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Does the Overcost Prediction Index Relate to Nursing Service Quality in BPJS Inpatients?

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INDEXING

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ABSTRACT

Health financing through the INA-CBGs system by BPJS Health frequently engenders a discrepancy between the actual hospital tariff and the INA-CBGs tariff. The discrepancy may result in overcosts associated with the quality of nursing services. This study examined the correlation between the overcost prediction index (which encompasses hospital tariffs, disease diagnosis, type of service, and length of stay) and the quality of nursing services in BPJS inpatients. The present study employed a quantitative descriptive method with a cross-sectional design, encompassing 104 BPJS class III inpatients at RSUD dr. Loekmonohadi Kudus, who were selected through a purposive sampling technique. The data were collected using a structured questionnaire tested for validity and reliability, then analyzed univariately and bivariately using Pearson's Chi-Square test. The findings indicated a substantial correlation between the components of the overcost prediction index and the quality of nursing services. This finding is statistically significant and makes a scientific contribution to developing health financing systems and nursing service quality. The practical implications of this study highlight the imperative for periodic evaluation of the INA-CBGs system, the precision of diagnosis coding, and the implementation of theory-based nursing service models to preserve service quality within the limitations imposed by JKN health financing.

Kata kunci:
BPJS;
Desain penelitian cross-sectional;
INA-CBGs;
Kualitas pelayanan keperawatan;
Overcosting

Pelaksanaan pembiayaan kesehatan melalui sistem INA-CBGs oleh BPJS Kesehatan sering kali menimbulkan ketidaksesuaian antara tarif aktual rumah sakit dengan tarif INA-CBGs. Ketidaksesuaian tersebut berpotensi menyebabkan overcost yang tentu berhubungan dengan kualitas layanan keperawatan. Penelitian ini bertujuan untuk menganalisis hubungan antara indeks prediksi overcost (yang mencakup tarif rumah sakit, diagnosis penyakit, jenis layanan, dan lama rawat inap) dengan kualitas layanan keperawatan pada pasien rawat inap BPJS. Penelitian menggunakan metode deskriptif kuantitatif dengan desain cross-sectional, melibatkan 104 pasien rawat inap kelas III BPJS di RSUD dr. Loekmonohadi Kudus, yang dipilih melalui teknik purposive sampling. Pengumpulan data dilakukan menggunakan kuesioner terstruktur yang telah diuji validitasnya, kemudian dianalisis secara univariat dan bivariat menggunakan uji Chi-Square Pearson. Hasil penelitian menunjukkan adanya hubungan yang signifikan antara seluruh komponen indeks prediksi overcost dengan kualitas layanan keperawatan. Temuan ini tidak hanya bermakna secara statistik, tetapi juga memberikan kontribusi ilmiah terhadap pengembangan sistem pembiayaan kesehatan dan mutu layanan. Implikasi praktisnya menegaskan perlunya evaluasi sistem INA-CBGs secara berkala, ketepatan pengkodean diagnosis serta penerapan model pelayanan keperawatan berbasis teori untuk menjaga mutu layanan dalam keterbatasan pembiayaan JKN.

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INTRODUCTION

Hospitals, as health service facilities, represent a vital component of the health resources that help to support efforts to improve people's health. Hospitals must provide safe, high-quality, non-discriminatory services and effectively prioritize patient health, as delineated by established service standards (*Law of the Republic of Indonesia Number 17*, 2023). The Government of the Republic of Indonesia implements social insurance programs to ensure equitable and quality access to services. The government has implemented the Universal

Health Coverage (UHC) program to support the achievement of the Sustainable Development Goals. The UHC program is officially known as the National Health Insurance System (JKN), which is overseen by the Social Security Agency for Health (BPJS *Kesehatan*). The implementation of BPJS *Kesehatan* services encompasses all levels of healthcare facilities, from primary to advanced (*Regulation of the Minister of Health of the Republic of Indonesia Number 3*, 2023).

