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Analysis of the Cost Recovery Rate (CRR) for BPJS Inpatients

Dharmawan Pradana Harla
Universitas Muhammadiyah Yogyakarta, Indonesia

dharmawanpradana @gmail.com

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Abstract

This study aims to analyze the development of Cost Recovery Rate (CRR) research on BPJS inpatient services through a systematic literature review approach combined with bibliometric analysis using VOSviewer. CRR is an important indicator for assessing a hospital's ability to cover inpatient service costs within the INA-CBGs financing scheme. The study adopts the PRISMA protocol, encompassing the stages of identification, screening, eligibility, and inclusion. Data sources were obtained from Google Scholar, Scopus, ScienceDirect, and Web of Science, covering publications from 2017 to 2025. The selection process resulted in 25 articles that met the inclusion criteria. Bibliometric analysis was conducted using network visualization and overlay visualization to map relationships among keywords and identify research trends. The mapping results reveal four main clusters: (1) patient characteristics and length of stay, (2) hospital cost analysis and tariff comparison, (3) evaluation of hospital performance in Indonesia, and (4) medical procedures and treatment complexity. The synthesis findings indicate that the CRR of BPJS inpatient services generally remains below 100%, suggesting that INA-CBGs tariffs have not fully covered hospital service costs. The most influential factors affecting CRR include length of stay, disease severity, type of medical procedures, class of care, and hospital cost structure. Overlay visualization demonstrates a shift in research focus from patient characteristics and basic cost analysis toward activity-based costing, service efficiency, and the appropriateness of INA-CBGs tariffs. Publication frequency also shows a significant increase in 2025. This study highlights that CRR research has evolved from clinical factor analysis toward broader evaluations of hospital financing systems and cost management efficiency.

Keywords: Cost Recovery Rate, BPJS, Inpatient Care, INA-CBGs, VOSviewer.

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INTRODUCTION

Health financing in Indonesia has undergone a significant transformation following the implementation of the National Health Insurance program (Jaminan Kesehatan Nasional, JKN), administered by the Healthcare and Social Security Agency (Badan Penyelenggara Jaminan Sosial Kesehatan, BPJS Kesehatan). This financing system adopts a bundled payment mechanism through the Indonesian Case Base Groups (INA-CBGs), which establishes standardized tariffs for each diagnosis and medical procedure (Saputra & Prima, 2022). This mechanism is designed to enhance the efficiency of healthcare financing while simultaneously controlling expenditures incurred by healthcare facilities. However, the implementation of a case-based payment system has introduced new challenges for hospitals, particularly concerning their ability to cover the costs of services provided to patients. One commonly used indicator to evaluate the financial sustainability of hospitals is the Cost Recovery Rate (CRR), defined as the ratio between hospital revenues and the costs of services delivered (Matos et al., 2021).

The Cost Recovery Rate plays a crucial role in assessing the operational sustainability of hospitals, especially in inpatient services, which generally incur higher costs compared to outpatient care (Arfiani & Fahlevi, 2020). CRR reflects whether the tariffs reimbursed by BPJS Kesehatan under the INA-CBGs scheme are sufficient to cover the actual costs of healthcare

services. A CRR value below one indicates that service costs exceed the payments received, resulting in a service deficit for the hospital. Conversely, a CRR value greater than one suggests that the revenues received are adequate to cover, and potentially exceed, the incurred service costs (Djalaluddin, 2021). Therefore, analyzing CRR is essential not only for evaluating the efficiency of the health financing system but also for identifying factors contributing to the gap between bundled tariffs and actual service costs.

Research on the Cost Recovery Rate (CRR) in inpatient services has been extensively developed within the healthcare and hospital management literature. Kasie et al. (2023) examined the influence of patient profiles, disease severity, length of stay, and class of care on the Cost Recovery Rate in inpatient cases at public hospitals. Their findings indicate that patient characteristics and length of stay significantly affect hospitals' cost recovery levels. Similarly, Maryati et al. (2021) demonstrated that variations in class of care and medical diagnoses influence the discrepancy between INA-CBGs tariffs and the actual service costs incurred by hospitals. Meanwhile, Sheehy et al. (2023) found that several hospitals experience low CRR values in certain inpatient cases due to a mismatch between bundled payment tariffs and the medical resources required during patient care.

Broader analyses further reveal that variations in service costs are influenced by several operational factors within hospitals. Sari and Kusumastuti (2020) emphasized that hospital cost structures, service management efficiency, and patterns of medical resource utilization significantly affect a hospital's ability to achieve an optimal Cost Recovery Rate. Handayani (2022) found that hospitals with more effective cost management systems tend to demonstrate more stable CRR levels compared to those lacking systematic cost control mechanisms. In addition, Suryani and Adawiyah (2021) highlighted that variations in patient length of stay contribute to discrepancies between actual costs and INA-CBGs tariffs received by hospitals.

Despite the growing body of research on Cost Recovery Rate, most prior studies have relied on conventional statistical approaches focusing on the relationship between clinical and financial variables. Moin-Ul-Aziz et al. (2025) underscored the importance of cost management systems in improving hospital cost recovery; however, their study does not comprehensively capture the overall trajectory of CRR research within the scientific literature. Similarly, Kasmita and Nagaring (2025) highlighted the gap between INA-CBGs tariffs and hospital service costs, yet their analysis remains limited to specific hospital cases. These conditions indicate that CRR research still requires a broader scientific mapping to better understand research themes, inter-variable relationships, and the direction of scholarly development in hospital financing.

A bibliometric approach using VOSviewer offers a systematic means of mapping research development through the analysis of keyword co-occurrence, co-authorship, and co-citation networks within the scientific literature. Such analysis enables clearer identification of relationships among concepts, research topics, and emerging trends. Wisnawa (2024) explained that VOSviewer facilitates the visualization of inter-topic relationships, thereby assisting researchers in identifying research clusters and the evolution of major themes within a field. Through this approach, research on Cost Recovery Rate can be examined not only from empirical findings in specific hospitals but also from a broader perspective of knowledge development within the scientific literature.

