

National health system experts from CEE countries (European Union members) were contacted to fill-in the data collection form and provide adequate references whenever available. Purposive, snowball sampling was used to identify the experts. The national representatives of the Health System and Policy Monitor (HSPM) Network functioning under the auspices of the European Observatory of Health System and Policies, were contacted. HSMP members have in-depth knowledge of the organisation and financing of their national health systems [36]. They received both the study's short proposal description as well as the data collection form. The invitation also included an example of a complete data form (filled-in with Polish data) and a request to indicate another national expert with adequate expertise in the case of non-participation. They were also encouraged to involve a practitioner - a policy-maker or a professional directly involved in the analyzed process (e.g., professional with working experience in the involved institutions). Up to two to three co-authors per involved country were allowed. Originally all 11 CEE countries (EU members) were targeted, yet for some countries no adequate experts who were willing to participate could be identified. Thus, the final analysis covered only seven countries.

Comparative analysis

The collected data were analysed and presented in tabular forms. The analysis focused on the five main areas, as defined by the main sections of the data collection form. The draft comparative results were shared with all national experts with a request for validation and/or clarification. Two rounds of comparative result validation were conducted. Any additional ambiguities were clarified iteratively through further correspondence.

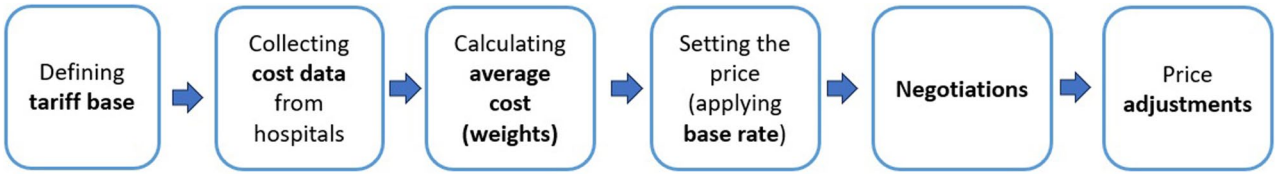

Fig. 1 Stages of the price setting process for publicly funded hospital care

Results

Hospital sector's capacities and payment schemes

The group of analysed countries is diverse in terms of both geographical area and total population (e.g. their populations range from 1.4 million in Estonia to 36.6 million in Poland), [25] which corresponds to diversity in terms of hospital sector total capacity. The estimated total number of hospitals (defined as acute care, inpatient stay over 24 h units) ranges from approx. only 30 in Estonia to 700 in Poland (Table S2 in the Supplementary File). All of the surveyed countries (with the exception of Estonia) have more hospital beds per 100,000 inhabitants than the EU average of 516.3. Public ownership of hospital beds prevails [24]. The analysed countries are characterized by relatively low hospital bed occupancy ratio (ranging from 58% in Hungary to 71% in Estonia), below average length of stay (from 4.4 days in Bulgaria to 6.6 days in Slovakia), and a high number of hospital discharges per 1000 population (from 125 in Estonia to 332 in Bulgaria) (Table S2 in Supplementary File). In 2023, the OECD averages for these indicators was: 71%, 6.4 days and 128 discharges, respectively [25]. This may suggest a combination of hospital overcapacity and rapid patient turnover (frequent short hospitalizations).

Table 1 presents a general comparative overview of payment systems for hospital care. In the majority of countries, a single, centralised payer operates. The exemptions are: Czechia (multiple payers, but with limited competition) and Slovakia (three competing insurance companies). With the exemption of Czechia, in all of the countries, the total expenditures for hospitals, measured in purchasing power standard (PPS) per inhabitant, are much below the EU average of 1342.7 (2022). In all of the countries, publicly funded expenditures for hospitals constitute the vast majority of total expenditures for hospitals.

All countries use blended payment methods for hospital care. In most countries, DRGs prevail as a dominant payment method for inpatient care (a stay longer than 24 h), used either directly or for volume targets in prospective budgets (in Czechia, Poland, and Slovakia). In all of the countries, diverse variables are used to classify cases, whose total number ranges from 435 clinical pathways and procedures in Bulgaria to as many as 1793 DRGs in Czechia. In most countries, the total number of DRGs ranges between 700 and 800 (Table S3 in the Supplementary File). For outpatient care, most countries use FFS, usually supplemented by other methods. Emergency care and maintaining a state of preparedness is usually financed via lump sum (diverse versions of fixed payments).

Application of costing standards

The analysed countries have diverse approaches regarding the existence and applicability of costing standards for hospitals. In Czechia, Poland, and Slovakia, obligatory costing standards exists for all hospitals contracted by the public payer (regardless of hospital ownership) (Table 2 and Table S4 in Supplementary File). In all three countries, these standards were developed by a dedicated government agency responsible for the health service tariffication process. The costing standards usually provide detailed guidelines on how to classify costs in hospitals, define costs centres, and assign direct and indirect costs, as well as how to calculate the final product costs (e.g. per DRG). In Estonia, similar guidelines exist, developed by the payer in collaboration with hospitals to support structured data collection, and are applied on a voluntary basis. In Hungary, guidelines on hospital cost measurement were published in the early 1990s during the introduction of the DRG system. They are still occasionally used by the payer when assessing the inclusion of new services. Additionally, methodological handbooks are available for hospital controlling units, covering both case-level and department-level cost measurement. However, their application is not mandatory, and case-level cost measurement has so far been adopted in only one hospital. In Lithuania and Bulgaria, no dedicated costing standards for health care providers exists and general accounting rules apply. In Lithuania however, public hospitals, as non-for-profit organisations, are obliged to follow dedicated accounting rules for public sector institutions.

Collecting cost data from hospitals

In five out of seven of the analysed countries, a structured process of collecting cost data from hospitals for the tariffication purposes exists. Yet it can differ significantly, e.g. in terms of hospital coverage, obligation to provide data, frequency, and the scope of reported cost data (Table 2 and Table S4 in Supplementary File).

