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Review

Management of Performance Indicators in Public Hospitals: Evidence and a Research Agenda

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Abstract

Performance indicators support monitoring, resource allocation, and accountability in public hospitals, yet research on their management remains fragmented. This study examines how the literature has approached performance indicator management in public hospitals. A bibliometric analysis of 89 open-access documents indexed in Web of Science and Scopus was conducted, complemented by a document analysis of the full texts of 84 articles to identify the indicators investigated and the dimensions directly measured. The results revealed an expanding but fragmented field in which efficiency occupied a central thematic position, while quality and care remained recurrent themes. The complementary analysis showed that efficiency and productivity was the most widely represented category across articles, while length of stay, mortality, and bed occupancy were the most recurrent indicator concepts. Based on these findings, the study proposes a research agenda focused on multidimensionality, comparability, managerial use, and digital integration. By linking the field's thematic configuration to the indicators examined in the full texts, it offers a literature-based reference for examining the composition of performance indicator sets reported in research on public hospitals and informing context-sensitive future research.

Keywords: public hospitals; performance indicators; indicator management; hospital performance

1. Introduction

Hospitals are complex organizations that occupy a central position in healthcare systems. Across OECD (Organisation for Economic Co-operation and Development) countries, hospital activities accounted for an average of 39% of health expenditure, the largest share among provider types [1]. At the same time, their organizational structure is characterized by diverse and interdependent clinical and administrative areas that bring together professionals, technologies, information, and resources [2,3]. This complexity makes hospital management particularly challenging and reinforces the need for an integrated understanding of performance [3].

Managing this performance requires balancing resource availability and efficient use with access, quality, and care outcomes, while considering the resources employed, the processes carried out, the services delivered, and the results achieved [1–3].

In the public sector, this challenge also involves multiple objectives, values, and actors, because the information produced supports internal monitoring, policymaking, resource allocation, and accountability to governments, oversight bodies, and citizens [4,5]. Public hospital performance therefore encompasses efficiency, quality, effectiveness, safety, responsiveness, access, and equity [4,6]. Monitoring these dimensions requires translating them

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Academic Editor: Sandra C. Buttigieg

Received: 17 August 2026
Revised: 2 October 2026
Accepted: 5 October 2026
Published: 25 November 2026

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into measurable information, although performance measurement concepts are not defined uniformly [7–9]. Performance measurement is the process of quantifying the efficiency and effectiveness of actions, whereas a performance measure is the metric used in that quantification [7]. In healthcare, this process entails selecting and using quantitative measures of capabilities, processes, and outcomes to monitor, assess, and communicate progress toward established objectives [4,10].

An indicator represents a complex phenomenon that cannot be apprehended directly and, when associated with a dimension of hospital performance, enables specific aspects of organizational functioning and outcomes to be measured and monitored [6]. Because an indicator does not fully reproduce the phenomenon being assessed, it should be interpreted alongside other measures and the organizational conditions under which it was produced [4,6].

Some indicators are selected as key measures because of their relationship to organizational objectives, critical success factors, and strategies and are termed key performance indicators (KPIs). Targets, in turn, establish the expected performance levels for these measures [2,11]. Indicators may be incorporated into performance measurement systems that combine conceptual frameworks, data sources and collection mechanisms, analysis and reporting procedures, and periodic review processes [4,7,8,10]. The existence of these systems, however, does not ensure that the information will be incorporated into decision-making. In public performance management, the measurement and use of information are linked to control, learning, and accountability [5]. In hospitals, indicator management encompasses indicator selection and operational definition, data collection, the presentation and interpretation of results, performance comparison, and the use of findings to improve care [4,6].

The development and interpretation of hospital indicators have been shaped by seminal approaches. Donabedian [12,13] systematized healthcare quality assessment into structure, process, and outcome, linking the conditions under which care is provided, the activities performed, and their effects. From a systems perspective, the Institute of Medicine [14] established six aims for improving care: safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity. At the hospital level, the Performance Assessment Tool for Quality Improvement in Hospitals (PATH) brought together clinical effectiveness, production efficiency, staff orientation, responsive governance, safety, and patient-centeredness [6].

In strategic management, Kaplan and Norton [15] proposed the Balanced Scorecard as a means of linking financial and nonfinancial indicators to organizational objectives and strategy. Its application to healthcare, however, requires adaptation to care-related purposes and to different stakeholders and organizational levels [16,17]. Within the efficiency approach, Farrell [18] laid the foundations for measuring productive efficiency, which underpinned the development of Data Envelopment Analysis [19,20]. This approach has been widely applied in hospitals, although it represents only one component of hospital performance [4,21].

These frameworks place different emphases on measurement. Quality and performance models organize clinical and organizational dimensions, the Balanced Scorecard links indicators to strategy, and the efficiency approach examines the relationship between resources and services produced. Indicator systems may also serve internal improvement, external assessment, and accountability, depending on the needs of the actors involved [4,6]. This diversity helps explain the coexistence of different dimensions, purposes, and classifications in the literature.

Comprehensive reviews identify effectiveness and efficiency among the most frequently represented dimensions, followed by safety and patient-centeredness [9,22]. Recent studies also report the recurrence of indicators related to bed utilization, patient safety, and financial

management [3]. Within specific domains, efficiency indicators have been organized into inputs, processes, and outputs [23], financial indicators into profiles containing definitions, formulas, and interpretation parameters [24], and hospital supply chain indicators into financial, managerial, and clinical categories [25].

Taken together, these studies show that the literature has advanced in identifying and classifying hospital performance dimensions and indicators, as well as in examining specific measurement domains in greater depth. Because the identified reviews pursued these aims, they were not designed to characterize how research on performance indicator management in public hospitals developed and is organized. Understanding this configuration requires examining the evolution of the literature, its main actors, collaboration patterns, intellectual foundations, and thematic structure, and linking these features to the indicators actually investigated in the publications.

Integrating these perspectives is particularly relevant to public hospitals, where performance information guides decisions by managers and governments and supports monitoring, resource allocation, and accountability [4,5].

Against this background, the study addresses the following question: How has the literature approached the management of performance indicators in public hospitals? The objective is to analyze how the literature has approached performance indicator management in public hospitals. To answer this question, a bibliometric analysis was conducted to characterize the scientific literature and map its intellectual and thematic structures, complemented by a full-text examination to identify the indicators investigated, their recurrence, and the dimensions they directly measure.

The analyzed corpus reveals an expanding yet dispersed research landscape in which efficiency occupies a central thematic position and is the most widely represented category across articles. At the indicator level, length of stay, mortality, and bed occupancy were the most recurrent concepts across the studies analyzed. Quality and safety, patient experience, and professional-related aspects were less widely represented in the literature analyzed.

By linking the scientific configuration of the field to the dimensions represented by its indicators, the study offers complementary perspectives on how public hospital performance has been addressed in the literature. This synthesis enables hospital managers, governments, and oversight bodies to recognize which dimensions are more or less represented in indicator sets and guides research aimed at improving their comparability, multidimensionality, and incorporation into organizational decision-making.

2. Materials and Methods

This descriptive study used a quantitative approach to characterize a specific phenomenon [26] by quantifying patterns, trends, and analytical approaches identified in the scientific literature [27]. A literature review was therefore conducted using bibliometric analysis, complemented by document analysis. Bibliometric analysis applies mathematical and statistical methods to examine the development of a field of knowledge [28]. It can reveal the temporal evolution of a field, the distribution of publications across sources and countries, author productivity, collaboration and citation patterns, intellectual foundations, thematic trends, and the evolution of research topics [28,29]. These methods thus provide a basis for understanding the structure and dynamics of scientific production, identifying gaps in the literature, and guiding future research.