Although Cost Recovery Rate has become an important indicator in evaluating healthcare financing, studies that map the development of CRR research using bibliometric approaches remain limited. Existing studies generally focus on evaluating INA-CBGs tariffs, hospital cost efficiency, and clinical factors influencing patient service costs. Research examining inter-topic relationships, patterns of scientific collaboration, and the trajectory of CRR studies in the international literature remains scarce. This condition indicates a research gap related to the scientific mapping of Cost Recovery Rate studies, particularly those analyzed through a bibliometric approach using VOSviewer.

Based on the above considerations, this study aims to analyze the development of research on the Cost Recovery Rate in inpatient services for BPJS patients using a bibliometric approach with VOSviewer. Specifically, this study seeks to identify trends in scientific publications, map relationships among keywords related to CRR, and determine clusters of research themes in healthcare financing studies. Furthermore, this study aims to identify the future direction of Cost Recovery Rate research in inpatient BPJS services, thereby providing a clearer scientific overview of the development of hospital financing research in the future.

METHOD

This study employs a systematic literature review (SLR) approach integrated with bibliometric analysis to map the development of research on the Cost Recovery Rate (CRR) of BPJS inpatient services within the scientific literature. This approach was selected to synthesize findings from existing studies while identifying conceptual relationships among key research themes, including healthcare financing, the INA-CBGs payment system, and hospital cost efficiency. The systematic literature review enables a structured and comprehensive synthesis of prior research, thereby providing a clearer understanding of the evolution of CRR studies in healthcare services. Meanwhile, bibliometric analysis is utilized to visualize relationships among keywords, authors, and research themes, allowing for a more measurable observation of research trends through scientific literature network mapping.

The research protocol follows the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) guidelines, which consist of four main stages: identification, screening, eligibility, and inclusion (Page et al., 2021). In the initial stage, the study objective was defined as analyzing the development of scientific literature on the Cost Recovery Rate of BPJS inpatient services and identifying conceptual relationships among CRR, INA-CBGs tariffs, hospital service costs, and healthcare financing efficiency. Subsequently, research questions were formulated to guide the literature search process and determine appropriate search strategies for identifying relevant articles. The integration of systematic literature review and bibliometric analysis was chosen because these approaches complement each other throughout the research process, from defining objectives and searching the literature to selecting articles and conducting analysis and synthesis.

The entire research process was conducted systematically using 25 scientific articles published between 2017 and 2025. This time frame was selected to capture recent developments in healthcare financing, the INA-CBGs payment system, and hospital cost recovery analysis. Data collection was carried out through several stages: (1) accessing scientific databases, including Google Scholar, Scopus, ScienceDirect, and Web of Science; (2) entering keywords into the title, abstract, and keyword fields; (3) limiting document types to research articles and review articles; (4) restricting the publication period from 2017 to 2025; and (5) executing the literature search process. The keywords used included: “Cost Recovery Rate,” “Hospital Cost Recovery,” “Inpatient Cost Recovery,” “BPJS Health Financing,” “INA-CBGs Tariff,” “Hospital Financial Performance,” and “Health Insurance Reimbursement.” All retrieved articles were downloaded in CSV or RIS format and stored in Mendeley for reference management. The dataset was subsequently analyzed using VOSviewer to generate bibliometric visualizations, including network visualization, overlay visualization, and density visualization, illustrating the relationships among research concepts related to Cost Recovery Rate in healthcare services.

During the screening stage, all identified articles were evaluated to determine their relevance to the research focus. The selection process involved reviewing titles, abstracts, and keywords to ensure alignment with the topic of Cost Recovery Rate in BPJS inpatient services and hospital healthcare financing systems. Articles deemed irrelevant were excluded based on predefined exclusion criteria. The selection criteria are presented in Table 1 below.

Table 1. Selection Criteria

No.	Exclusion Criteria	Number of Excluded Articles
1	Articles not written in English	18 articles
2	Articles that do not address the concepts of cost recovery, hospital financing, or healthcare payment systems	26 articles
3	Duplicate articles from different databases	5 articles

The screening process based on the aforementioned exclusion criteria resulted in 38 articles that met the initial eligibility requirements for the subsequent stage. These articles were then further assessed at the eligibility phase through full-text review to ensure methodological appropriateness and conceptual relevance to the study of the Cost Recovery Rate within healthcare financing systems.

The quality appraisal of the selected articles was conducted using the following evaluation criteria:

a. Whether the article was published in a scientific journal indexed in Scopus, Web of Science, ScienceDirect, or Google Scholar within the period of 2017–2025;
b. Whether the article discusses Cost Recovery Rate, hospital service costs, INA-CBGs payment systems, or healthcare financing;
c. Whether the article explains the relationship between service costs, healthcare payment tariffs, or hospital financial efficiency.

Articles that met these criteria (i.e., received affirmative responses to all evaluation questions) were considered to satisfy the quality standards and were included in the final inclusion stage.

This selection process yielded 25 scientific articles, which were subsequently analyzed systematically using a systematic literature review approach. Furthermore, VOSviewer was employed to visualize the conceptual relationships among Cost Recovery Rate, INA-CBGs tariffs, inpatient service costs, and hospital financial performance. The resulting mapping was then utilized to develop a thematic synthesis and to identify research trends and future directions in the study of Cost Recovery Rate within healthcare financing systems.