Usually, a government and/or public administration institution is responsible for gathering and analysing cost data from hospitals. This is either a government agency supervised by the Ministry of Health (MoH) (as in in Czechia and Poland), or the MoH itself (as in Slovakia). In the case of Estonia and Lithuania, there is no institutional division between the task of collecting cost data/calculating tariff cost bases and setting the prices, as all tasks are carried out directly by the payer (Table 2). The capacity of institutions, measured in the total number of employees, varies from just few specialists (full time equivalent – FTE) in Estonia and Lithuania to approx. 60

Table 1 Overview of the payment systems for hospitals

Country/ Feature	Health insurance payer structure	Total expenditures for hospitals in PPS per inhabitant (2022)[a]	Share (%) of public expenditures for hospitals in total expenditures for hospitals (2022)[b]	Payment methods applied for care provided in hospitals (within publicly funded systems)		
				Inpatient care (> 24 h)	Outpatient Care	Emergency Care
BG	single payer, centralised (with 28 regional branches)	655.3	92.1%	Case payment (clinical pathways and clinical procedures); per diem	Case payment (ambulatory procedures)	Lump sum (fixed payment), FFS
CZ	multiple payers, with limited competition	1353.3	96.9%	Global budget (based on DRG volume targets), DRGs, Fixed payment (for palliative care)	FFS + Case payments (day surgeries), P4P elements (dialysis providers)	Lump sum (fixed payment), FFS
EE	single payer, centralised	846.4	96.4%	DRGs, FFS, Per diem, Bundled payments (for knee and hip replacement and stroke patients), Global budget (for rural and small general hospitals)	FFS	Lump sum (fixed payment), FFS
HU	single payer, centralised	779.5	96.4%	DRGs (for active care), Fixed payment (for salaries), per diem	FFS + Fixed payment (for salaries)	Lump sum (fixed payment), DRGs, FFS
LT	single payer, centralised	724.9	93.5%	DRGs, FFS, Per diem	Case payment, FFS (for expensive procedures and examinations)	Lump sum (fixed payment)
PL	single payer, centralised (with 16 regional branches)	826.8	95.2%	Global budget (based on DRGs volume targets) for hospital included in network, DRGs, P4P elements, FFS, per diem	Per visit payments (adjusted for number and type of services) + FFS, P4P elements (oncological network)	24 h lump sum (fixed payment)
SK	three competing payers (insurance institutions)	664.1	87.7%	Prospective budget (based on DRG volume targets)	FFS	Lump sum, FFS

[a]EU average 1342.7 PPS (purchasing power standard) per inhabitant

[b]Calculated as expenditures for hospitals financed from HF1 (Government schemes and compulsory contributory health care financing schemes) per expenditures for hospitals financed from TOT_HF (All financing schemes); EU average 95.45%

Table 2 Collecting cost data from hospitals for the tariff (price) setting purposes

Country / Feature	Dedicated cost standards	Institution collecting data	Hospitals reporting data	Obligation	Scope of cost data reported	Frequency	Data quality control
BG	No	n/a	n/a	n/a	n/a	n/a	n/a
CZ	Yes - obligatory	Dedicated government agency: The Institute of Health Information and Statistics of the Czech Republic (supervised by the MoH)	A purposive sample	Voluntary	All costs related to providing medical services	Annually	Yes (automatic cross-check)
EE	Yes - voluntary	Public payer: Estonian Health Insurance Fund	Depends: 6 network hospitals or purposive sample	Voluntary	All costs related to providing medical services	Every second year (standard procedure) or on request.	Yes (automatic cross-check)
HU	No	n/a	n/a	n/a	n/a	n/a	n/a
LT	No	Public payer: The National Health Insurance Fund	Depends: 60 hospitals or purposive sample	Obligatory	All costs related to providing medical services	Varied - depends on the scope of services undergoing tariffication	Yes (automatic cross-check)
PL	Yes - obligatory	Dedicated government agency: The Agency for Health Technology Assessment and Tariff System (supervised by the MoH).	A purposive sample	Obligatory	All costs related to providing medical services	Varied - depends on the scope of services tariffication	Yes (automatic cross-check + contact with providers)
SK	Yes - obligatory	Ministry of Health (Department of the Centre for Classification System)	All hospitals	Obligatory	All costs related to providing medical services	Annually	Yes (validation protocol + contact with providers)

specialists (FTE) in the dedicated Tariffication Department in the Agency for Health Technology Assessment and Tariff System in Poland. In both Hungary and Bulgaria, the national health insurance fund is responsible for setting the prices, yet cost data are not systematically gathered from hospitals for tariffication purposes. In Bulgaria, the MoH regularly collects general financial data from both state and municipal hospitals, yet these are used mostly to monitor hospitals' financial situation/debt levels, and not for the purposes of hospital service tariffication. In Hungary, some department-level hospital cost data can be retrieved from the centralised hospital management system operated by the National Directorate General for Hospitals, yet these are not routinely used for the price setting processes.

Across the five countries with structured cost reporting systems, the share of hospitals that provide cost data varies between the countries, as well as within a given country, depending on the purpose and/or scope of tariff adjustment (Table 2 and Table S4 in Supplementary File). For example, in Czechia cost data are provided by a dedicated group of reference hospitals with whom the government agency responsible for tariffication process (The Institute of Health Information and Statistics of the Czech Republic) signs agreements. In 2023, this group included 34 acute care hospitals, which constituted approx. 20% of all acute care hospitals. In Estonia, the number of hospitals providing cost data depends on the purpose of tariff adjustments: for revision of specific cost components (e.g. utility costs) across all tariffs - six (out of 20) network hospitals provide cost data; for adjusting the price for a specific type of service/clinical area - a purposive sample of providers is chosen (e.g. providers whose financial volume of the respective services constitutes 70% of the total financial volume of those services contracted for by the Estonian Health Insurance Fund, or from the four healthcare providers with the largest financial volumes of the respective services). In Lithuania the hospital cost reporting is determined by the payment method: in case of medical care financed via DRGs – 60 hospitals report cost data (approx. 68% of all hospitals in Lithuania); for care financed outside DRGs - a purposive sample of providers is selected for cost reporting (up to 10 providers that offer at least 50% of the evaluated services). In Slovakia and Poland, all hospitals providing services within the public health insurance system (regardless of ownership) are obliged to report cost data. For example, in Poland, the provision of cost data was made mandatory in 2021 (when dedicated costing standards for hospitals were implemented); however, no penalties for not fulfilling this obligation were planned. In consequence, the share of Polish hospitals reporting cost data can vary depending on the scope of services being reviewed (Table 2 and Table S5 in Supplementary File). In general, in most countries, reporting cost data is obligatory and there is no dedicated remuneration for provision of data. However, in Czechia, hospitals are partially remunerated for being reference hospitals, while in Poland, providers that report cost data receive additional points to use while submitting offers to provide services under the contract with public payer (in open tender competitions).