However, challenges persist in practice, particularly in patient treatment tariffs (Kruk et al., 2018). BPJS *Kesehatan* implements a financing system based on the Indonesian Case Based Groups (INA-CBGs). A substantial challenge lies in the discrepancy between INA-CBG tariffs and the actual hospital tariffs, which has been shown to result in overcosting (Agustina et al., 2019). A recent change has been observed in the methodology employed by the INA-CBGs financing system for determining hospital tariffs. The new approach moves away from the conventional classification of services by type, opting instead for a system based on disease groups, also known as Diagnosis-Related Groups (DRGs) (Ren et al., 2024). Hospital tariffs are assessed to be proportional to the quality of service provided to patients. Hospitals regard overcost as a form of loss, with ramifications for service efficiency, including the nursing service quality (Beauvais et al., 2020).

Nursing services represent a critical component of the care provided to hospitalized patients. The effectiveness and efficiency of the financing system influence nurses' motivation. Overcost negatively impacts service quality (Aiken et al., 2021). Several studies have reported that errors in recording patient data also contribute to overcost claims (Lighterness et al., 2024; Satibi et al., 2019). The relevant data set encompasses age, gender, actual hospital tariffs, INA-CBG tariffs, disease codes, service types, responsible doctors, and length of stay (Wandana et al., 2020). The difference between INA-CBG tariffs and hospital tariffs causes hospital losses (Lathifah et al., 2020). Almeida & Tavares (2021) reported that inaccurate coding of disease diagnoses has also been demonstrated to contribute to tariff claims error and increase the incidence of overcosts. Coding accuracy varies, with errors arising from technical factors, such as the coder's memorization of diagnosis codes. Albagmi (2024) reported that the inaccuracy of primary diagnosis was 26.8%, and the inaccuracy of secondary diagnosis was 9.9%. Based on the findings, these errors can be attributed to a deficiency in the training and experience levels of the coders. This practice often leads to the primary diagnosis code not being rechecked against the therapy provided. This phenomenon may also be attributed to the coder's lack of knowledge regarding the patient's medical condition and potential complications.

The prediction of INA-CBGs tariffs is feasible by analyzing claim data and the Activity-Based Costing (ABC) approach. The ABC identifies the type of service and calculates the unit cost for each service type (Firdaus & Nurpadi, 2020; *Regulation Minister of Health Regulation Number 16, 2019).* Clinical indicators, such as Length of Stay (LoS), have been demonstrated to optimize resource utilization and prevent overcosting (Stone et al., 2022). Putra et al. (2023) found that restructuring INA-CBGs' tariffs significantly impacts nursing service quality, as measured by facility availability and patient satisfaction. Karina (2021) emphasizes that these INA-CBG tariffs also refer to the types of services provided. In Indonesia, hospitals have applied the ABC method as a standard procedure for managing BPJS *Kesehatan* patient care tariff claims. However, the ABC method's efficacy depends on real-time patient data availability. To date, no system or methodology has been developed to predict patient

treatment tariffs based on historical disease diagnosis data and historical tariff data. Therefore, to anticipate overcosting, a data-driven predictive approach is imperative. This approach may include the application of data mining and predictive modeling to estimate the potential overcost (Y. Wang et al., 2018) and its impact on the service quality. Nwoke (2024) obtained that the data mining predictive approach utilizes historical tariffs and medical records to forecast future tariffs with greater precision, aligning with existing cases. It is attributable to the system's capacity to identify anomalies, predict treatment tariffs, and discern patterns in cases (Tabassum et al., 2024; Wójcik et al., 2025). The ability to predict patient treatment tariffs will enhance the quality of hospital services, with an orientation toward achieving patient satisfaction (Haghgou et al., 2024).

Previous studies have identified the issue of tariffs or administrative errors, such as inaccurate diagnosis coding or length of hospitalization that exceeds the standard. In Indonesia, several hospitals, including Dr. Loekmono Hadi Kudus General Hospital, have employed the Activity-Based Costing (ABC) method to calculate the cost of BPJS Health patient services. However, its application predominantly focuses on calculating costs, without considering its relationship to service quality, particularly in nursing services. Indeed, the quality of nursing services is contingent upon the accuracy of the financing received by the hospital. A paucity of studies specifically analyzes the relationship between the overcost prediction index and the quality of nursing services. Consequently, this study is imperative to fill the gap in the scientific literature concerning the relationship between the overcost prediction index and nursing service quality. The index encompasses hospital tariffs, disease diagnoses, service type, and stay length. Healthcare administrators must comprehend this relationship as a foundational element for effective decision-making and financing policies in hospitals, particularly in institutions that cater predominantly to BPJS *Kesehatan* patients.