2.1. Data Collection and Search Strategy

Data were collected from the Web of Science (WoS) and Scopus databases on 1 July 2026. No time restriction was applied; the search therefore covered all records indexed in the databases through the collection date. The search strategy combined sets of descriptors following established bibliometric review practices [30] and was designed to retrieve studies at the intersection of the public hospital context and performance indicator management, intentionally centering on the explicit designation "public hospital(s)" to maintain alignment with the study object. The same descriptors and Boolean operators were entered through the search functions of both databases. Within each set, terms were linked using the OR operator, while the two sets were combined using AND to retrieve studies addressing both dimensions, as shown in Table 1.

Table 1. Search strategy.

Strategy		#1 AND #2
Web of Science (TS—Topic Searches) [1] Scopus (Article title, Abstract, Keywords)	#1	("Public Hospital" OR "Public Hospitals")
	#2	("Indicator Management" OR "Indicators Management" OR "Indicator System" OR "Indicators Systems" OR "Performance Indicator" OR "Performance Indicators" OR "Key Performance Indicator" OR "Key Performance Indicators" OR "KPI" OR "KPIs" OR "Indicator Framework" OR "Indicator Frameworks" OR "Indicator Dashboard" OR "Indicator Dashboards")

[1] In Web of Science, the TS (Topic) field searches document titles, abstracts, author keywords, and Keywords Plus®.

The search retrieved 398 documents, including 152 from Web of Science and 246 from Scopus. Because the complementary indicator analysis required full-text examination, the open-access filter was applied to all search results before the bibliometric corpus was finalized. This deliberate methodological decision involved a trade-off. It enabled full-text examination of all documents retained in the bibliometric corpus and made it possible to connect the bibliometric mapping with the complementary indicator analysis using a shared base of accessible studies. At the same time, the resulting bibliometric corpus may not include relevant non-open-access publications.

The filter retained 198 documents, including 77 from Web of Science and 121 from Scopus. After removing two editorial materials, one epidemiological report, and 66 duplicates, 129 documents remained. Titles and abstracts were then screened manually for substantive coverage of the public hospital context and performance indicators, without restricting the type or dimension of the measures. Forty documents that merely mentioned public hospitals as contextual information or addressed indicators only superficially or incidentally were excluded.

The final bibliometric corpus comprised 89 documents, as summarized in Figure 1. All 89 documents were available for full-text examination, while 84 met the additional substantive criteria for the complementary indicator analysis, as described in Section 2.2.

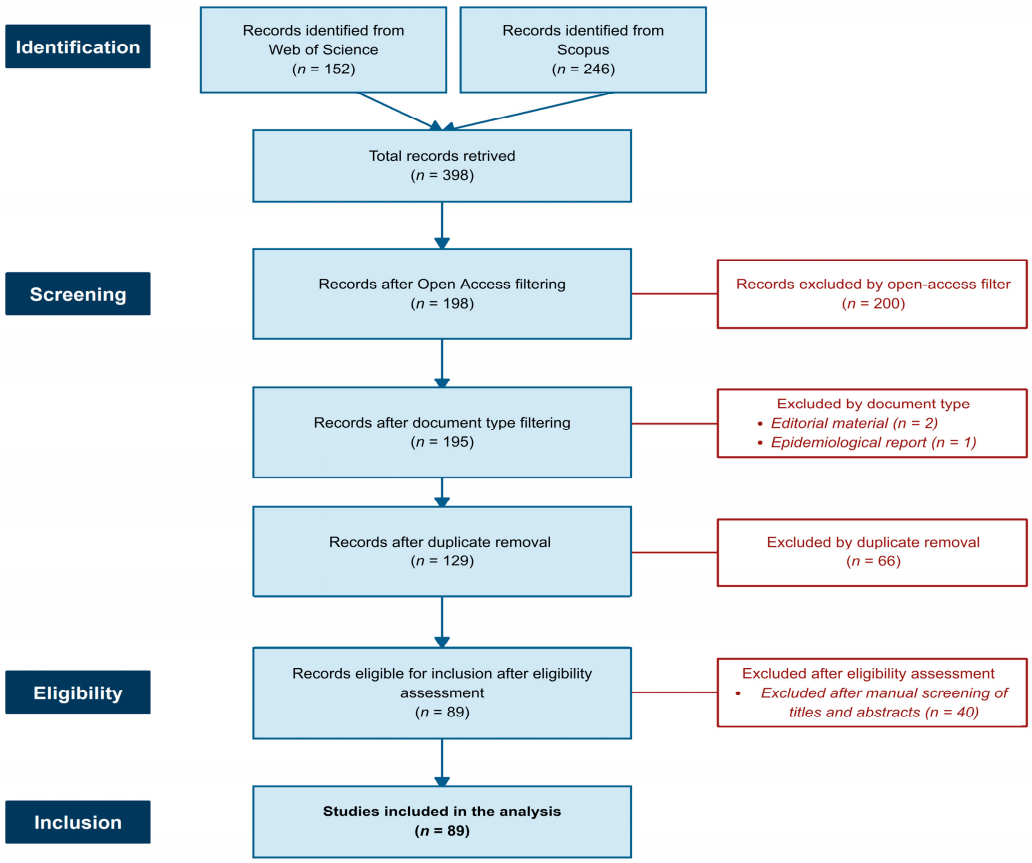


Figure 1. Flow of bibliometric corpus construction. Note: Figure automatically generated by Biblioshiny version 5.0 based on the research data. The flowchart format is defined by the software interface, which uses a model based on the PRISMA diagram and adapted for bibliometric studies.

2.2. Data Processing and Analysis

The data were processed in R 4.5.3 using the bibliometrix 5.0 package through Biblioshiny and RStudio 2026.07.1 [30]. The package was used to calculate bibliometric indicators and produce the analyses and maps reported in Section 3.

The bibliometric analyses were selected to characterize complementary aspects of the field's development and organization [28–30] and to contextualize the examination of performance indicators in the full texts. Annual scientific production describes the field's temporal development. Analyses by corresponding authors' country and authors' countries of affiliation, together with international collaboration patterns, characterize the field's geographic distribution, while cumulative production by country shows how national contributions have changed over time.

Bradford's Law characterizes the concentration and dispersion of publication sources, author productivity identifies the most prolific contributors, and Lotka's Law describes the distribution of authors according to the number of publications they produce [29]. Citation indicators, including total citations and average citations per document or per year, characterize the citation impact or attention received by documents in the corpus. The frequency of cited references identifies works that recur across the analyzed literature, while RPYS (Reference Publication Year Spectroscopy) identifies peaks in the publication years of cited references that may point to the field's historical roots [31].

The thematic map identifies clusters of co-occurring author keywords. Centrality reflects a theme's relevance and connection to the field, whereas density reflects its internal development. Trend topics show changes in the prominence of terms, and thematic evolution traces the continuity and shifts in themes across periods [30,32].

Author keywords were used in the keyword-based analyses to examine the terminology through which studies were indexed in the corpus. Because author keywords are selected by the authors and may vary in specificity and terminology, keyword-based maps are interpreted as patterns in the vocabulary used in the corpus, rather than as a complete or independently validated representation of article content. Indicator identification and recurrence analysis were based on examination of the full texts.

The full texts of the 89 documents were examined to assess whether they addressed at least one indicator related to hospital performance. Of these, 84 met the substantive criteria for the complementary analysis because they developed, selected, validated, applied, calculated, compared, or monitored at least one such indicator.