The scope and level of detail of reported cost data varies across countries (Table 2 and Table S4 in Supplementary File). Usually, the reporting covers both cost and utilisation data related to providing medical services (with research and educational costs excluded). In most countries, medical costs are reported per cost centre (e.g. hospital ward) and specific procedure/hospitalisation case using standard cost categories (e.g. remuneration, pharmaceutical, medical devices, etc.). The process of reporting case/hospitalisation specific costs can vary between the countries as well as within a given country depending on the scope of services undergoing evaluation. For example, in Lithuania, hospitals are required to conduct detailed micro-costing estimations (indicating quantitatively all resources used during specific procedures and the respective costs) only in relation to services financed outside DRGs, while in Poland it is a standard requirement for the complete data set.

The frequency of data reporting varies across countries as well. As a standard procedure it can take place annually (in Czechia and Slovakia) or every two years (in Estonia). It can also depend on the scope of services undergoing tariff revision. In both Lithuania and Poland, a tariffication plan is published (for four years and annually, respectively), indicating which services will be evaluated (thus it may happen that the same hospital will be obliged to provide data even a few times a year). In all five countries where cost data are reported, they undergo quality checks. These usually involve diverse validation protocols, cross-check templates, and/or iterative verification in cooperation with reporting hospitals. In both Lithuania and Poland, educational sessions/trainings for providers are offered to enhance quality of the reported data (Table S4 in Supplementary File).

The process of price setting

The tariff/price bases are directly linked to the payment methods, thus most countries use relative weight and/or points per DRG for hospital inpatient care. These are often supplemented by prices set per service and/or per diem, which are used for other types of care as well (Table 3). In most countries, the institutions responsible for the tariffication process publish methodological guidelines (and/or regulations) (Table S5 in the Supplementary File), including statistical methods used and additional variables included in the price calculation

Table 3 Price (tariff) setting processes

Country / Feature	Tariff base	Price calculation	Costing approach	Time lag between cost data acquisition and price setting	Negotiations	Price adjustments	Information disclosure standards
BG	Clinical pathway/ procedure;	No systematic cost calculations are conducted. Prices from previous years are usually adjusted based on variables related to the payer's projected budget and service volumes. Experts' opinions are used to calculate the price of new services.	Top-down gross-costing	n/a	Collective negotiations (with the Bulgarian Union of Physicians)	Per type of patient and diagnosis (e.g. a correction factor of 1.14 for children diagnosed with a specific disease), aimed at compensating for higher costs. Performance specific (e.g. lower prices when specific types of volume threshold are met) aimed at increased efficiency.	Tariffs and general reimbursement rules are published online.
CZ	Relative weights per DRG	Average actual cost per DRG is calculated (outliers are removed). The unified base rate is calculated based on the total expected budget for acute inpatient care. Thus, the actual reimbursement (final price) might be lower than the valorised average total costs in the reference hospitals.	Mixed top-down and bottom-up micro-costing	1 Year	Both individual (prior to signing individual contracts) and collective negotiations	Per type of service (e.g. a correction factor of 1.05 for highly specialised services) aimed at compensating for higher costs. Per type of medical care (e.g. a correction factor f 1.03 for providing acute psychiatric care or mental care), aimed at encouraging provision of specific types of care.	Tariffs and calculation methods are published online
EE	DRG, Service, Per diem	Average actual cost (based on cost data reported by hospitals) is compared with optimal cost (based on experts' opinions of the resources needed to provide a given service as well as optimal resource use – e.g. effective equipment use). Costs are calculated per service and per diem, which are then use to adjust DRG prices. Unified base rate is used.	Top-down micro-costing (Activity based costing)	1 Year	Unilateral price setting by the payer (there are, however, individual negotiations on the volume limits)	No price adjustments per type of service or patient (there are, however, correction factors if hospitals exceed the agreed contract: 0.7 for outpatient and day care services and 0.3 for inpatient services, aimed at limiting overprovision)	Tariffs and calculation methods are published online
HU	Weights per DRG, per diem	No systematic cost calculations are conducted. Average actual cost is valorised per DRG, calculated based on historical data (1999). The unified base rate is calculated based on the expected budget for acute inpatient care. Thus, the actual reimbursement (final price) might be lower than the valorised average total costs in the reference hospitals. (No update since 2018.) The payer conducts cost estimations for newly introduced procedures (experts' opinions are used).	Mixed: bottom-up and top-down micro-costing	n/a	Unilateral price setting by the payer (no negotiations)	Per type of services (e.g. a correction factor of 1.1. for one-day surgeries, and large prosthetic procedures), aimed at reducing waiting times	Tariffs and calculation methods are published online

Table 3 (continued)

Country / Feature	Tariff base	Price calculation	Costing approach	Time lag between cost data acquisition and price setting	Negotiations	Price adjustments	Information disclosure standards
LT	Weights (per DRG), Service	DRG weights are imported from the Australian system and adjusted to the local context. Average actual cost per DRG is calculated (outliers are removed) to assess the tariff base while the base rate is determined by dividing the pubic payer's budget by a weighted number of active treatments. For services financed outside DRGs the price reflects the average actual costs.	Mixed top-down and bottom up gross-costing (for DRGs) and bottom-up micro-costing for services financed outside DRGs	Varied (depending on the scope of services undergoing evaluation), from two months to as much as two years	Unilateral price setting by the payer (no negotiations)	Per type of service (e.g. for services requiring costly technological components), aimed at compensating for higher costs.	Tariffs and calculation methods are published online
PL	Points (per DRG); Service, Patient day	As a standard procedure, average actual cost per DRG is calculated (outliers are removed) to assess the tariff base. It is then multiplied by a base rate defined by the payer's budget. In some cases a multiplier of cost changes over time is applied with the objective of updating the tariff to reflect the actual cost at the moment of tariff application, and to provide a 'development bonus' (covering prospective cost increases). It consists of three components: staff costs, capital costs, and overall prices increase/inflation. Depending on the scope of services undergoing tariffication, the final report can also include international and commercial price comparison.	Mixed top-down and bottom-up micro-costing	Varied (depending on the scope of services undergoing evaluation), from several months to more than 2 years	Individual negotiations (both the price per 1 unit of tariff base as well as the volume limits of services can be negotiated)	Per type of service (e.g. a correction factors of 1.1–1.2 for defined ophthalmology and orthopedics surgeries performed in day care settings; a correction factor of 1.6. for providing emergency outpatient services), aimed at increasing provision of day/outpatient care and thus improving efficiency as well as limiting waiting times. Per type of patients (e.g. a correction factor of 1.2. for care for children) aimed at increasing provision of services for vulnerable patients and limiting waiting times.	Tariffs and calculation methods are published online
SK	Relative weight per DRG	Relative weight per DRG (based on cost data from hospitals) are calculated, but the final tariff is determined by a ^\base rate which reflects the capacity of the state budget for in-patient care (there are six categories of base rates - reflecting six hospital reference levels)	Top-down micro-costing	1 Year	Both individual and collective negotiations (the latter related to contracting rules and the payer's budget)	Per type of service (the higher reference level of hospital, the higher base rate), aimed at compensating for the higher cost of highly specialised hospitals. Per type of care (e.g. for specialised cardiovascular and oncology care), aimed at increasing provision of specialised care.	Tariffs and calculation methods are published online.