RESEARCH METHOD

The study was conducted from January to February 2025 at Dr. Loekmono Hadi Kudus General Hospital. The study employed a descriptive quantitative approach with a cross-sectional research design. The technique for determining respondents was purposive sampling, with the criteria being that respondents were BPJS *Kesehatan* Class III inpatients at Dr. Loekmono Hadi Kudus General Hospital and had complete medical records. The study included a total of 104 patients as respondents. Data were collected using a survey method and a questionnaire. The questionnaire under review encompassed inquiries related to both independent and dependent variables. The research framework is presented in the Figure 1.

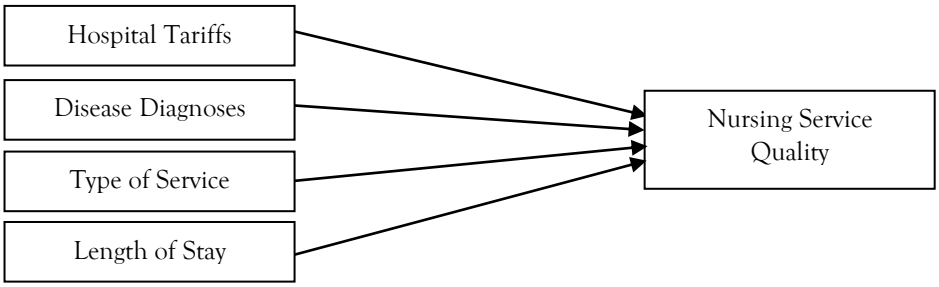

Figure 1. Research Framework
***Source**: (This Study, 2025)*

The independent variable in the study is the overcost prediction index, which includes hospital tariffs, disease diagnoses, type of service, and length of stay. The data for the independent variable were of a nominal type. The dependent variable is the nursing service quality. Fatima et al. (2019) found that nursing service quality is measured by combining multiple sub-aspects of nursing practice standards. This independent variable refers to the five aspects of service quality in healthcare: responsiveness, assurance, tangibles, empathy, and reliability (Chrisnandy et al., 2024). These aspects were developed into indicator variables for the study. The indicators include patient safety, patient comfort, patient knowledge about their disease diagnosis, patient satisfaction, improvement in patient self-care skills, and patient anxiety. The data for the dependent variable were of an ordinal type, measured using a rating scale from 0 to 4 (Hair et al., 2022). The rating scale criteria are as follows:

0 : If the nursing practice standards are not met
1 : If the nursing service performs inappropriately according to nursing practice standards
2 : If the nursing service performs less appropriately according to nursing practice standards
3 : If the nursing service performs quite appropriately according to nursing practice standards
4 : If the nursing service performs very appropriately according to nursing practice standards

According to Field (2017), nursing service quality assessment data are categorized as follows: Good (59-80%), Moderate (28-58%), and Poor (<28%).

Data analysis in the study employed univariate and bivariate analyses, applying Pearson Chi-Square tests to determine the relationship between the independent variables with the dependent variable (Tabachnick et al., 2019). Data were analyzed using SPSS (Statistical Package for the Social Sciences) software. The results of the validity and reliability test analysis of the research instrument obtained a Cronbach's Alpha value of 0.943. Data were analyzed using a 95% confidence interval and a significance level of 5% (0.05). The degree of freedom (df) is 1. The conclusion of the Pearson Chi-Square test indicates that if X-count > X-table (3.841), then H0 is rejected. If the Exact Sig. (2-sides) value exceeds the significance level (0.05), indicating no relationship between the dependent variable and the independent variable (H0 is rejected). The hypotheses have been formulated as follows:

Hypothesis 0 (H_0). There is no relationship between the overcost prediction index and the nursing service quality.
Hypothesis 1 (H_1). The nursing service quality and the overcost prediction index of hospital tariffs are related.
Hypothesis 2 (H_2). The nursing service quality and the overcost prediction index of disease diagnoses are related.
Hypothesis 3 (H_3). The nursing service quality and the overcost prediction index type of service are related.
Hypothesis 4 (H_4). The nursing service quality and the overcost prediction index length of stay are related.