The indicators identified in the full texts were extracted using their original designations and organized in Microsoft Excel. When explicitly reported, the classifications adopted by the original articles were also recorded to support interpretation. To identify recurring indicator concepts across articles, lexical variants and qualified forms of the same central construct were grouped under a harmonized label, whereas conceptually distinct measures remained separate and unique indicators retained their original designation. Harmonized labels were used solely for recurrence analysis and did not replace the original indicators, the authors' classifications, or the transversal performance categories.

Recurrence was calculated as the number of distinct articles reporting each indicator concept, with each article counted only once per harmonized label. Separately, the indicators were organized into cross-cutting performance categories according to the aspect of performance directly measured, using frameworks from quality assessment, strategic management, and hospital efficiency selected based on the bibliometric findings. The complete list of the 89 documents and the indicator recurrence matrix, including harmonized labels, article codes, and transversal performance categories, are provided as supplementary data (Supplementary File S1).

Taken together, the bibliometric analyses characterize the development, geographic distribution, and intellectual and thematic organization of the field, while the complementary full-text analysis identifies the performance indicators examined in the studies. This combination connects the field-level configuration to the indicators reported in the literature.

3. Results

The results describe the structural, intellectual, and thematic configuration of the field and, in the complementary analysis, the indicators identified in the full texts.

3.1. Bibliometric Analysis

The bibliometric corpus comprised 89 documents published between 1999 and 2026 across 73 sources. The collection included 414 authors, 2344 cited references, and 291 author keywords. The annual growth rate of production was 2.6%, with an average of 4.72 coauthors per document and international coauthorship in 14.61% of the documents. Table 2 summarizes the main descriptive information for the bibliometric collection.

Table 2. Main information on the bibliometric collection.

Bibliometric Indicator	Results	Bibliometric Indicator	Results
Timespan	1999:2026	Sources	73
Documents	89	Annual growth rate (AGR) %	2.6
Document average age	7.81	Average citations per doc	9.989
References	2344	Authors	414
Co-authors per doc	4.72	International co-authorships %	14.61
Author's keywords	291	Authors of single-authored docs	4

The annual growth rate was 2.60%, but the temporal distribution revealed a recent concentration. Between 1999 and 2012, 11 documents were published, with annual production ranging from zero to two. Between 2013 and 2026, 78 documents were published, accounting for 87.6% of the corpus. The sharpest change occurred in 2014, when seven documents were published, compared with two in the previous year. The 2020–2026 period accounted for 44 documents, equivalent to 49.4% of the collection. The highest annual output was recorded in 2024, with nine documents, followed by 2020, 2021, and 2025, with eight documents each (Figure 2).

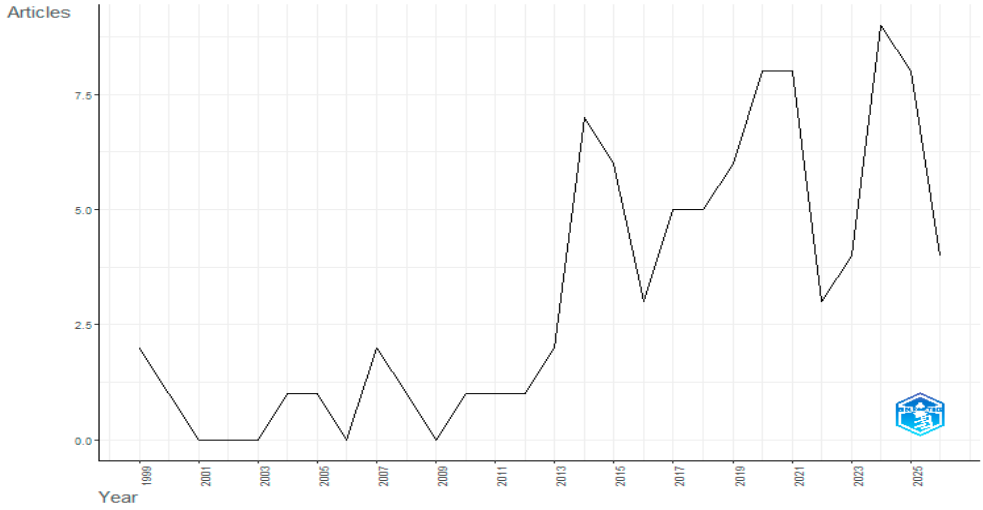


Figure 2. Annual scientific production.

Based on the corresponding author's country, China and Iran led production, with 15 documents each (16.85%), followed by Australia ($n = 9$; 10.11%), Brazil ($n = 7$; 7.87%), and Spain ($n = 4$; 4.49%). Together, these five countries accounted for 50 of the 89 documents (56.2%), as shown in Table 3.

Table 3. Production, citations, and international collaboration of the five most productive countries.

Country	Documents (%)	Total Citations	Avg. Citations/Doc.	Multi-Country Collaboration (MCP)
China	15 (16.85%)	114	7.6	33.33%
Iran	15 (16.85%)	112	7.5	6.67%
Australia	9 (10.11%)	73	8.1	22.22%
Brazil	7 (7.87%)	42	6.0	0.00%
Spain	4 (4.49%)	51	12.8	0.00%

China and Iran also recorded the highest total citation counts, with 114 and 112 citations, respectively. Among the five most productive countries, Spain had the highest

average citations per document (12.8), but this position did not extend to the full collection. Countries with lower publication volumes achieved higher averages, including South Korea (one document, 58.0 citations per document), Canada (one document, 35.0), the United Kingdom (three documents, 31.0), and New Zealand (two documents, 14.5).

Among the leading producers (Figure 3), China recorded five internationally coauthored documents, whereas Iran had only one. Australia had two multi-country documents, while Brazil and Spain recorded no multi-country documents (MCPs).

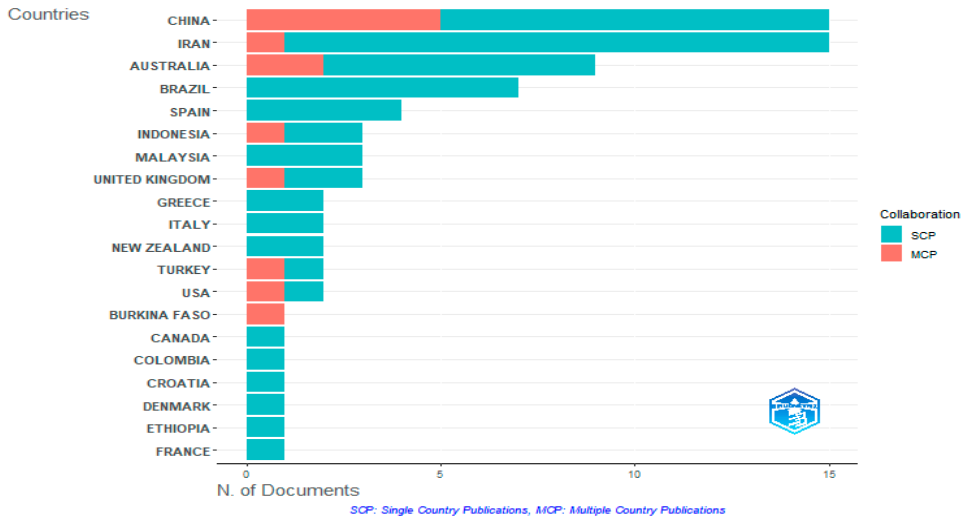


Figure 3. Corresponding authors' countries.

In addition to the composition of international collaboration, the temporal evolution of cumulative production was examined according to the countries identified in the authors' affiliations (Figure 4). Australia entered the field earlier, whereas production in China and Iran grew mainly from the second half of the 2010s onward. Brazil showed more recent growth, while Spain remained relatively stable after 2021.