formula. The process usually involves calculation of the average actual cost per DRG/service, based on the cost data reported by hospitals, and its reflection in relative weight or points (in Lithuania, weights are imported from the Australian DRG systems and adjusted to the local context). Most often, different versions of the micro-costing approach (top-down, bottom-up or mixed) are used for the average actual cost calculation while experts' opinions are used to calculate the average cost of newly introduced technologies/services. In Estonia, experts' opinions are also used to calculate the 'optimal cost', indicating the most effective use of resources (e.g. the equipment costs are calculated assuming their most effective usage while the staff costs reflect the formal, collective agreements on wages for medical professionals). In most countries, to calculate a price, the tariff bases (weights, points) are then multiplied by base rates defined in the payer's projected budget. In consequence, although the general objective is for the price to cover the average actual costs, this depends on the payer's available budget for a given year. In both Bulgaria and Hungary, DRG/pathway weights are not calculated on an annual basis (as there is no cost reporting system). In Hungary historical weights are used, while the base rate has remained the same since 2018 (increased costs for hospitals are offset by a large and growing targeted wage subsidy). However, as of writing this paper, a pilot project has been launched by the payer aimed at implementing a standardised, case level cost collection methodology across ten hospitals. In Bulgaria, the payer adjusts the prices from previous years by variables mostly related to the payer's projected budget and service volumes.

Among the five countries where cost data are systematically gathered for tariffication purposes - the time lag between the data acquisition and the implementation of an adjusted price is usually one year in Czechia, Estonia, and Slovakia, and can vary from a few months to approx. two years in Lithuania and Poland. There can, however, be diverse exemptions. For example, in Estonia, in cases where newly calculated tariffs have a budget impact that exceeds the payer's (the Estonian Health Insurance Fund) budget limits, the tariff increase can be implemented gradually over a period of a few years. In Poland, the general rule is that the payer (the National Health Fund) implements the new tariff up to four months after its publication. However, the time spent calculating new tariffs can vary significantly. It is usually much shorter when a single cost component (e.g. remuneration) across all tariffs is being adjusted than when tariffs for a predefined range of DRGs are being revised.

In most countries, some form of negotiations with providers is conducted regarding health service cost reimbursement (Table 3). However, these negotiations can focus on other aspects than direct price negotiations. For example, in both Czechia and Slovakia, collective negotiations (e.g. with associations of providers) help define the priorities of the payer's budget, e.g. the percentage share of different types of care. Bulgaria is the only country where collective negotiations focus on the final price of a particular item. Individual price negotiations, held prior to signing agreements with individual hospitals, take place in Czechia, Poland, and Slovakia. For example, in Poland, while submitting an offer during an open tender announced by the payer, a hospital can negotiate both the price per 1 unit of tariff base (usually 1 point) as well as the volume limits of services. The payer indicates the proposed price, while the provider submitting an offer can indicate a price lower (e.g. to get more points during the offer assessment) or higher than the one proposed by the payer. However, during the actual negotiation stage the provider can only decrease its price offer (it cannot be increased above the value indicated in the offer). In summary, in four out of seven analysed countries, the prices are set unilaterally (they are the same for all hospitals across the country).

Most countries apply different price adjustments, usually taking the form of a percentage increase or decrease of the basic price. Their objectives are usually to compensate for higher costs (e.g. in highly specialised and/or technologically costly services in Czechia, Lithuania, and Slovakia) or to encourage provision of specified services (e.g. psychiatric care in Czechia, specialised cardiovascular and oncology care in Slovakia, care for children in Poland). In Poland, numerous price adjustments have been implemented within the last few years with the objective of shifting emphasis from in- to out-patient care (e.g. for ophthalmology and orthopedic surgeries performed in day care settings). None of the analysed countries apply geographical price adjustments (e.g. for rural vs. urban hospitals), while Slovakia seems to be the only country where price levels differ depending on the hospital type (the higher reference level of hospital the higher base rate). In most of the analyzed countries, both the calculation methods and tariffs are published online.

Challenges of the process

Numerous challenges of the price setting process can be identified across the group of analysed countries (Table 4). They can be classified into four main areas: (1) completeness and quality of the cost data gathered from hospitals (relatively low hospital participation, low quality and insufficient representativeness of the reported data); (2) institutional capacities of the involved organisations (insufficient human and technical resources in both the organisation responsible for gathering cost data and analysing and setting the tariffs, as well as hospitals during the cost reporting process); (3) methodological approach (challenges related to: including special

Table 4 Challenges of the price setting process

Area	Examples
Completeness and quality of the cost data gathered from hospitals	• Hospital participation: a relatively low number of providers reporting data when participation is voluntary (Estonia) or when there are no regulatory tools to enforce the obligation to provide data (Poland), both of which can affect the final data sample representativeness; a lack of systematic hospital cost reporting processes for the purposes of tariffication (Bulgaria, Hungary) • Quality of the reported data: low quality reported data, e.g. when data are not complete (Slovakia, Poland) or not reported according to the pre-defined standards (Poland)
Institutional capacities of the involved organisations	• Institutional capacities of the leading organisations: a limited number of employees (with adequate expertise) in the organisations responsible for the tariffication process (Estonia, Hungary, Lithuania) • Institutional capacities of the hospitals: technical limitation of the hospitals' IT systems that do not allow for effective data processing (Slovakia) or interoperability (Poland); lack of adequate skills among administrative staff or lack of cooperation between medical and administrative staff needed for conducting micro-costing estimations (Poland)
Methodological approach	• Including hospital characteristics: lack of mechanism for including differences in hospital costs depending on location, specialisation, or additional task carried out by hospitals, e.g. local hospitals vs. university clinics (Bulgaria, Czechia, Poland) • Complexity of the costing model: highly complex methodological approach limits providers' understanding (Poland) • Accuracy of depreciation costs: concerns about appropriateness of including depreciation costs for long-term assets acquired from different investment sources (Lithuania) • Adjusting for inflation: the lack of regular adjustment for inflation, especially in cases when the time lag between the cost data acquisition and setting prices is long, leads to situations where a new tariff is already outdated at the moment of implementation (Estonia, Bulgaria, Hungary, Lithuania,)
Health system context	• Payer's budget: insufficient available funding reflected in the base rate can impact the final price to be below the average actual costs (Bulgaria, Hungary, Lithuania, Slovakia) • Process governance: insufficient communication between the involved stakeholders (Slovakia) or lack of transparency (Bulgaria) undermine provider's trust; lack of strong political leadership hinders implementation of dedicated system at the health system level (Hungary)