RESULTS AND DISCUSSION

Respondents in the study were BPJS *Kesehatan* Class III inpatients at Dr. Loekmono Hadi Kudus General Hospital. A total of 104 patients participated in the study (see Table 1). Most of the patients were female, totaling 62 (59.62%). Furthermore, most patients were aged

between 53 and 63, with 41 patients (39.42%). The characteristics of respondents in the study are presented in the Table 1.

Table 1. Characteristic of Patients

Variable	Category	Frequency (N)	Percentage (%)
Sex	Male	42	40.38
	Female	62	59.62
	Total	104	100.00
Age	42-52	20	19.23
	53-63	41	39.42
	64-74	36	34.62
	75-85	7	6.73
	Total	104	100.00

Source: *(Primary Data Processed, 2025)*

A differential frequency of patients in BPJS *Kesehatan* Class III inpatient rooms at Dr. Loekmono Hadi Kudus General Hospital was observed for each independent variable (see Table 2). The hospital tariffs for 73 patients (70.19%) aligned with the INA-CBGs tariffs. Most patients had a primary diagnosis, totaling 63 (60.53%), while 41 (39.42%) had secondary diagnoses. Seventy-one (71) patients (68.27%) received primary services, and 33 (31.73%) received secondary services. Most patients were hospitalized for fewer than six days, with 73 patients (70.19%). Health service tariffs for 28 patients (26.92%) were inappropriate with the INA-CBGs tariffs, resulting in overcosting. Data analysis also showed that inappropriate patient hospital tariffs with the INA-CBGs tariffs are not necessarily claimed to be overcost. Patients who claimed overcost are convinced that their hospital tariffs do not align with the INA CBGS tariffs. The frequency of patients by the overcost prediction index is presented in the Table 2.

Table 2. Frequency of Patients for Overcost Prediction Index Variable

Indicator		Frequency (N)	Percentage (%)
Hospital Tariffs			
	Appropriate with INA-CBGs	73	70.19
	Inappropriate with INA-CBGs	31	29.81
	Total	104	100.00
Disease Diagnoses			
	Primary	63	60.58
	Secondary	41	39.42
	Total	104	100.00
Type of Service			
	Primary	71	68.27
	Secondary	33	31.73
	Total	104	100.00
Length of Stay			
	< 6 days	73	70.19
	≥ 6 days	31	29.81
	Total	104	100.00
Overcost Condition			
	Not Overcosting	76	73.08
	Overcosting	28	26.92
	Total	104	100.00

Source: (*Primary Data Processed*, 2025)

Patients assessed the nursing service quality in BPJS *Kesehatan* Class III inpatient rooms at Dr. Loekmono Hadi Kudus General Hospital, based on nursing service standards, which include the aspects of responsiveness, assurance, tangibles, empathy, and reliability. Data analysis showed that 60 patients (57.69%) rated the quality of nursing service. In comparison, 47 patients (45.19%) rated it as moderate (see Table 3). The assessment of nursing service quality was oriented toward patient health and comfort. The frequency distribution of patients' nursing service quality assessments is presented in the Table 3.

Table 3. Frequency of Patients for Nursing Service Quality Variable

Indicator	Frequency (N)	Percentage (%)
Nursing Service Quality		
Good	57	54.81
Medium	47	45.19
Poor	0	0.00
Total	104	100.00

Source: (*Primary Data Processed*, 2025)