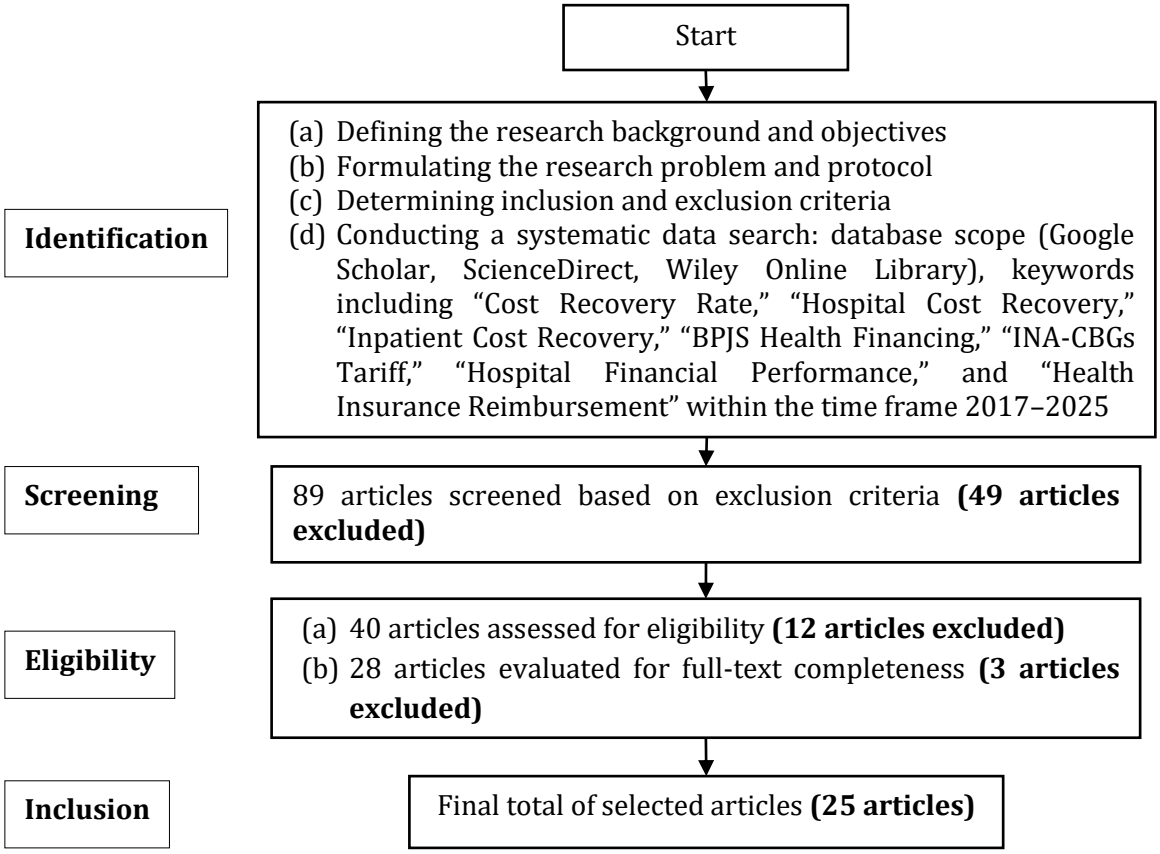


Figure 1. PRISMA Flow Diagram

The flow diagram in Figure 1 illustrates the stages of the systematic literature review, beginning with the identification phase, which includes defining the research objectives, formulating the research questions, developing the review protocol, and establishing inclusion and exclusion criteria. This is followed by a systematic search conducted through Google Scholar, ScienceDirect, and Wiley Online Library using keywords related to the neutrophil–lymphocyte ratio and liver cirrhosis for the 2017–2025 period, resulting in 89 retrieved articles. During the screening stage, 49 articles were excluded, and 40 articles passed the initial selection based on title and abstract. Subsequently, in the eligibility phase, methodological quality and full-text

completeness were assessed, leading to the exclusion of 15 articles and the validation of 25 articles without further exclusions. Finally, in the inclusion stage, a total of 25 articles met all criteria and were included for systematic analysis, visualized using VOSviewer, and further examined manually to synthesize the research findings.

RESULT AND DISCUSSION

The network visualization generated using VOSviewer illustrates the conceptual relationships among keywords identified in the literature on the Cost Recovery Rate (CRR) of BPJS inpatient services. Each node represents a research keyword, while the connecting lines indicate the co-occurrence relationships between concepts within scientific publications. The size of each node reflects the frequency of occurrence of a given concept in the literature, whereas the color of the node classifies research topics into distinct thematic clusters. The mapping results reveal that studies on CRR in healthcare services are not solely concentrated on the financial aspects of hospitals, but also encompass patient characteristics, clinical service patterns, healthcare financing systems, and the evaluation of inpatient service costs.