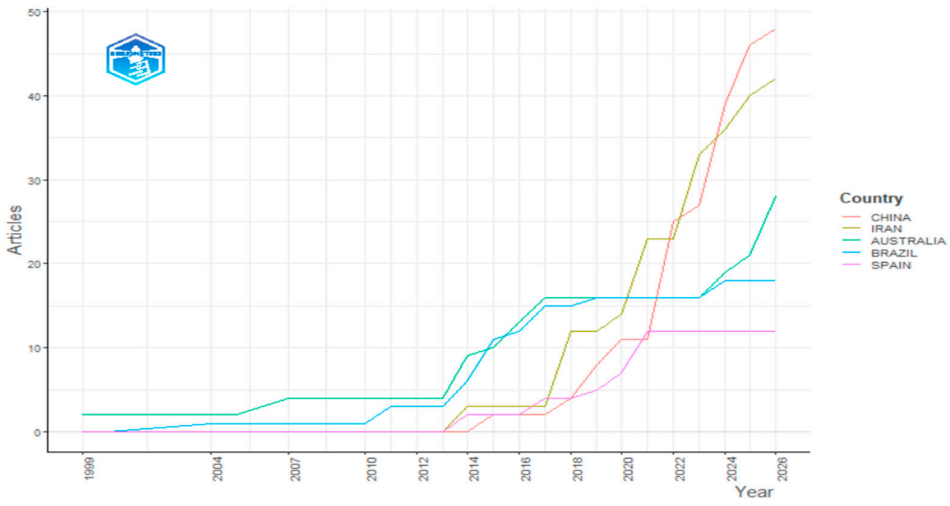


Figure 4. Cumulative scientific production by country of author affiliation. Note: The figure presents cumulative country production based on authors' affiliations. Therefore, its values differ from those in Table 3, which are based exclusively on the corresponding author's country.

The 73 sources followed the concentration and dispersion pattern described by Bradford's Law (Figure 5). Zone 1 comprised 14 sources that accounted for 30 of the 89 documents, or 33.7% of the collection. BMC Health Services Research, with seven documents, and the International Journal of Environmental Research and Public Health, with three, were the leading sources. The remaining 59 documents were distributed across 59 sources: 30 sources and 30 documents in Zone 2, and 29 sources and 29 documents in Zone 3. Thus, 19.2% of the sources concentrated 33.7% of the documents, whereas the remaining documents were highly dispersed across sources.

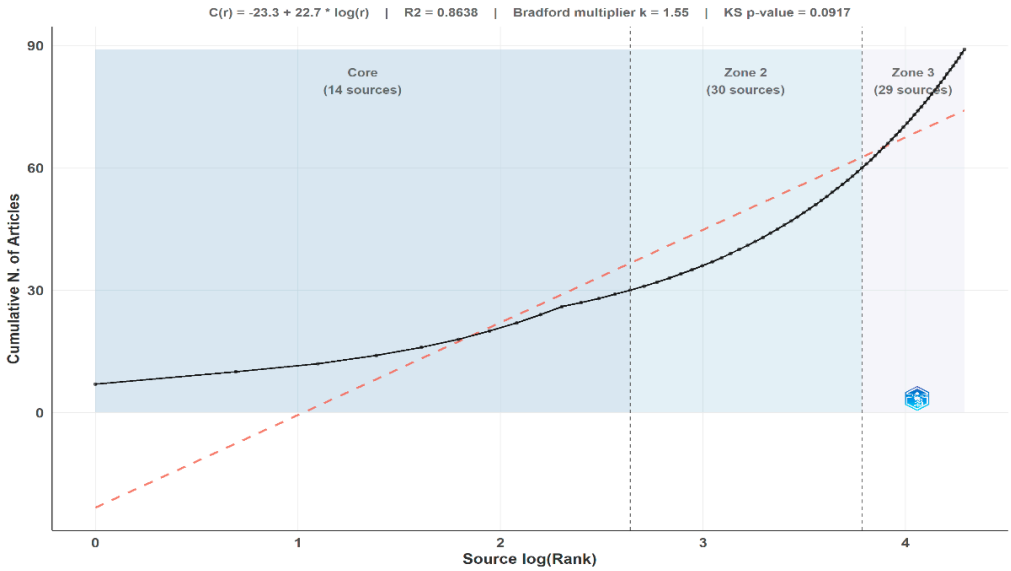


Figure 5. Bradford's Law.

Author productivity was strongly concentrated. Of the 414 identified authors, 408 (98.55%) contributed to only one document, while six (1.45%) contributed to two. No author contributed to more than two documents. Although the distribution exhibits the inverse relationship described by Lotka's Law, the high estimated exponent (Beta = 6.09) indicates greater concentration than the classical form of the law, which is generally associated with a Beta value close to 2. This result demonstrates low author recurrence in the field.

The dispersion observed across sources and authors was complemented by an analysis of the documents' citation impact. The collection averaged 9.99 citations per document. Table 4 presents the ten most cited documents in the collection. By cumulative citations, Martin and Smith [33] had the highest count (63), followed by Cho et al. [34] (58), and Sulku [35] (39). When average citations per year were considered, however, Prado-Prado et al. [36] had the highest value (4.9), followed by Cho et al. [34] (4.8) and Feng et al. [37] (4.3).

Reference Publication Year Spectroscopy (RPYS) can identify possible intellectual roots of a field [31]. Figure 6 shows peaks in 1981, 1986, 1992, 1995, 1998, 2004, 2006, 2010, 2013, and 2020. The last year accounted for 150 occurrences and the largest deviation from the five-year moving median (+48), distributed across 145 references, indicating a recent and diverse research front rather than the isolated influence of a single publication.

Table 4. Ten most cited documents in the collection (global citations).

Author	Document	Total Citations	TC Per Year
Martin & Smith [33]	Multiple public service performance indicators: Toward an integrated statistical approach	63	2.9
Cho et al. [34]	Performance Evaluation of Public Hospital Information Systems by the Information System Success Model	58	4.8
Sulku [35]	The health sector reforms and the efficiency of public hospitals in Turkey: provincial markets	39	2.6
Koné Péfoyo & Wodchis [38]	Organizational performance impacting patient satisfaction in Ontario hospitals: A multilevel analysis	35	2.5
Prado-Prado et al. [36]	Increasing Competitiveness through the Implementation of Lean Management in Healthcare	34	4.9
Landis-Lewis et al. [39]	Barriers to using eHealth data for clinical performance feedback in Malawi: A case study	32	2.7
Feng et al. [37]	Impact of DRGs-based inpatient service management on the performance of regional inpatient services in Shanghai, China: an interrupted time series study, 2013–2019	30	4.3
Pourmohammadi et al. [22]	A comprehensive map of the evidence on the performance evaluation indicators of public hospitals: a scoping study and best fit framework synthesis	27	3.0
Ng & Harrison [40]	Key performance indicators for clinical pharmacy services in New Zealand public hospitals: stakeholder perspectives	27	1.6
Holden & Smart [41]	Adding value to the patient experience in emergency medicine: What features of the emergency department visit are most important to patients?	26	0.9

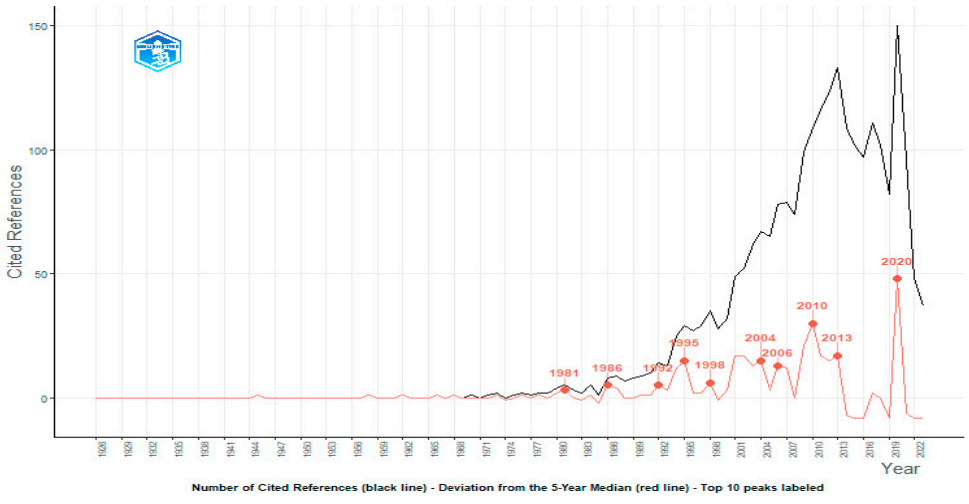


Figure 6. Reference Publication Year Spectroscopy (RPYS).