In this study, as there was no data in the "poor" nursing service quality category, the analysis focused on the two main categories: the terms "good" and "medium" are employed. The Chi-Square test assessed the relationship between the overcost prediction index and the nursing service quality. Furthermore, the Odds Ratio (OR) is calculated to determine the extent to which patients in a certain index have the best quality of service compared to other indices. This approach was adopted to ensure the results' validity and avoid data distortion due to the inequality of category distribution. The overcost prediction index is significantly related to the nursing service quality in BPJS *Kesehatan* Class III inpatient rooms at Dr. Loekmono Hadi Kudus General Hospital (see Table 4). Based on the hospital tariffs index, it was shown that patients whose tariffs were appropriate with INA-CBGs received good nursing service quality (69.9%), compared to only 19.4% of patients with inappropriate tariffs. Regarding disease diagnoses, 56 patients with primary diagnoses received good nursing services (88.9%), while 7 patients received moderate nursing services (11.1%).

In contrast, 40 patients with secondary diagnoses received moderate nursing services (97.6%), and only 1 received good nursing service (2.4%). In terms of type of service, 50 patients receiving primary services reported good nursing service quality (70.4%), while 21 patients rated it as moderate (29.6%). Among those receiving secondary services, only 7 patients (21.2%) rated the service as good, while 26 (78.8%) rated it as moderate. Based on the length of stay index, most patients hospitalized for fewer than six days received good nursing services, compared to those hospitalized for more than six days. The Chi-Square test results indicated a statistically significant relationship between the overcost prediction index and the nursing service quality; p-value = 0.001 (< 0.05), Exact Sig.(2-sided) = 0.001 (< 3.841). This finding indicates that H_0 was rejected. The Odds Ratio (OR) value measures the likelihood of an incident occurring. The calculation of the OR is conducted based on a 2×2 contingency table, which categorizes the respondent data according to the categories of the independent variable and the outcomes of nursing service quality. The formula employed is OR = (a × d)/(b

× c), where a, b, c, and d represent the frequencies of each cell in the table. If the OR value is 1, there is no observed difference in risk or chance. An OR value higher than 1 indicates that groups within a certain category are more likely to achieve a positive outcome. The relationship between the overcost prediction index and the nursing service quality is presented in Table 4.

Table 4. Relationship Between Overcost Prediction Index and Nursing Service Quality

Overcost Prediction Index	Nursing Service Quality						Total		P-Value	Exact Sig.(2-sided)	Odds Ratio (OR)
	Good		Medium		Poor						
	N	%	N	%	N	%	N	%			
1. Hospital Tariffs											
Appropriate with INA-CBGs	51	69.9	22	30.1	0	0	73	100	0.001	0.001	9.659
Inappropriate with INA-CBGs	6	19.4	25	80.6	0	0	31	100			
2. Disease Diagnoses											
Primary	56	88.9	7	11.1	0	0	63	100	0.001	0.001	320
Secondary	1	2.4	40	97.6	0	0	41	100			
3. Type of Service											
Primary	50	70.4	21	29.6	0	0	71	100	0.001	0.001	8.844
Secondary	7	21.2	26	78.8	0	0	33	100			
4. Length of Stay											
< 6 days	54	74.0	19	26.0	0	0	73	100	0.001	0.001	26.256
≥ 6 days	3	9.7	28	90.3	0	0	31	100			

Source: (*Primary Data Processed*, 2025)

Hospital Tariffs

Before BPJS Kesehatan, the predominant financing system in many Indonesian hospitals was the fee-for-service system. This system uses a specific methodology for calculating hospital tariffs, determining the charges based on the number and type of service provided (Hadning et al., 2020; Kroneman et al., 2016). However, financing for health systems, such as INA-CBGs, has been applied in hospitals across various countries to enhance service efficiency and quality (Saputra et al., 2020). The fundamental distinction between the INA-CBGs and fee-for-service systems lies in their financing mechanisms and their respective impacts on cost efficiency and service quality. It is imperative to note that each medical procedure, examination, and treatment is associated with a specific tariff. The quantity of medical actions performed correlates directly with the total tariff charged to the patient. This structure can lead to overutilization of services, subsequently increasing the overall cost of patient treatment. Significant discrepancies between INA-CBG tariffs and actual hospital tariffs are still frequently observed. Systematic monitoring and evaluation are imperative to enhance the efficiency and quality of services (Satibi et al., 2019).