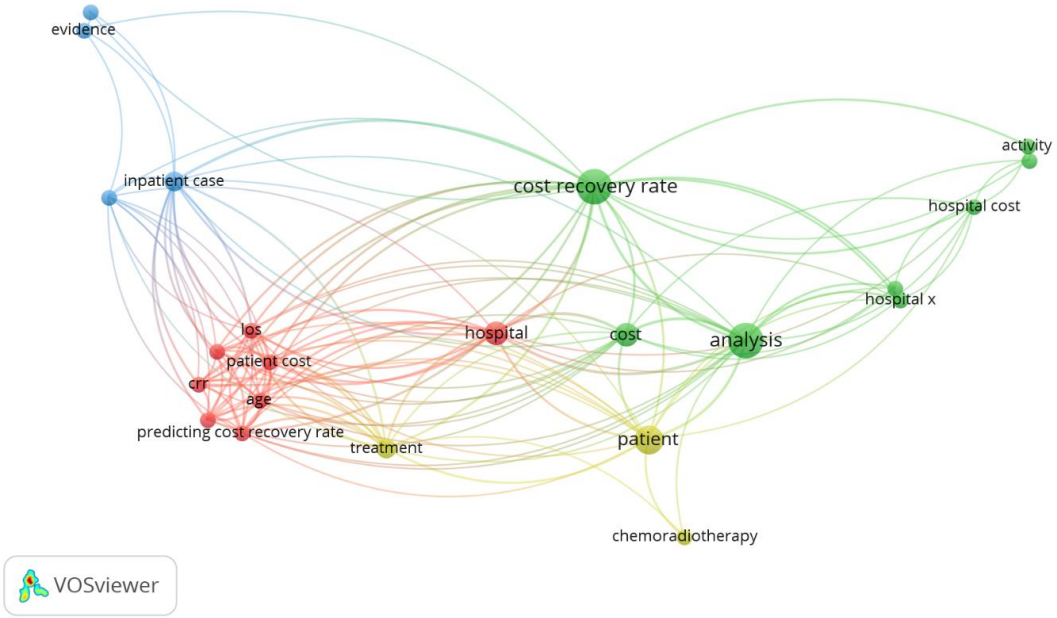


Figure 2. Network Visualization Results of the Study

The mapping results presented in the network visualization reveal that Cluster 1 (red) connects several key concepts, including age, application, CRR, hospital, LOS, patient cost, predicting cost recovery, and stay. This cluster indicates that research on Cost Recovery Rate (CRR) is closely associated with patient characteristics as well as service-related factors that influence inpatient costs. Among these variables, length of stay (LOS) and patient cost are the most frequently analyzed, as both determine the magnitude of healthcare expenditures incurred by hospitals. Fahlevi et al. (2021) explain that length of stay, disease severity, and class of care are critical determinants in predicting the CRR value of inpatients. This finding is further supported by Fahlevi et al. (2020), who demonstrate that case severity and LOS have a significant effect on actual patient costs and the discrepancy between hospital costs and insurance claims received. Rahayu et al. (2023) also show that patient profiles, including age and treatment characteristics, are associated with variations in cost recovery for inpatient cases. Furthermore, Arfiani and Fahlevi (2020) find that differences in patient age, gender, and length of stay influence the gap between INA-CBGs claims and actual hospital service costs. In addition, Kasie et al. (2023) emphasize that disease type, severity level, length of stay, and patient age are key factors explaining variations in CRR values among BPJS inpatient populations.

The results of the Network Visualization mapping indicate that Cluster 2 (green) connects the concepts of activity, analysis, comparison, cost, cost recovery rate, hospital cost, hospital X, and inpatient service. This cluster reflects a research focus on hospital cost analysis and the comparison between service tariffs and the actual costs of healthcare delivery. Aurelia and Pujiyanti (2017) revealed that the unit cost of inpatient services calculated using the Activity-Based Costing method is often higher than the reimbursement rates provided by BPJS, resulting in a cost recovery rate (CRR) below 100%. Hasan et al. (2025) demonstrated that the unit cost of hemodialysis services exceeds both hospital tariffs and INA-CBGs rates, leading to suboptimal cost recovery. Similar findings were reported by Pramanta et al. (2025), indicating that most CT scan services have CRR values below 100%, reflecting a mismatch between service tariffs and actual costs. Manasikana et al. (2025) further emphasized that certain high-technology medical procedures generate cost deficits because INA-CBGs tariffs do not accurately represent real operational expenses. A literature review conducted by Kurniawan and Rahmah (2025) also identified discrepancies between healthcare unit costs and INA-CBGs tariffs, thereby affecting hospitals' ability to recover service costs.

The Network Visualization mapping further shows that Cluster 3 (blue) links the concepts of evidence, Indonesian hospital, Indonesian public hospital, and inpatient case. This cluster represents studies that examine hospital financing practices and the evaluation of healthcare performance in Indonesia. Handayani et al. (2019) found that the financial performance of public hospitals, including the cost recovery rate indicator, changed following the implementation of hospital financial autonomy. Yuniarti et al. (2020) also noted that changes in healthcare service conditions can influence hospital financial performance as well as cost recovery ratios. Nasikin (2025) identified CRR as a key indicator of hospital service efficiency, closely related to healthcare management and resource utilization. Maulana and Khalik (2025) argued that hospital financial indicators, including CRR, should be analyzed alongside service performance indicators such as Bed Occupancy Rate (BOR) and Average Length of Stay (ALOS) to comprehensively assess hospital performance. Sari and Setiawati (2025) demonstrated that hospital performance evaluation using the Balanced Scorecard approach also places financial indicators as a critical component in healthcare management.

Furthermore, the Network Visualization mapping indicates that Cluster 4 (yellow) connects the concepts of chemoradiotherapy, patient, and treatment. This cluster highlights the relationship between specific medical interventions and variations in healthcare costs that influence cost recovery values. Filippi et al. (2024) described that combination therapies in cancer patients require substantial healthcare resources, thereby increasing service costs. Voogt et al. (2021) similarly showed that certain therapeutic approaches may improve clinical outcomes but are associated with higher treatment costs. Kim et al. (2022) emphasized that patient clinical characteristics and disease severity significantly affect treatment needs and healthcare expenditures. Varma et al. (2021) found that clinical events in cardiovascular patients lead to increased utilization of healthcare resources and higher inpatient costs. These findings suggest that the nature of medical procedures and the complexity of treatment play a crucial role in determining healthcare costs, which ultimately affects hospitals' cost recovery rates.

In addition to these four primary clusters, the literature also indicates that Cost Recovery Rate (CRR) analysis is frequently employed as a basis for hospital managerial decision-making. Hafni and Widyaningsih (2025) demonstrate that CRR evaluation in BPJS inpatient services can assist hospitals in formulating cost-control strategies for healthcare delivery. Hafni et al. (2025) further explain that variations in CRR values across service units can be addressed through cross-subsidy mechanisms among hospital services. Yusuf et al. (2022) reveal that discrepancies between the cost of cesarean section services and INA-CBGs tariffs may result in financial losses for hospitals if tariff evaluations are not conducted. Meanwhile, Yassir et al. (2025) emphasize that cost recovery in high-cost inpatient cases is more strongly influenced by treatment characteristics and the complexity of medical procedures rather than by patients' demographic characteristics.