The analysis of individual publications complements the RPYS results. As shown in Table 5, Veillard et al. [6] was the most recurrent reference, followed by Donabedian [13], Kaplan and Norton [15], Travassos et al. [42], and Thomas and Hofer [43]. These works address hospital performance assessment frameworks, quality assessment, strategic measurement, hospital mortality, and risk adjustment. Only Kaplan and Norton [15] and Thomas and Hofer [43] were published in years identified as peaks, demonstrating that the recurrence of an individual publication and the annual concentration of references represent distinct aspects of the field's intellectual structure.

Table 5. Most recurrent references cited in the RPYS corpus.

Reference	Freq.	Contribution/Associated Paradigm
Veillard et al. (2005), A Performance Assessment Framework for Hospitals: The WHO Regional Office for Europe PATH Project	5	Multidimensional hospital performance assessment framework developed within the PATH project
Donabedian (1988), The Quality of Care: How Can It Be Assessed?	4	Quality assessment based on the relationships among structure, process, and outcome
Kaplan and Norton (1992), The Balanced Scorecard: Measures That Drive Performance	3	Strategic performance measurement through the Balanced Scorecard perspectives
Travassos et al. (1999), Hospital mortality as an indicator of clinical performance: a review	3	Discussion of hospital mortality as a quality indicator
Thomas and Hofer (1998), Research Evidence on the Validity of Risk-Adjusted Mortality Rate as a Measure of Hospital Quality of Care	3	Assessment of the validity of risk-adjusted mortality as a measure of hospital quality

The thematic map identified 13 clusters based on keyword co-occurrence. Centrality represents a theme's connection to the field, whereas density reflects its internal development, enabling motor, niche, basic or transversal, and emerging or declining themes to be distinguished [30,32]. Table 6 presents the frequency, centrality, density, and associated terms for each cluster.

Figure 7 presents the relative positions of the clusters listed in Table 6 across the four quadrants. 'Hospital' was the most frequent cluster and, together with 'efficiency', occupied the motor theme quadrant. 'Efficiency' had the highest centrality (0.667) and high density (70.0). 'Performance indicators' showed high centrality (0.617) but lower density (40.0), positioning it as a basic or transversal theme; 'hospitals', associated with 'financial performance', also occupied this region. 'Emergency department' had the highest density, whereas 'health policy' and 'risk adjustment' formed specialized clusters. 'COVID-19' and 'hospital management' occupied the emerging-or-declining quadrant, while 'electronic medical records' and 'hospital performance' remained close to the quadrant boundaries, with low frequency and centrality (Figure 7).

Because the thematic map provides a static representation, the trend topics analysis (Figure 8) shows the temporal distribution of terms.

Table 6. Clusters in the thematic map based on author keywords.

Cluster	Freq.	Centrality	Density	Associated Terms
Hospital	26	0.548	52.74	performance; balanced scorecard; evaluation; quality indicators; TOPSIS
Public hospital	13	0.278	77.78	management; new public management; organizational performance; quality of care; qualitative research
Efficiency	11	0.667	70.00	clinical governance; effectiveness; health quality management; key performance indicators
Hospitals	10	0.333	30.95	financial performance
Health policy	10	0.167	54.17	lean management; health systems; public hospitals
Performance evaluation	9	0.250	48.61	service quality; China
Emergency department	9	0.222	79.17	discrete-event simulation; lean healthcare; waiting time
Risk adjustment	8	0.000	51.85	quality of health care; indicators of health services
Performance indicators	7	0.617	40.00	health transformation plan
COVID-19	4	0.083	25.00	COVID-19
Hospital management	3	0.000	33.33	hospital management
Electronic medical records	2	0.000	50.00	electronic medical records
Hospital performance	2	0.000	50.00	hospital performance

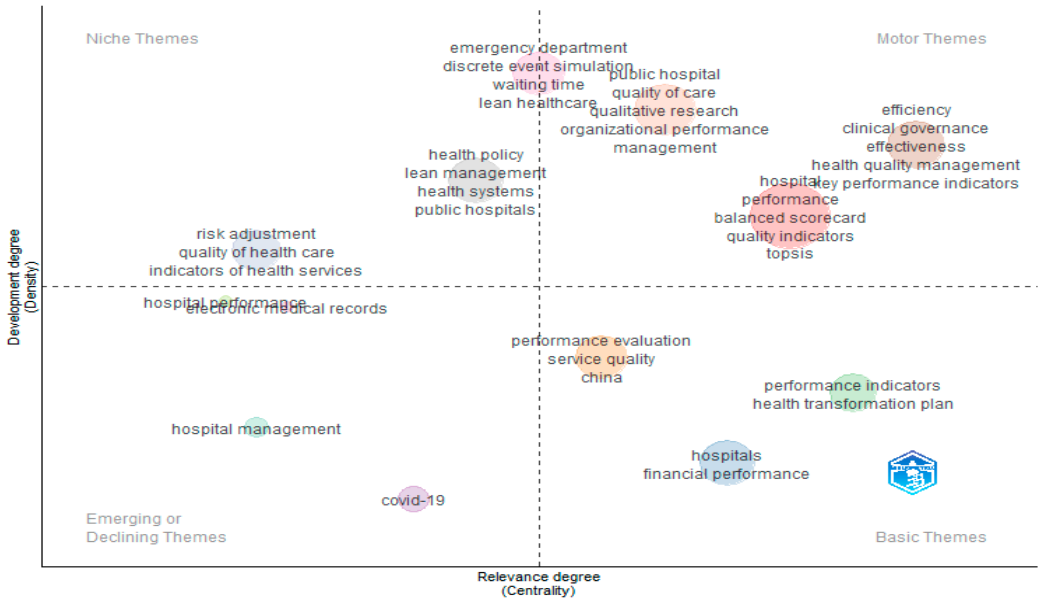


Figure 7. Thematic map of author keywords.