Table 4 demonstrates that the utilization of hospital tariffs calculated based on the INA-CBGs tariff system provides financial incentives for hospitals, thereby facilitating improvements in service quality (Priyono et al., 2021). The analysis of the relationship between the hospital tariffs and the nursing service quality reported an Odds Ratio (OR) of 9.6 (95% CI: 3.4–26.8). Patients with hospital tariffs associated with INA-CBGs are 9.6 times more likely to receive good nursing service quality than patients whose tariffs do not match the INA-CBGs system. Furthermore Hadning & Kubra (2025) noted that overcost conditions result in an imbalance between tariffs and the quality of services provided. The availability of a sufficient

budget is a primary factor in achieving optimal nursing service quality. In addition, the importance of clinical, managerial, and policy approaches in effectively managing patient financing is emphasized—particularly when considering patient characteristics without compromising service quality. These findings aligned with Donabedian's concept of service quality (Ferreira et al., 2023), which encompasses multiple factors such as nurse competence, availability of health facilities and equipment, adequate health supplies, compliance with nursing service standards, patient recovery, survival rates, and disease complications. Nursing service quality is related to hospital tariffs, nursing staff, and overall service processes (Ferreira et al., 2020).

Hospital tariffs that exceed those established by the INA-CBGs system result in an overcosting condition. According to Nilmawati et al. (2025), the cost discrepancy is not covered by BPJS *Kesehatan*, creating a significant financial challenge for hospitals, as overcosting negatively impacts both the quality and quantity of services provided to BPJS *Kesehatan* patients. Since hospitals are prohibited from charging BPJS *Kesehatan* patients for the cost difference, they may incur financial losses and must modify their service strategies to remain sustainable (Hadning & Kubra, 2025). Moreover, this overcosting condition affects the performance of medical staff and the availability of medical facilities. Although the INA-CBGs tariff system is designed for cost efficiency, failure to adjust for disease complexity can negatively affect the nursing service quality provided (Ferreira et al., 2020). Hospitals may limit human resources, medical equipment, and overall service comfort to reduce operational costs and achieve efficiency. While services may still be delivered, excessive cost-cutting can lead to declining service quality. The hospital tariffs index is a key indicator of overcosting and is significantly related to hospital internal policies and BPJS Kesehatan patient services management. Striking a balance between cost efficiency and service quality optimization is crucial to ensure that the INA-CBGs system does not inadvertently harm patients or hospitals. (Dianingati & Riewpaiboon, 2019) emphasize the importance of implementing accurate future tariffs prediction systems/tools to improve efficiency and service quality. These predictions can utilize relevant cost data and medical records to forecast future tariffs more precisely, aligning with existing cases (Nwoke, 2024). Hospitals must implement effective tariff management strategies to maintain high-quality service within the constraints of a fixed financing scheme. Additionally, the Republic of Indonesia government should regularly evaluate the INA-CBGs financing system by BPJS *Kesehatan*, ensuring its alignment with the characteristics of Indonesian society and regions.

Disease Diagnoses

Disease diagnoses will, in turn, influence the treatment nurses provide patients. The disease diagnoses can potentially be associated with the number and type of services provided to patients. Consequently, the disease diagnosis prediction index is pivotal to the INA-CBGs financing system. Disease diagnoses impact tariff estimation, based on the category of the primary diagnoses, presence of comorbidities, occurrence of complications, and severity of patient condition. Ensuring the accuracy of disease diagnoses is imperative (Bertocchi et al., 2024). The distinction in medical diagnoses dictates specific nursing service provision for the patient. Determination of the tariffs to be paid to hospitals for BPJS *Kesehatan* patient treatment, particularly for inpatient treatment, is contingent upon the accuracy of disease

diagnoses. According to Alharthi et al. (2024), the systematic coding of disease diagnoses has been demonstrated to facilitate the effective management of health financing processes.