Overlay Visualization in VOSviewer is utilized to illustrate the temporal development of a research topic based on the publication year of articles. The color of each node represents the period in which keywords appear in the scientific literature. Blue indicates earlier research topics, green reflects the developmental phase of the research, while yellow represents relatively recent and emerging themes. Through this approach, the trajectory of research on the Cost Recovery Rate (CRR) of BPJS inpatient services can be observed through shifts in research focus over time. This

visualization facilitates a deeper understanding of how hospital service costs, patient characteristics, and the evaluation of healthcare financing systems have evolved within the scientific literature.

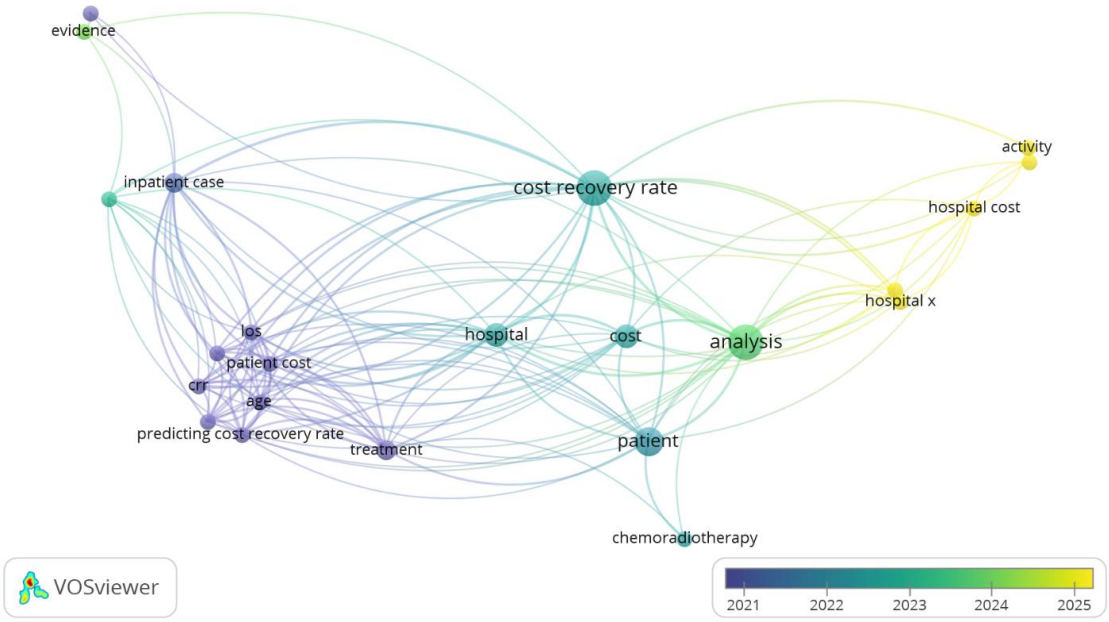


Figure 3. Overlay Visualization of Research Findings

The overlay visualization results illustrate the temporal evolution of research themes related to the Cost Recovery Rate (CRR) of BPJS inpatient services. In the initial phase, blue-colored nodes such as age, patient cost, length of stay (LOS), predicting cost recovery rate, and inpatient case indicate a research focus on cost determinants and the characteristics of inpatient services. Studies in this phase emphasize the relationship between length of stay, patient age, and service costs in determining a hospital's ability to recover service expenditures. Aurelia and Pujiyanti (2017) demonstrate that the unit cost of inpatient services often exceeds BPJS reimbursement rates, resulting in CRR values that fall below the actual costs incurred by hospitals. Subsequently, the emergence of green-colored nodes such as cost recovery rate, hospital, cost, analysis, and patient reflects an expansion of research focus toward the evaluation of healthcare financing systems, particularly the relationship between hospital service costs and INA-CBGs tariffs. Rahayu et al. (2023) and Kasie et al. (2023) further explain that factors such as disease severity, type of illness, and length of stay significantly influence variations in CRR values within inpatient services.

The most recent period is represented by yellow-colored nodes such as hospital cost, hospital X, and activity, indicating a growing scholarly focus on more detailed analyses of healthcare service costs. Research in this phase emphasizes the application of activity-based costing approaches as well as the evaluation of the alignment between hospital service tariffs and the actual costs of care delivery. Hasan et al. (2025) demonstrate that unit cost calculations using Activity-Based Costing yield higher service costs compared to INA-CBGs tariffs, while Pramanta et al. (2025) find that the majority of CT scan services exhibit Cost Recovery Rate (CRR) values below 100%. Furthermore, the overlay visualization highlights the relationship between service costs and the complexity of medical procedures, as reflected in nodes such as treatment and chemoradiotherapy. Filippi et al. (2024) and Varma et al. (2021) argue that complex medical interventions require greater healthcare resources, thereby increasing hospitalization costs. These findings suggest that the trajectory of CRR research has evolved from examining basic patient cost factors toward a broader evaluation of healthcare financing systems and hospital service efficiency.

Table 2. Frequency of Articles by Year of Publication

Year	Frequency	Percentage (%)
2017	1	4
2018	0	0
2019	1	4
2020	3	12
2021	4	16
2022	2	8
2023	2	8
2024	2	8
2025	10	40
Total	25	100

When interpreted in relation to Table 2, which presents the frequency of articles by year of publication, it is evident that research on the Cost Recovery Rate (CRR) of BPJS inpatient services has experienced a notable increase in recent years. In the early phase of the observed period, the number of publications remained relatively limited. In 2017 and 2019, only one article was published in each year, accounting for 4 percent of the total. This pattern indicates that studies on cost recovery within BPJS inpatient services were still in an initial stage of development during that period. A gradual increase became apparent in 2020, with three articles representing approximately 12 percent of the total publications. This upward trend continued in 2021, which recorded four articles or 16 percent of the total. This period corresponds to the green nodes in the overlay visualization, which signify the developmental phase of research on CRR and healthcare financing systems.