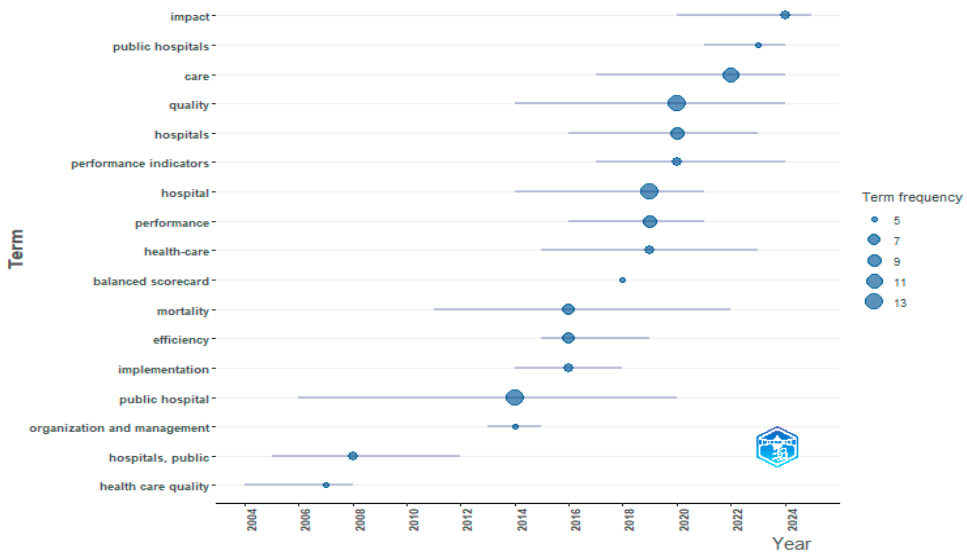


Figure 8. Trend topics based on the temporal distribution of keywords.

The trend topics indicated a transition from 'health care quality' and 'hospitals, public', with median years of 2007 and 2008, to 'public hospital' and 'organization and management' in 2014; 'efficiency', 'mortality', and 'implementation' in 2016; and 'balanced scorecard' in 2018. The most recent terms included 'quality', 'hospitals', and 'performance indicators' in 2020, 'care' in 2022, 'public hospitals' in 2023, and 'impact' in 2024.

'Quality' occurred 13 times, 'public hospital' and 'hospital' 12 times each, and 'care' 11 times. After disregarding the terms embedded in the search strategy, quality and care were the most frequent substantive concepts, whereas the recent position of 'performance indicators' indicates that measurement has become more explicit in the documents.

Figure 9 presents thematic evolution across four periods and shows the continuity and transformation of these clusters.

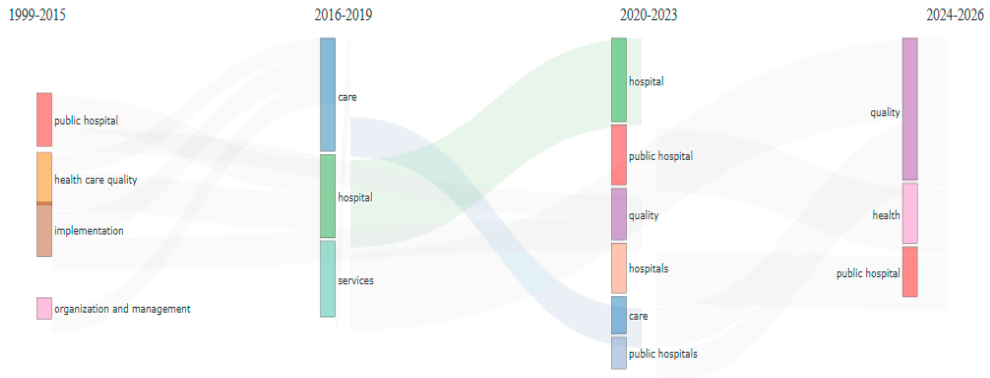


Figure 9. Thematic evolution of the field across four periods (flow diagram).

The thematic evolution showed that 'public hospital', 'health care quality', and 'implementation' were subsequently connected to 'care', 'hospital', and 'services'. Following the diversification observed between 2020 and 2023, the flows converged toward 'quality', 'health', and 'public hospital' in 2024–2026. The substantive result is the continuity of quality and care, accompanied by the incorporation of language related to performance assessment and indicators (Figure 9).

3.2. Complementary Analysis of Performance Indicators

This section complements the bibliometric analysis by examining hospital performance indicators. Of the 89 documents, 84 actually addressed at least one indicator. Khanna [44], Seymour et al. [45], Henderson et al. [46], Landis-Lewis et al. [39], and Vali et al. [47] were retained only in the bibliometric analysis.

The intellectual roots and themes identified through bibliometrics guided the selection of the frameworks used to organize the indicators. Donabedian [12,13] informed the distinction among structure, process, and outcome; the Institute of Medicine [14] informed safety, effectiveness, patient-centeredness, and efficiency; and Kaplan and Norton [15] informed the financial and learning-and-growth perspectives. Hollingsworth [21] informed efficiency and productivity, whereas PATH provided a multidimensional application to the hospital context [6]. Based on these frameworks, the indicators were organized into eight substantive cross-cutting performance categories, while cases that could not be adequately assigned were placed in 'Other performance dimensions' (Table 7).

Table 7. Transversal performance categories used in the complementary analysis.

Category	Operational Definition
Structure, capacity, and resources	Availability and composition of physical, human, technological, and organizational resources, such as beds, staff, and equipment.
Clinical and administrative process	Activities, practices, and flows involved in healthcare delivery, such as adherence to protocols, waiting times, and admission and discharge processes.
Outcome and clinical effectiveness	Effects of care on patients' health and recovery, such as mortality, readmission, and clinical complications.
Efficiency and productivity	Capacity utilization and the relationship between resources used and services delivered, such as occupancy, turnover, length of stay, and service volume.
Quality and safety	Safety of care and prevention of harm, including adverse events, infections, and healthcare-related errors.
Financial and economic	Costs, revenues, margins, liquidity, indebtedness, and financial sustainability.
Patient experience	Patient-reported satisfaction, perceptions, experiences, and assessments of care.
Human resources, learning, and growth	Workforce development, including staff training, satisfaction, retention, and turnover.
Other performance dimensions	Indicators related to public value, social responsibility, institutional legitimacy, and digital information system performance.

To examine recurrence across articles, semantically similar designations of the same central indicator concept were counted under a harmonized label. Table 8 presents the 15 most recurrent indicator concepts, ranked by the number of distinct articles in which they were identified.

Table 8. Fifteen most recurrent indicator concepts across articles.

Indicator Concept (Harmonized Label)	Transversal Performance Category	Articles (*n*)	Articles (%)
Length of stay	Efficiency and productivity	39	46.4%
Mortality	Outcome and clinical effectiveness	27	32.1%
Bed occupancy	Efficiency and productivity	27	32.1%
Waiting time	Clinical and administrative process	14	16.7%
Bed turnover	Efficiency and productivity	14	16.7%
Patient satisfaction	Patient experience	12	14.3%
Staff satisfaction	Human resources, learning and growth	10	11.9%
Inpatient admissions	Efficiency and productivity	9	10.7%
Readmission	Outcome and clinical effectiveness	9	10.7%
Healthcare-associated infection	Quality and safety	8	9.5%
Surgical volume	Efficiency and productivity	7	8.3%
Profitability and margin	Financial and economic	6	7.1%
Staff training and development	Human resources, learning and growth	6	7.1%
Number of beds	Structure, capacity and resources	5	6.0%
Inpatient cost per day	Financial and economic	5	6.0%

Note: Harmonized labels were used solely to identify recurrence across articles by grouping lexical variants and qualified forms of the same central indicator construct. The article codes associated with each harmonized indicator concept are listed in the recurrence matrix in Supplementary File S1, which also provides the complete list of included documents.

Length of stay was the most recurrent indicator concept, appearing in 39 of the 84 articles (46.4%). Mortality and bed occupancy followed, each reported in 27 articles (32.1%). Waiting time and bed turnover were each identified in 14 articles (16.7%), followed by patient satisfaction in 12 (14.3%) and staff satisfaction in 10 (11.9%).