hospital characteristics, highly complex costing models, accuracy in cost valuation, and the impact of inflation); and (4) the context of the overall health system (the impact of insufficient funding and challenges related to process governance, e.g., insufficient communication, lack of transparency).

The scope and intensity of particular problems may vary between countries, yet their combined impact is reflected in discrepancies between actual costs and the prices offered by the payer. Limited accuracy of costs weights and the lack of adequate adjustments (e.g., by hospital type) contribute to under-pricing of certain hospital services (the price does not cover actual costs), as reported in Bulgaria, Estonia, Hungary, Lithuania, Poland. Under-pricing may also be driven by the limited payer budget capacity, reflected in an excessively low base rate, as reported in Slovakia. Some countries, report existence of both under-priced as well as over-priced hospital tariffs (Bulgaria and Poland), with hospital financial management focused on balancing/subsidizing between the two cases.

Discussion

In the majority of analyses CEE counties, the price-setting process for hospital care follows the general framework identified in international literature (Fig. 1). In Czechia, Estonia, Lithuania, Poland and Slovakia, it involves the following phrases (1) cost data are reported by hospitals (usually a defined sample of providers) based on a pre-defined costing template; (2) a dedicated government institution gathers and analyses the data and calculates the bases of the tariffs based on pre-defined methodological guidelines, which usually involves calculation of average actual costs per specific item of care; (3) to calculate prices, the tariff bases are multiplied by a base rate (amount of money per tariff base unit), defined by the payer's budget capacities. In most of the analysed countries, the payer also adjusts the final price of specific services (or care provided for a specific group of patients) by implementing diverse correction factors (usually a percentage increase of the price) in order to meet pre-defined health policy objectives. However, the details of each step can vary between the countries (e.g. in relation to the scope of hospitals reporting cost data, the role of negotiations with providers, the application and objectives of final price adjustments). In the case of Bulgaria and Hungary, there is no structured hospital cost data collection system for tariffication purposes (historical tariff bases are adjusted).

The results indicate that although in most countries the overall price setting processes reflects those in Western Europe [3, 11, 12], the CEE countries can be at different levels of policy development and system maturity. In two (Bulgaria, Lithuania) out of the seven analysed countries, there are no dedicated costing standards for hospitals. Such standards can help providers to adjust their accounting systems to better meet the relevant cost data reporting rules and thus allow for more reliable and comparable data acquisition [12, 13, 37, 38]. In addition, detailed costing standards can help hospital managers to

calculate the actual cost of a given service/unit of activity on a regular basis [13]. For example, in Poland, hospitals can share such individual cost calculations with the agency responsible for the tariffication process (these calculations are later included in a final tariffication report). This helps to build a more evidence-based approach and strengthens the transparency of the whole process. While, in some countries, adjusting prices for inflation is a standard procedure (in Czechia and Slovakia) in others it happens more sporadically (in Estonia, Lithuania, Poland), or inflation is not taken into consideration at all (in Bulgaria and Hungary), which can pose a significant long-term financial risk for hospitals [39].

Our study also points towards the existence of similar trade-offs between the accuracy of the price setting process and system feasibility as those identified in Western European countries [12]. More complex systems can support better data accuracy. For example, a higher number of specific DRG groups and a bottom-up micro costing approach gives greater chances of accurately reflecting actual recourses use [32, 34, 40, 41]. However, at the same time, there are also increased transactional costs. Our study has shown that one of the challenges of the pricing system is providers lacking understanding of the costing model and therefore having difficulties conducting micro-costing estimations. There is a similar trade-off regarding hospital coverage. On the one hand, a high share of hospitals reporting cost data makes it possible to see the complete picture, with full data representation [12]. On the other hand, this increases the administrative burden for both hospitals and the institution responsible for processing the data.

In three of the analysed countries (Czechia, Poland and Slovakia), the technical task of cost calculation is separated from the more political task of negotiating with providers (carried out by the payers) [2, 35]. In the remaining two countries (with cost reporting systems) the cost calculations are carried out directly within the payer structures (Estonia, Lithuania). The latter, may elicit, on the one hand, controversies about the political independence of the process, but on the other, it may limit the administrative burden and enhance effective governance (e.g. when decisions related to prices, volume, and budget are all made within a single institution). Regardless of the institutional landscape, good governance rules and data transparency remain crucial. In four out of the seven analysed countries, unilateral price setting takes place which is perceived as a good approach to limit price discrimination and contain cost growth [3]. At the same time, most of the countries follow international trends [3, 34, 42] and apply varied price adjustments (e.g. percentage increases in prices) aimed at meeting pre-defined policy objectives (e.g. incentivizing provision of specific services, reducing waiting times, etc.). Consequently, the 'final price' (the amount of money received by the provider after price adjustment) may ultimately be determined by a policy decision.

The challenges related to the technical and administrative process of price-setting may play a dominant role in successful implementation of hospital payment reforms. The impact of the final price value, may overshadow the intended incentives of the payment method [3]. When the price of a given hospital service/case do not cover the actual provider costs, hospitals may choose to limit the provision of that service or be forced to incur financial deficit. In Central and Eastern European countries, under-pricing of hospital services is perceived as one of the main causes of public hospital financial deficits and debts accumulation [26–29]. These have often been addressed through dedicated hospital sector reforms and bail-out programs, which required additional funding from the central government [20]. Conversely, the existence of highly profitable (over-priced) items creates incentives for overprovision of particular services. This may be driven by provider-induced demand (provision of services beyond patient's actual needs) and cherry-picking (focusing on provision of only profitable services). Both concepts have been broadly discussed in international health economic literature [43–45] as sources of system level inefficiencies. The process of setting prices may therefore influence both under- and overprovision of hospital services, contributing to low-value care [46]. Our results emphasize the importance of the both the reliability and transparency of the price-setting process within the payment scheme models.