In the subsequent period, the number of publications remained relatively stable from 2022 to 2024, with two articles published each year, accounting for approximately 8 percent of the total publications. During this phase, research began to expand its focus from patient cost analysis toward the evaluation of health financing systems and the efficiency of hospital services. The peak of research development occurred in 2025, with ten articles published, representing 40 percent of the total publications. This significant increase corresponds with the yellow-colored nodes in the overlay visualization, which indicate emerging research themes such as hospital cost, activity, and cost analysis of healthcare services. This trend suggests a growing academic interest in cost recovery analysis within healthcare financing systems, particularly in efforts to understand the alignment between hospital service costs and reimbursement tariffs implemented under national health insurance programs.

Table 3. Summary of 30 Included Articles

No	Author(s) (Year)	Objective	Method (Total Study Objects)	Key Findings
1	Arfiani & Fahlevi (2020)	To analyze the cost recovery rate (CRR) and cost control in public hospitals following the implementation of INA-DRGs/CBGs.	Mixed-method case study in a Type A provincial referral hospital in Sumatra; data from documents, patient databases, and INA-DRGs/CBGs claims (2018); semi-structured interviews with physicians and management. Total objects: not specified.	The cumulative CRR was only 60%, indicating that INA-CBGs tariffs were 40% lower than total hospital claims. Variations were observed by age, gender, length of stay, and severity. Cost control remained aggregate-based rather than case-based, thus suboptimal.
2	Armand et al.	To explore the safety	Phase 1b trial	In cHL, ORR reached

	(2021)	and efficacy of PD-1 combined with CTLA-4 or KIR blockade in relapsed/refractory lymphoid malignancies.	involving adult patients with relapsed/refractory cHL, NHL, or multiple myeloma. Total objects: 137 patients.	74% and 76%, while CRR was 23% and 24%. The combination showed activity in cHL, but nivolumab/ipilimumab had higher toxicity without significant efficacy improvement over nivolumab monotherapy.
3	Aurelia & Pujiyanti (2017)	To analyze unit costs and CRR of inpatient Acute Coronary Syndrome services.	Activity-based costing in a Class C hospital in South Jakarta. Total objects: not specified.	The unit cost was IDR 6,083,444. CRR was 227.98% for fee-for-service patients and 71.38% for BPJS patients. Clinical pathway development and recruitment of permanent physicians were recommended.
4	Fahlevi et al. (2021)	To predict CRR of inpatient cases using machine learning.	Analysis of hospital insurance claims (2017–2020) using logistic regression and decision trees. Total objects: 15,955 cases.	Determinants of CRR included care class, admission month, gender, discharge status, severity, LOS, ICU use, surgery, and diagnostics. Decision tree highlighted LOS, care class, and severity as key classifiers.
5	Fahlevi, Putra, & Oktari (2020)	To examine determinants of actual costs, cost gaps, and CRR in ischemic stroke patients.	Multiple regression and semi-structured interviews. Total objects: 677 observations.	Severity level and LOS significantly influenced costs and CRR. Gender and age were not significant. Hospitals had not optimally utilized big data for cost control.
6	Filippi et al. (2024)	To report interim overall survival from PACIFIC-R in stage III unresectable NSCLC patients treated with durvalumab.	Retrospective observational study across 10 countries. Total objects: 1,154 patients.	Median OS was not reached; 3-year OS was 63.2%. Better outcomes were observed in patients with PD-L1 ≥1% and concurrent CRT.
7	Hafni & Widyaningsih (2025)	To analyze CRR by case type and service characteristics in JKN inpatient cardiac care.	Descriptive quantitative case study using primary and secondary data (2023). Total objects: 19 case types.	Overall CRR was 95%. CRR varied by severity (99%), care class (96%), and LOS (95%). Strategies included claim optimization, tariff evaluation, and clinical pathways.
8	Hafni, Aji, & Andriani (2025)	To analyze CRR of JKN inpatients in Hospital X Yogyakarta.	Explanatory sequential mixed-methods. Total objects: not specified.	CRR was 143% (respiratory), 95% (cardiology), and 80% (obstetrics-gynecology). Cross-subsidization between clinics was

				recommended.
9	Handayani, Basri, & Fahlevi (2019)	To compare financial and non-financial hospital performance after financial autonomy (BLU).	Qualitative descriptive study in two hospitals. Total objects: 2 hospitals.	Revenue and profit increased, but profitability, CRR, and independence declined. Some service indicators exceeded standards.
10	Hasan, Adrianto, & Anggraeni (2025)	To determine unit cost of hemodialysis and CRR using ABC.	Descriptive case study using 2023 financial data. Total objects: not specified.	Unit cost was IDR 1,364,257, higher than both hospital and INA-CBGs tariffs. CRR remained below 100%, influenced by direct and overhead costs.
11	Kasie, Widiyaningsih, & Suparjo (2023)	To examine CRR differences by disease type, care class, severity, LOS, and age.	Mixed-method study with 308 patients.	Significant CRR differences were found by disease type, severity, LOS, and age, but not by care class. Clinical pathways and efficiency monitoring were recommended.
12	Kim et al. (2022)	To present clinical characteristics and 5-year survival of lung cancer patients.	Cohort analysis (KALC-R 2015). Total objects: 2,657 patients.	Older age, poor performance status, and advanced stage were independent risk factors. Survival declined with disease progression.
13	Kurniawan & Rahmah (2025)	To review literature on unit cost, tariffs, and CRR.	Literature review of 17 studies.	Most services had higher unit costs than INA-CBGs tariffs. Integration of ABC and clinical pathways was recommended.
14	Manasikana, Suryawati, & Harto (2025)	To estimate unit cost of ureteroscopy and CRR under INA-CBGs.	Retrospective quantitative study. Total objects: 360 procedures.	Unit cost ranged from IDR 8.3–9.3 million. Significant deficits occurred, especially in Class III services (CRR 69%).
15	Maulana & Khalik (2025)	To analyze hospital performance using Balanced Scorecard.	Qualitative descriptive study. Total objects: 1 hospital, 7 informants.	Financial performance was mixed; CRR was below standard. Other perspectives were moderately good.
16	Nasikin (2025)	To analyze hospital efficiency and service quality in the health transformation era.	Sequential mixed-methods. Total objects: not specified.	Data-driven management and digitalization improved performance. Efficiency indicators included BTO, CRR, and waiting time.
17	Pramanta, Kodyat, & Jak (2025)	To evaluate CRR of CT Scan services.	Quantitative cost analysis. Total objects: not specified.	Most CT Scan CRRs were below 100%, indicating ineffective tariff structures.
18	Rahayu, Fahlevi, &	To examine the effect of patient profile and	Regression analysis with 23,125 cases.	Gender, age, LOS, severity, and care class