Coverage was calculated across the 84 articles, with each article counted only once within each transversal performance category. Because an article could report indicators assigned to different categories, the percentages do not sum to 100%. 'Efficiency and productivity' had the highest coverage, appearing in 53 articles (63.1%), followed by 'Clinical and administrative process' in 46 (54.8%). 'Structure, capacity, and resources' was identified in 35 articles (41.7%), 'Outcome and clinical effectiveness' in 34 (40.5%), and 'Financial and economic' in 32 (38.1%). The lowest coverage values were observed for 'Quality and safety' (28.6%), 'Human resources, learning, and growth' (26.2%), 'Patient experience' (25.0%), and 'Other performance dimensions' (6.0%), as shown in Figure 10.

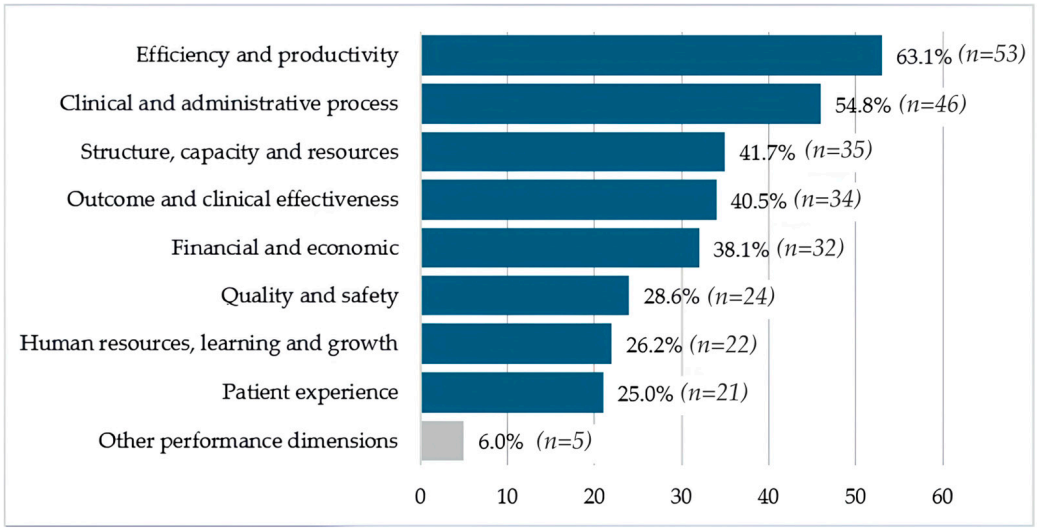


Figure 10. Percentage of articles reporting at least one indicator in each transversal performance category.

4. Discussion

Scientific production on performance indicator management in public hospitals has expanded recently but remains dispersed across authors, sources, and collaboration networks. The fact that 87.6% of the documents were published from 2013 onward indicates growing interest (Figure 2). This growth, however, was not accompanied by the emergence of a stable research community, as 98.55% of the authors contributed to only one document, no author published more than two documents, and international collaboration was present in 14.61% of the collection (Table 2). The distribution of documents across 73 sources further reinforces this dispersion (Figure 5). The findings thus characterize the analyzed literature as expanding but still marked by limited author continuity and restricted international collaboration.

Country-level analyses add a geographic dimension to this picture. Publication output is concentrated among a small group of corresponding-author countries, while citation patterns and international coauthorship vary across them (Table 3, Figure 3). Figure 4 also shows different temporal trajectories in the contributions associated with authors' affiliations. These findings suggest that the literature has an uneven geographic distribution. Since public-sector performance information serves different actors and purposes and is shaped by institutional contexts [4,5], these country patterns describe the geography of scholarly production rather than differences in hospital performance.

The intellectual analyses show that the field draws on multiple conceptual traditions. The RPYS pattern spans several historical periods. Its most recent peak includes many references published in the same year, suggesting that it reflects a broad set of cited works rather than one isolated publication (Figure 6). Table 5 complements this view by identifying the most recurrent references, which represent different perspectives, including multidimensional hospital assessment [6], quality assessment [12,13], strategic measurement [15], and debates on hospital mortality and risk adjustment [42,43].

Although these works were not focused exclusively on public hospitals, their recurrence indicates that the analyzed literature draws on multiple perspectives on hospital performance. Considered alongside the Institute of Medicine domains [14] and hospital efficiency approaches [21], they provide intellectual context for the categories identified in the full-text analysis and support the use of the cross-cutting classification as an analytical

aid. This classification is neither a universal taxonomy nor a substitute for the classifications used in the original articles.

The thematic structure also provides insight into how indicator management appears in the field. Management-related terms were distributed across clusters associated with assessment, the Balanced Scorecard, clinical governance, quality management, and efficiency. 'Performance indicators' was positioned as a basic or transversal theme, whereas 'hospital management' appeared among the emerging or declining themes (Table 6, Figure 7). This configuration suggests that, within the analyzed literature, indicator management is approached primarily through measurement and assessment models and their application to different performance dimensions, without concentrating the topic in a single cluster.

Among these approaches, efficiency showed the clearest convergence between the bibliometric analysis and the full-text examination. The 'efficiency' cluster had the highest centrality and was positioned among the motor themes, while 'Efficiency and productivity' was the most widely represented category, appearing in 63.1% of the articles (Table 6, Figures 7 and 10). This centrality is consistent with the extensive application of efficiency measurement in hospitals [21,23].

In public hospitals, this predominance is consistent with the need to monitor resource use and installed capacity, but it may also reflect the greater availability and comparability of these measures [4]. The thematic centrality of efficiency does not mean that efficiency is equivalent to overall hospital performance. Rather, the finding shows that efficiency is visible both in the thematic structure of the field and in the performance categories identified through the full-text analysis.

At the indicator level, length of stay, mortality, and bed occupancy were the most recurrent concepts across articles after semantic variants were harmonized for counting purposes (Table 8). The presence of bed occupancy is consistent with the findings of Hadian et al. [3], whereas mortality relates to Donabedian's outcome dimension [12,13] and to the debate on its use as a measure of hospital quality developed by Travassos et al. [42] and Thomas and Hofer [43].

The category-level and indicator-level analyses provide complementary perspectives. Efficiency and productivity was represented in the largest number of articles, whereas the recurrence analysis identified length of stay, mortality, and bed occupancy as the most frequently investigated indicator concepts. These findings refer to distinct analytical levels: category coverage indicates how widely a performance dimension is represented across articles, while indicator recurrence shows how consistently specific measurement concepts appear across the literature despite variations in terminology.

These patterns describe the configuration of the included literature rather than a hierarchy of substantive importance or an exhaustive set of performance measures for public hospitals. The prominence or recurrence of a measure may also reflect research focus, data availability and comparability, measurement feasibility, and differences in indicator definitions and reporting.

Variation in the original frameworks shows that indicators are not uniquely associated with a single dimension. Bed occupancy was examined from clinical, financial, operational, and efficiency perspectives [48–51], while mortality was associated with quality and safety, effectiveness, and clinical performance [50–53]. In public hospitals, this plurality is particularly relevant because the same measure may support clinical monitoring, internal management, resource allocation, and accountability to different actors [4,5]. The absence of a consensus classification [9] further reinforces the need to interpret indicators according to their objectives and application contexts [4,6].

Under the cross-cutting classification adopted, quality and safety indicators appeared in 28.6% of the articles, human resources, learning, and growth indicators in 26.2%, and patient experience indicators in 25.0%, proportions lower than those observed for efficiency, processes, and structure (Figure 10). The comparatively lower representation of these dimensions in the analyzed literature may warrant further examination, given that hospital performance also encompasses safety, responsiveness, access, equity, and workforce development [4,6].

These percentages, however, do not support the conclusion that quality, patients, or professionals receive equally limited attention in the articles. Differences from reviews that place safety and patient-centeredness among the represented dimensions should be interpreted cautiously because the reviews adopt different scopes, classifications, and units of analysis [9,22]. Above all, the findings show that the multidimensionality recognized by the Institute of Medicine [14] and PATH [6] can assume different configurations when translated into specific indicators.