To the authors best knowledge this is the first study providing a structured overview of the price setting process for hospital care in CEE countries. There are, however, two main limitations to be noted. The first consists in the risk of bias and the potential influence of arbitrary factors during the data collection process. We have tried to limit this by encouraging respondents to provide references whenever available, as well as seeking out professionals with expertise in the analysed topic (in most of the countries, the originally contacted HSMP Network member has collaborated with another specialist, often a practitioner in the related field). The second limitation derives from the study scope, which, by focusing on hospital care within public health insurance systems, does not provide a full picture of the pricing system. We have not analysed processes within private/voluntary health insurance schemes and out-of-pocket payments. However, as shown in Table 1, in the group of analysed countries, these other sources of funding have a marginal role in the context of hospital care.

Despite these limitations, our study provides important implications for both future research and health policy. In terms of the former, a qualitative analysis of different

stakeholders' perspectives could provide deeper insight into the challenges of implementing an effective price setting process and thus providing more specific and better tailored policy recommendations. Also, quantitative costing studies, e.g. aimed at comparing costs between different providers, could help in providing evidence for enhancing tariffication methodology. Our results indicate that regardless of country specific differences in the pricing process, the data infrastructure and governance systems are of crucial importance. Hospital managers need clear guidelines on costing methodology, including continuous training/education options. This must be supported by adequate IT infrastructure. There is growing literature on the use of digital solutions, including artificial intelligence and big data analytics within health financing systems [47–49]. Such solutions have proved effective, e.g. in automated data extraction from medical documentation [50, 51], and thus can also be used for utilisation and cost data tracking. These solutions could enhance process efficiency by limiting the potential trade-off between the timeliness, completeness, and accuracy of the cost data reporting and feasibility constraints. However, their implementation must be complemented by an adequate regulatory framework, including cybersecurity protocols and strong leadership of both regulatory bodies and individual hospitals. As with any other type of health system reform, improving different stakeholders' cooperation and data transparency could help in building more participatory consensus in health policy design. Due to the similar health system contexts of CEE countries, there is significant potential to share cross-country knowledge and learn from each other's experiences. At the same time, by defining the main obstacles and bottlenecks of the pricing process, our results may be of interest for countries which are yet to build or reform their pricing systems (e.g., some middle income countries in Europe and Central Asia).

Conclusions

The systems of pricing hospital services within public health insurance schemes in the seven analysed CEE countries (Bulgaria, Estonia, Czechia, Hungary, Lithuania, Poland, and Slovakia) are at different stages of development. While in some countries, hospitals must follow detailed costing standards and report comprehensive data, including micro-costing estimations, in others there are neither dedicated costing standards for hospitals, nor any structured cost reporting systems. However, even in countries with a structured cost collection process, it usually only includes a purposively selected sample of providers while tariff updates often relate solely to a pre-defined scope of services. The analysed countries face similar challenges in building effective price setting systems. Limited accuracy of costs weights, lack of adequate adjustments, and/or insufficient payer budget can lead to both under- and over-pricing of selected hospital services This can distort the intended incentives structure within the payment method and lead to system level inefficiencies. Investment in data infrastructure and improved system governance are needed in all of the analysed countries.

Abbreviations

BG	Bulgaria
CEE	Central and Eastern Europe
CZ	Czechia
DRG	Diagnose Related Groups
EE	Estonia
EU	European Union
FFS	Fee for Service
FTE	Full time equivalent
HU	Hungary
LT	Lithuania
MoH	Ministry of Health
PL	Poland
SK	Slovakia

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13561-026-00730-2.

Supplementary Material 1

Authors' contributions

All authors meet the authorship criteria and agree to the submission of the manuscript. All authors have made substantial contributions to the conception or design of the work, according to the International Committee of Medical Journal Editors (ICMJE) and to the Committee on Publication Ethics (COPE). Conceptualization: KDJ; Data curation: All authors; Formal analysis: KDJ; Methodology: KDJ; Validation: All authors; Writing-Original draft: KDJ, Writing – review & editing All authors; Supervision: KDJ.

Funding

This publication was supported by internal research funding at the Jagiellonian University Medical College, project number N43/GBS/000001, entitled "*Determinants of the Financial Situation of Public Hospitals in Central and Eastern European Countries – A Comparative Analysis*".

Data availability

All data generated or analysed during this study are included in this published article (and its supplementary information files).

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Institute of Public Health, Faculty of Health Sciences, Jagiellonian University Medical College, Skawinska 8 St, Krakow 31-531 , Poland
[2]Department of Health Economics and Management, Faculty of Public Health, Medical University of Varna, Varna, Bulgaria
[3]World Health Organization Barcelona Office for Health Systems Financing, Barcelona, Spain

[4]Health Services Management Training Centre, Semmelweis University, Budapest, Hungary
[5]Advance HealthcareManagement Institute, Prague, Czechia
[6]Institute of Family Medicine and Public Health, University of Tartu, Tartu, Estonia
[7]Department of Public Health, Institute of Health Sciences, Faculty of Medicine, Vilnius University, Vilnius , Lithuania
[8]Department of Nursing and Health Professional Studies, Slovak Medical University, Bratislava, Slovakia
[9]Freelance Health Industry Consultant, Budapest, Hungary
[10]Institute of Health Analyses - Centre for Classification System of DRG, Ministry of Health, Bratislava, Slovakia
[11]Institute of Economic Studies, Faculty of Social Sciences, Charles University, Prague, Czechia
[12]Interdisciplinary Health Data Centre, Jagiellonian University Medical College, Krakow, Poland

Received: 22 November 2025 / Accepted: 22 January 2026
Published online: 27 January 2026