	Mulyany (2023)	service factors on CRR.		significantly affected CRR.
19	Sari & Setiawati (2025)	To evaluate hospital performance using Balanced Scorecard.	Quantitative descriptive study. Total objects: 1 hospital.	Financial performance was generally good, but operational indicators required improvement.
20	Suryawati & Nandini (2024)	To analyze clinical pathology service costs.	Cost analysis using step-down method. Total objects: 54 services.	Unit costs ranged from IDR 46,566–406,220; tariff setting should consider multiple factors.
21	Varma et al. (2021)	To quantify healthcare resource use in CRT non-responders.	Prospective registry analysis. Total objects: 879 patients.	Non-responders had higher costs and adverse outcomes.
22	Voogt et al. (2021)	To compare CR rates in rectal cancer treatments.	Matched case-control study. Total objects: 242 patients.	CR rate was significantly higher in ICT+CRT group.
23	Yassir, Syam BZ, & Fahlevi (2025)	To analyze determinants of CRR in high-cost patients.	Regression and decision tree analysis. Total objects: 121,482 cases.	Severity, discharge type, and intervention category were dominant factors.
24	Yuniarti, Paryanti, & Tejaningsih (2020)	To compare hospital performance before and during COVID-19.	Qualitative comparative study. Total objects: 1 hospital.	Performance declined significantly during the pandemic.
25	Yusuf, Muin, & Majid (2022)	To compare actual costs of cesarean section with INA-CBGs tariffs.	Cross-sectional observational study. Total objects: not specified.	Actual costs exceeded INA-CBGs tariffs, leading to financial losses.

Table 3 summarizes 25 research articles examining the Cost Recovery Rate (CRR) in healthcare services, particularly inpatient hospital care within the health financing system. Most studies aim to analyze the comparison between hospital service costs and INA-CBGs tariffs, as well as to identify factors influencing hospitals' ability to recover service costs. The methodologies employed vary widely, including case studies, cost analysis using Activity-Based Costing, statistical regression, machine learning approaches, as well as systematic reviews and hospital performance evaluations. The research objects are also diverse, ranging from inpatient cases across various diseases, specific medical procedures such as hemodialysis, ureteroscopy, CT scans, and cesarean sections, to broader analyses of hospital financial performance.

The findings generally indicate that the Cost Recovery Rate (CRR) for patients under the BPJS scheme frequently falls below 100%, suggesting that INA-CBGs tariffs do not fully cover hospital service costs. The factors most commonly influencing CRR include length of stay, disease severity, types of medical procedures, class of care, and the hospital's cost structure. Several studies also emphasize the need for cost control based on unit cost analysis, the implementation of clinical pathways, the utilization of patient data for cost prediction, and the evaluation of INA-CBGs tariff policies. Furthermore, a number of studies highlight that the complexity of medical procedures and the intensity of healthcare resource utilization contribute to increased inpatient costs, thereby affecting hospitals' ability to achieve optimal cost recovery.

DISCUSSION

The principal novelty of this study lies in its integration of a PRISMA-guided systematic literature review with VOSviewer-based bibliometric mapping to examine the development of Cost Recovery Rate (CRR) research specifically in BPJS inpatient services during 2017–2025. Previous

studies generally assessed CRR within a single hospital, diagnostic group, or medical procedure and therefore produced evidence that was highly dependent on a particular service context. By combining thematic synthesis, keyword co-occurrence mapping, overlay visualization, and the annual distribution of publications, this study provides a broader account of how clinical determinants, hospital costing, reimbursement adequacy, and performance evaluation have become interconnected in the CRR literature. This integrated perspective is original because the study does not merely calculate CRR or test individual determinants; it identifies the conceptual structure, dominant themes, and temporal direction of the field.

The synthesis of 25 included articles shows that the CRR of BPJS inpatient services is generally below 100%, although several service units or diagnostic groups may achieve values at or above 100%. The VOSviewer analysis identifies four principal clusters: patient characteristics and length of stay; hospital cost analysis and tariff comparison; evaluation of hospital performance in Indonesia; and medical procedures or treatment complexity. Across these clusters, length of stay, disease severity, type of intervention, class of care, and hospital cost structure emerge as the factors most consistently associated with variation in CRR. The overlay visualization also indicates a shift from early studies of patient-level cost determinants toward more recent work on activity-based costing, service efficiency, and the adequacy of INA-CBGs tariffs. In addition, 10 of the 25 articles were published in 2025, representing 40% of the included literature and demonstrating a marked descriptive increase in scholarly attention to this issue.