Taken together, the findings reveal a relationship that would not be visible from either the bibliometric analysis or the indicator examination alone. Some results converge with patterns already recognized in hospital performance research, particularly the prominence of efficiency and the recurrence of indicators such as length of stay, mortality, and bed occupancy. The distinctive contribution of this study lies in connecting these patterns to the scientific and thematic configuration of research on public hospitals. While the bibliometric analysis positions efficiency as a central theme and maintains quality and care as recurrent reference points, the full-text analysis shows how performance is translated into specific categories and indicator concepts across articles (Figures 7, 9 and 10).

For public hospitals, this distinction highlights the need to examine whether indicator sets adequately represent the different objectives and responsibilities of these organizations, without assuming that a single model applies to every context.

Research Agenda

The joint interpretation of the thematic map, trend topics, thematic evolution, and complementary indicator analysis enabled potential directions for future research to be outlined. The continuity of ‘quality’, ‘health’, and ‘care’, the recent presence of ‘performance indicators’, and the peripheral positions of ‘hospital management’, ‘electronic medical records’, and ‘hospital performance’ indicate potential research fronts (Figures 7–9). Because the thematic map alone cannot distinguish emerging from declining themes, these findings were linked to recommendations from selected recent studies, which are used illustratively. Table 9 presents the proposed research agenda derived from these findings.

The proposed directions encompass both the content of measurement systems and their incorporation into public hospital management. The first area emphasizes broader multidimensionality and the technical comparability of indicators. The second highlights their adaptation to decision-making needs and integration with digital systems and predictive models. Multicenter, longitudinal, and comparative studies constitute a cross-cutting methodological direction, particularly for examining measure validity and effects across different institutional contexts.

Table 9. Proposed research agenda for performance indicator management in public hospitals.

Evidence Produced by the Study	Proposed Research Direction	Convergent Recent Studies
Continuity and recent presence of "quality", "health" and "care", alongside lower dissemination of indicators directly related to quality and safety, patient experience and human resources.	Expand and validate multidimensional indicator sets that integrate clinical outcomes, quality and safety, patient experience, workforce development and economic performance.	[54–57]
"Performance indicators" as a basic or transversal theme and the peripheral position of "hospital management".	Examine how indicators are combined according to decision needs, communicated and used across managerial levels, and how dashboards and performance systems affect resource allocation, processes and outcomes.	[50,58]
Low centrality and frequency of "electronic medical records" and the recent presence of terminology related to performance indicators.	Investigate the integration of electronic records, dashboards and predictive models into performance monitoring, including data quality, implementation and effects on organizational decisions.	[50,59,60]
Different original classifications of semantically related indicators and the absence of equivalence among their definitions and calculation methods.	Compare definitions, formulas, populations, adjustment methods and evaluation models, and validate indicators through multicenter, longitudinal and comparative studies.	[51,54,61,62]

5. Conclusions

This study analyzed how the literature has approached performance indicator management in public hospitals by linking the scientific configuration of the field to the indicators investigated. Within the analyzed corpus, the findings indicate a recent and dispersed body of research in which efficiency occupies a central thematic position and is the most widely represented category across articles. At the indicator level, length of stay, mortality, and bed occupancy were the most recurrent concepts across the studies analyzed. Measures directly related to quality and safety, patient experience, and professional-related aspects were less widely represented.

The principal theoretical contribution lies in linking the thematic configuration of the field to the dimensions and indicator concepts actually represented in the studies. Rather than examining these elements in isolation, this integration distinguishes thematic prominence in the scientific literature from its translation into specific measures of hospital performance. Methodologically, combining bibliometrics with full-text examination connected the scientific structure of the field to the content of the measures and enabled the analysis of both the coverage of performance categories across articles and the recurrence of specific indicator concepts despite variations in terminology.

In practical terms, the findings provide a reference for the different actors involved in public hospital management. For hospital managers, the synthesis can inform examination of how indicator sets cover efficiency, processes, resources, clinical outcomes, safety, patient experience, and professional development. For governments and policymakers, the synthesis can serve as a reference when reviewing the performance dimensions included in monitoring and resource-allocation frameworks. Such decisions should be informed by policy objectives, local needs, and institutional contexts, rather than by indicator recurrence in the literature alone.

For oversight bodies, the findings reinforce the value of interpreting indicators jointly and in relation to their purposes. This helps prevent isolated measures from being treated as complete representations of hospital performance. For professionals, patients, and citizens, the findings make visible dimensions directly related to work, experience, and care that remain less widely represented in the analyzed corpus.

The proposed agenda guides research on multidimensionality, technical comparability, the managerial use of indicators, and integration with digital systems and predictive models. The findings should, however, be interpreted in light of the study's scope and limitations. First, the open-access criterion was applied to the retrieved corpus because the complementary indicator analysis required full-text examination. This made it possible for the bibliometric and full-text analyses to use the same set of accessible studies, but may have excluded relevant non-open-access publications from the bibliometric component.

Second, the search strategy was intentionally centered on the explicit designation "public hospital(s)". Studies referring to publicly owned or publicly funded hospitals through other institutional designations may therefore not have been retrieved. Third, 2026 output covers only the period before data collection in July. From a management perspective, the thematic maps, cross-cutting categories, and recurrence counts describe patterns observed in the eligible corpus. These results do not constitute an exhaustive, system-level ontology of all possible hospital performance criteria. In addition, the semantic harmonization used for recurrence analysis does not imply equivalence among indicator definitions, populations, units, or calculation methods.

Beyond the directions outlined in the research agenda, future studies could broaden the scope of the literature covered and the terminology used to identify public hospital organizations while examining whether different institutional and health-system contexts produce distinct patterns of performance measurement. System-level frameworks or ontologies, supported by theoretical guidance and empirical validation, could assess the completeness, relevance, and contextual applicability of indicator sets. Such studies could also examine whether indicators with low or no recurrence are underrepresented in the literature, reported under different labels, or difficult to operationalize.

Further theoretical and empirical research may also deepen the discussion of efficiency and its role within hospital performance, as well as examine how indicators are interpreted, communicated, used, and revised in public hospital decision-making across managerial levels, functional areas, actors, and institutional contexts. Multicenter, longitudinal, and comparative designs can also support the assessment of indicator validity and effects across different settings.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/hospitals3040022/s1, File S1. Bibliometric Corpus and Indicator Recurrence Matrix. References [63–122] are cited in the Supplementary Materials.

Author Contributions: Conceptualization, F.M.A.-d.-S. and S.F.A.-V.; methodology, F.M.A.-d.-S.; validation, F.M.A.-d.-S. and S.F.A.-V.; formal analysis, F.M.A.-d.-S.; investigation, F.M.A.-d.-S.; data curation, F.M.A.-d.-S.; writing—original draft preparation, F.M.A.-d.-S.; writing—review and editing, F.M.A.-d.-S.; visualization, F.M.A.-d.-S.; supervision, S.F.A.-V.; project administration, S.F.A.-V. All authors have read and agreed to the published version of the manuscript.

Funding: This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior—Brasil (CAPES)—Finance Code 001.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries may be directed to the corresponding author.

Acknowledgments: This study was conducted within the Postgraduate Program in Administration at the State University of Londrina (PPGA-UEL), Brazil. The authors used Claude Sonnet 5 (Anthropic) to assist with English translation and linguistic revision, and reviewed and edited all outputs, taking full responsibility for the content of this publication.

Conflicts of Interest: The authors declare no conflicts of interest.

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