References

1. Cashin C, editor. Assessing Health Provider Payment Systems: A Practical Guide for Countries Moving toward UHC | Joint Learning Network. 2015. https://jointlearningnetwork.org/resources/assessing-health-provider-payment-systems-a-practical-guide-for-countries-w/ .Accessed February 14, 2025.
2. Designing and Implementing Health Care Provider Payment Systems. How-To Manuals. *Designing and implementing health care provider payment systems*. Published Online May. 2009;14. https://doi.org/10.1596/978-0-8213-7815-1.
3. Barber S, Lorenzoni L, Ong P. *Price Setting and Price Regulation in Health Care: Lessons for Advancing Universal Health Coverage.*; 2019. Accessed February 14, 2025. https://iris.who.int/handle/10665/325547
4. *Better Ways to Pay for Health Care | OECD*. Accessed February 15, 2025. https://www.oecd.org/en/publications/better-ways-to-pay-for-health-care_9789264258211-en.html
5. Milstein R, Schreyögg J. The end of an era? Activity-based funding based on diagnosis-related groups: A review of payment reforms in the inpatient sector in 10 high-income countries. Health Policy (New York). 2024;141:104990. https://doi.org/10.1016/J.HEALTHPOL.2023.104990.
6. Eijkenaar F, Emmert M, Scheppach M, Schöffski O. Effects of pay for performance in health care: A systematic review of systematic reviews. Health Policy (New York). 2013;110(2–3):115–30. https://doi.org/10.1016/J.HEALTHPOL.2013.01.008.
7. Leao DLL, Cremers HP, van Veghel D, Pavlova M, Groot W. The Impact of Value-Based Payment Models for Networks of Care and Transmural Care: A Systematic Literature Review. *Applied Health Economics and Health Policy 2023 21:3*. 2023;21(3):441–466. https://doi.org/10.1007/S40258-023-00790-Z
8. Vlaanderen FP, Tanke MA, Bloem BR et al. Design and effects of outcome-based payment models in healthcare: a systematic review. *The European Journal of Health Economics 2018 20:2*. 2018;20(2):217–232. https://doi.org/10.1007/S10198-018-0989-8
9. Feldhaus I, Mathauer I. Effects of mixed provider payment systems and aligned cost sharing practices on expenditure growth management, efficiency, and equity: a structured review of the literature. *BMC Health Services Research 2018 18:1*. 2018;18(1):996-. https://doi.org/10.1186/S12913-018-3779-1
10. Reinhardt UE, The Pricing Of US. Hospital Services: Chaos Behind A Veil Of Secrecy. *https*:https://doi.org/10.1377/hlthaff25157. 2017;25(1):57–59. https://doi.org/10.1377/HLTHAFF.25.1.57
11. Tan S et al. DRGs and cost accounting:Which is driving which? In: *Busse editor*. 2011. Accessed February 16, 2025. https://eurohealthobservatory.who.int/publications/m/diagnosis-related-groups-in-europe
12. Tan SS, Geissler A, Serdén L, et al. DRG systems in europe: variations in cost accounting systems among 12 countries. Eur J Public Health. 2014;24(6):1023–8. https://doi.org/10.1093/EURPUB/CKU025.
13. Raulinajtys-Grzybek M. Cost accounting models used for price-setting of health services: an international review. Health Policy (New York). 2014;118(3):341–53. https://doi.org/10.1016/J.HEALTHPOL.2014.07.007.
14. Gaughan J, Kobel C. Coronary artery bypass grafts and diagnosis related groups: patient classification and hospital reimbursement in 10 European countries. *Health Economics Review 2014 4:1*. 2014;4(1):4-. https://doi.org/10.1186/S13561-014-0004-8
15. Mathauer I. Setting health insurance remuneration rates of private providers in kenya: the role of costing, challenges and implications. Int J Health Plann Manage. 2011;26(1):e30–47. 10. 1002/HPM.1038;WGROUP:STRING:PUBLICATION.
16. Honda A, Obse A. Payment Arrangements for Private Healthcare Purchasing Under Publicly Funded Systems in Low- and Middle-Income Countries: Issues and Implications. *Applied Health Economics and Health Policy 2020 18:6*. 2020;18(6):811–823. https://doi.org/10.1007/S40258-019-00550-Y
17. Barber SL, Lorenzoni L, Ong P. Institutions for health care price setting and regulation: A comparative review of eight settings. Int J Health Plann Manage. 2020;35(2):639–48. 10. 1002/HPM.2954;WGROUP:STRING:PUBLICATION.
18. Sumankuuro J, Griffiths F, Koon AD, et al. The experiences of strategic purchasing of healthcare in nine Middle-Income countries: A systematic qualitative review. Int J Health Policy Manag. 2023;12(Issue 1):1–21. https://doi.org/10.34172/IJHPM.2023.7352.
19. Ndayishimiye C, Sowada C, Dubas-Jakóbczyk K. Health care provider payment reforms in African States of the Commonwealth—a scoping review. Front Public Health. 2025;13:1446497. https://doi.org/10.3389/FPUBH.2025.1446497/BIBTEX.
20. Dubas-Jakóbczyk K, Albreht T, Behmane D, et al. Hospital reforms in 11 central and Eastern European countries between 2008 and 2019: a comparative analysis. Health Policy (New York). 2020;124(4):368–79. https://doi.org/10.1016/J.HEALTHPOL.2020.02.003.
21. Romaniuk P, Szromek AR. The evolution of the health system outcomes in Central and Eastern Europe and their association with sociconomic and political factors: an analysis of 25 years of transition. *BMC Health Services Research 2016 16:1*. 2016;16(1):95-. https://doi.org/10.1186/S12913-016-1344-3
22. Csanádi M, Kaló Z, Rutten-van Molken M, et al. Prioritization of implementation barriers related to integrated care models in central and Eastern European countries. Health Policy (New York). 2022;126(11):1173–9. https://doi.org/10.1016/J.HEALTHPOL.2022.08.012.
23. Sowa PM. Governance of hospitals in central and Eastern Europe. *Governance of hospitals in central and Eastern Europe*. Published Online January. 2016;1:1–260. https://doi.org/10.1007/978-981-287-766-6/COVER.
24. Home - Eurostat. Accessed February 14. 2025. https://ec.europa.eu/eurostat
25. Hospital beds and occupancy: Health at a Glance 2025 | OECD. Accessed January 15. 2026. https://www.oecd.org/en/publications/health-at-a-glance-2025_8f9e3f98-en/full-report/hospital-beds-and-occupancy_152d839e.html#figure-d1e26922-00916766fd
26. Šimović H, Mihelja Zaja M, Primorac M, Šimović H, Mihelja Zaja M, Primorac M. Fiscal (un)sustainability of the Croatian healthcare system: additional impact of the COVID-19 crisis. Public Sect Econ. 2021;45(4):495–515. https://doi.org/10.3326/PSE.45.4.5.
27. Jovanović T. Challenges of the Slovenian healthcare system exposed in hospitals' recovery plans. Stud Health Technol Inf. 2020;272:354–7. https://doi.org/10.3233/SHTI200568.
28. Dubas-Jakóbczyk K, Kozieł A. Towards financial sustainability of the hospital sector in Poland—A post hoc evaluation of policy approaches. Sustain 2020. 2020;12(12):4801. https://doi.org/10.3390/SU12124801.
29. Dubas-Jakóbczyk K, Ndayishimiye C, Szetela P, Sowada C, Kocot E. Financial performance of hospitals in Europe – a scoping review. *BMC Health Services Research 2025 25:1*. 2025;25(1):933-. https://doi.org/10.1186/S12913-025-13080-2
30. Ndayishimiye C, Tambor M, Behmane D et al. Health care provider payment schemes and their changes since 2010 across nine Central and Eastern European countries – a comparative analysis. *Health Policy (New York)*. Published online February 7, 2025:105261. https://doi.org/10.1016/J.HEALTHPOL.2025.105261
31. Cots F, Chiarello P, Salvador X, Castells X, Quentin W. DRG-based hospital payment: intended and unintended consequences. In: Busse et al, editor. Diagnosis related groups in Europe. WHO; 2011. https://eurohealthobservatory.who.int/publications/m/diagnosis-related-groups-in-europe.
32. Tan SS, Rutten FFH, Van Ineveld BM, Redekop WK, Hakkaart-Van Roijen L. Comparing methodologies for the cost Estimation of hospital services. Eur J Health Econ. 2009;10(1):39–45. https://doi.org/10.1007/S10198-008-0101-X/METRICS.
33. Milcent C, Eu CM. Persistent inconsistencies in patient cost variability within the French DRG classification system over the 2012–2019 period. *Health Economics Review 2025 15:1*. 2025;15(1):91-. https://doi.org/10.1186/S13561-025-00663-2
34. Ozaltin A, Cashin C, editors. *Costing of Health Services for Provider Payment: A Practical Manual | Joint Learning Network*.; 2014. Accessed February 14, 2025. https://jointlearningnetwork.org/resources/costing-of-health-services-for-provider-payment-a-practical-manual/