These findings are broadly consistent with previous empirical studies. Arfiani and Fahlevi (2020) reported a cumulative CRR of approximately 60% in a public referral hospital and linked the deficit to the limited alignment between INA-CBGs payments and actual service costs. Aurelia and Pujiyanti (2017) similarly found that the CRR for BPJS patients with acute coronary syndrome was 71.38%, whereas the fee-for-service group generated a substantially higher recovery rate. Fahlevi, Putra, and Oktari (2020) showed that severity and length of stay significantly influenced actual cost, cost gaps, and CRR among ischemic stroke patients, while Fahlevi et al. (2021) identified length of stay, care class, severity, intensive care use, surgery, and diagnostic services as important predictors of CRR. Rahayu et al. (2023) also demonstrated that age, gender, length of stay, severity, and class of care affected CRR across a large inpatient dataset. Kasie et al. (2023) confirmed significant CRR differences by disease type, severity, length of stay, and age. More recent evidence reinforces the same pattern: Hafni, Aji, and Andriani (2025) reported heterogeneous CRR values of 143%, 95%, and 80% across respiratory, cardiology, and obstetrics-gynecology services; Hafni and Widyaningsih (2025) found an overall cardiac-service CRR of 95%; Hasan et al. (2025) found hemodialysis unit costs above both hospital and INA-CBGs tariffs; and Manasikana et al. (2025) reported a CRR of only 69% for Class III ureteroscopy procedures.

The similarities among these studies can be explained by the basic structure of case-based reimbursement. INA-CBGs tariffs are predetermined for diagnostic and severity groups, whereas actual hospital expenditure varies according to length of stay, complications, intensive care requirements, pharmaceuticals, consumables, operating-room time, diagnostic intensity, and overhead allocation. Consequently, cases that consume more resources than assumed in the tariff frequently produce a CRR below 100%. Differences among study results are also reasonable. They may reflect variations in hospital ownership and class, regional tariff groups, clinical case mix, severity distribution, care class, study period, sample size, costing method, and the treatment of direct and indirect costs. For example, activity-based costing may identify a larger cost gap than conventional allocation because it traces resource consumption more specifically, while an aggregate hospital analysis may conceal profitable and loss-making service lines through internal cross-subsidization. The fourth bibliometric cluster concerning treatment and chemoradiotherapy should also be interpreted cautiously because the abbreviations CR and CRR are sometimes used for clinical or complete response rates rather than Cost Recovery Rate. This semantic ambiguity may introduce false-positive records unless titles, abstracts, and full texts are manually disambiguated during screening.

This study contributes to the literature by organizing fragmented evidence into a coherent explanatory pathway: patient and disease complexity influences resource utilization and length of stay; resource utilization determines actual service cost; the difference between actual cost and the INA-CBGs tariff determines CRR; and persistent CRR deficits affect hospital financial sustainability and service capacity. The bibliometric mapping further shows that the field is moving beyond isolated descriptions of tariff gaps toward more analytical approaches involving cost prediction,

activity-based costing, clinical pathways, and hospital performance management. Thus, the study fills a gap between individual hospital-level cost studies and a field-level understanding of how CRR research has developed. It also identifies underdeveloped areas, including comparative analyses across hospital classes and regions, the effects of tariff revisions over time, standardized definitions of cost components, and stronger integration between clinical outcomes and financial performance.

The findings have practical, academic, and policy implications. Hospital managers should establish service-line unit-cost calculations, strengthen clinical pathways, improve diagnostic and procedural coding, monitor length of stay and high-cost resource use, and develop CRR dashboards that distinguish profitable and deficit-generating cases rather than relying only on aggregate financial indicators. Cross-subsidization may be used as a short-term managerial strategy, but it should not replace systematic cost control or tariff evaluation. Policymakers should periodically recalibrate INA-CBGs tariffs using recent cost data, regional cost variation, severity, technology intensity, and high-cost consumables, while also providing targeted review mechanisms for services that consistently generate structural deficits. Academically, future reviews should use reproducible database-specific search strings, report the number of records at every PRISMA stage, verify bibliographic metadata and DOI accuracy, and explicitly distinguish Cost Recovery Rate from other meanings of CR or CRR. Future research should also incorporate citation and co-authorship networks, compare hospital classes and diagnostic groups, and conduct empirical or meta-analytic assessments to determine the magnitude of tariff-cost gaps and their consequences for quality, access, and hospital sustainability.

CONCLUSION

This study demonstrates that research on the Cost Recovery Rate (CRR) of BPJS inpatient services has expanded significantly and is predominantly characterized by the issue of misalignment between hospital service costs and INA-CBGs reimbursement tariffs. The synthesis of 25 articles reveals that the CRR for BPJS inpatient services generally remains below 100%, indicating that hospitals are not yet able to fully recover the costs of services from the payments received. The VOSviewer mapping further identifies four principal research themes, namely patient characteristics and length of stay, analysis of service costs, evaluation of hospital performance, and the influence of medical procedure complexity on inpatient costs. The factors most consistently affecting CRR include length of stay, severity of illness, class of care, type of medical procedures, and hospital cost structures. The implications of this study highlight the critical importance of strengthening hospital cost management within the JKN financing system. Hospitals cannot rely solely on INA-CBGs tariffs but must develop more comprehensive cost control systems based on unit cost analysis, clinical pathways, and the utilization of patient data for cost prediction. From a policy perspective, these findings underscore the need for periodic evaluation of INA-CBGs tariff structures to ensure better alignment with the variability of inpatient service needs, particularly for high-severity cases and resource-intensive medical procedures. Future research should broaden the scope of analysis by incorporating a larger body of literature, more diverse databases, and bibliometric approaches that extend beyond keyword analysis to include author collaboration and citation networks. Further studies are also needed to compare different types of hospitals, regions, and diagnostic groups in order to provide a more nuanced understanding of cost recovery patterns. In addition, empirical research based on actual hospital data remains essential to validate bibliometric findings and to generate more practical recommendations for the management of healthcare financing systems.

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