35. Vogl M. Assessing DRG cost accounting with respect to resource allocation and tariff calculation: the case of Germany. *Health Economics Review* 2012 2:1. 2012;2(1):15-. https://doi.org/10.1186/2191-1991-2-15
36. Network behind the Health Systems and Policy Monitor. Accessed February 14. 2025. https://eurohealthobservatory.who.int/monitors/health-systems-monitor/network
37. Guinness L, Ghosh S, Mehndiratta A, Shah HA. Role of healthcare cost accounting in pricing and reimbursement in low-income and middle-income countries: a scoping review. BMJ Open. 2022;12(9):e065019. https://doi.org/10.1136/BMJOPEN-2022-065019.
38. Chugh Y, Sharma S, Guinness L, et al. Establishing National hospital costing systems: insights from the qualitative assessment of cost surveillance pilot in Indian hospitals. BMJ Open. 2024;14(9):e082965. https://doi.org/10.1136/BMJOPEN-2023-082965.
39. Health system effects of economy-wide inflation: How resilient are European health systems? Accessed March 30. 2025. https://eurohealthobservatory.who.int/publications/i/health-system-effects-of-economy-wide-inflation-how-resilient-are-european-health-systems
40. Amies-Cull B, Luengo-Fernandez R, Scarborough P, Wolstenholme J. NHS reference costs: a history and cautionary note. *Health Economics Review 2023 13:1*. 2023;13(1):54-. https://doi.org/10.1186/S13561-023-00469-0
41. Hrifach A, Brault C, Couray-Targe S et al. Mixed method versus full top-down microcosting for organ recovery cost assessment in a French hospital group. *Health Economics Review 2016 6:1*. 2016;6(1):53-. https://doi.org/10.1186/S13561-016-0133-3
42. Cashin C, Gatome-Munyua A. The strategic health purchasing progress tracking framework: A practical approach to Describing, Assessing, and improving strategic purchasing for universal health coverage. Health Syst Reform. 2022;8(2). https://doi.org/10.1080/23288604.2022.2051794.
43. Johnson EM. Physician-Induced Demand. *Encyclopedia of health economics*. Published Online January. 2014;177–82. https://doi.org/10.1016/B978-0-12-375678-7.00805-1.
44. Savva N, Debo L, Shumsky RA. Hospital reimbursement in the presence of Cherry picking and upcoding. Manage Sci. 2023;69(11):6777–99. https://doi.org/10.1287/MNSC.2023.4752.
45. Zhou M, Zhao S, Fu M. Supply-induced demand for medical services under price regulation: evidence from hospital expansion in China. China Econ Rev. 2021;68:101642. https://doi.org/10.1016/J.CHIECO.2021.101642.
46. Identifying. measuring and reducing low-value care in the context of health system performance assessment - Public Health. Accessed January 14, 2026. https://health.ec.europa.eu/publications/identifying-measuring-and-reducing-low-value-care-context-health-system-performance-assessment_en
47. Ho CWL, Ali J, Caals K. Ensuring trustworthy use of artificial intelligence and big data analytics in health insurance. Bull World Health Organ. 2020;98(4):263–9. https://doi.org/10.2471/BLT.19.234732.
48. Oranje M, Mathauer I. Exploring the effects of digital technologies in health financing for universal health coverage: a synthesis of country experiences and lessons. Oxf Open Digit Health. 2024;2. https://doi.org/10.1093/OODH/OQAE016.
49. Pioch C, Struckmann V, Brikci N, et al. Digital technologies for health financing in low-income and middle-income countries: a scoping review protocol. BMJ Open. 2024;14(6):e080132. https://doi.org/10.1136/BMJOPEN-2023-080132.
50. Hebal F, Nanney E, Stake C, Miller ML, Lales G, Barsness KA. Automated data extraction: merging clinical care with real-time cohort-specific research and quality improvement data. J Pediatr Surg. 2017;52(1):149–52. https://doi.org/10.1016/J.JPEDSURG.2016.10.040.
51. van Dijk WB, Fiolet ATL, Schuit E, et al. Text-mining in electronic healthcare records can be used as efficient tool for screening and data collection in cardiovascular trials: a multicenter validation study. J Clin Epidemiol. 2021;132:97–105. https://doi.org/10.1016/j.jclinepi.2020.11.014.

Publisher's note