The analysis of the relationship between the disease diagnoses and the nursing service quality reported an Odds Ratio (OR) of 320 (95% CI: 37.8–2704.1) (see Table. 4). This indicates that patients with a primary diagnosis have 320 times more likely to receive good nursing service quality compared to those with a secondary diagnosis. The primary diagnosis is the main disease prompting the patient to seek medical attention. Murtagh et al. (2021) found that the primary diagnosis necessitates hospitalization and primary treatment, whereas the secondary diagnosis is considered part of the health services related to the primary condition. This finding indicates that the complexity of healthcare and nursing services depends on the accuracy of primary diagnosis coding (Suriawan et al., 2017). The results of the data analysis also indicate that the disease diagnosis index has the highest odds ratio (OR) value of any other index. The 320 value indicates a strong correlation between the overcost condition and the accuracy of diagnosis coding. The coders' accuracy in classifying diseases is crucial for the financing system and nursing service quality. The findings served to reinforce the conclusions of previous research. Patients with primary diagnosis require more intensive and specific medical interventions, impacting service quality. In contrast, patients with secondary diagnosis generally have a lower risk of disease complexity and require moderate nursing interventions (Kerr et al., 2021).

Disease diagnoses coding involves translating a patient's medical condition into international standard codes, such as ICD–10, which are subsequently used to submit tariff claims to the BPJS *Kesehatan* system (WHO, 2019). A coding officer (coder) performs this task, who relies on data extracted from the patient's medical records. According to Suriawan et al. (2017), the diagnosis coding process is not manual; medical records entered into the INA-CBGs system are automatically stored in the national central repository. Accurate diagnosis coding determines the diagnosis category within the INA-CBGs system. Zhuang et al. (2025) obtained that the primary diagnosis code and codes for disease complications and comorbidities determine the INA-CBGs tariff class and the amount of the tariff claims the hospital will receive. Inaccuracies in diagnosis coding can negatively impact the tariff claims submitted. Consequently, accurate coding is essential for the effective operation of the national reporting system, health policy formulation, and the evaluation of health service quality. Concurrent with technological progress, integrating artificial intelligence algorithms with electronic medical record systems has demonstrated a capacity to enhance the efficiency and accuracy of diagnosis coding. This condition, in turn, has the effect of reducing human errors and accelerating the process of filing claims (C. Wang et al., 2021). However, the main challenge persists in the quality of medical records data, the training and the experience of coders to ensure that data interpretation aligns with international standards. Regularly recalibrating the tariff system is imperative based on real-time data and periodic diagnoses, disease classifications, and disease severity evaluations. The enhancement of human resource capacity and the integration of information technology are imperative.

Type of Service

Type of service constitutes a classification system that categorizes medical and nursing procedures according to disease diagnoses. The INA-CBGs financing system includes an index of medical actions performed on patients. Accuracy in determining the type of service directly

impacts hospital tariffs. Accurate coding of services in medical records and coding systems is imperative to ensure that the tariff claims in the INA-CBGs system correspond to the type of service provided (Zhuang et al., 2025; Murtagh et al., 2021). In the event of a discrepancy between the disease diagnoses coding and the actual data, the type of service provided will also be inappropriate for the established disease diagnoses. Consequently, the type of service constitutes a pivotal factor related to nursing service quality (Kruk et al., 2018).

The analysis of the relationship between the type or service and the nursing service quality reported an Odds Ratio (OR) of 8.84 (95% CI: 3.32–23.5) (see Table. 4). This value indicates that patients with primary (main) type of service have 8.8 times more likely to receive good nursing service quality compared to patients with secondary type of service. According to McCullough et al. (2020), the primary type of service refers to the medical service that addresses the patient's main health condition, while the secondary type of service refers to advanced medical services aimed at accelerating the healing process and preventing disease complications. The accuracy of the primary diagnosis coding is also a factor in determining service priorities. The complexity of medical action dictates the intensity of nursing services provided. This condition has been shown to encourage nurses to provide more comprehensive service in terms of technical and interpersonal approaches to patients (Aiken et al., 2021; Marhenta et al., 2020).

According to Liu & Aungsuroch (2018) emphasize that a supportive work environment and the effective management of nurse burnout significantly contribute to optimizing service quality. This condition indirectly impacts the nursing service quality provided to patients, both primary and secondary types of service. A study by Dewi et al. (2022) demonstrated a significant relationship between nurse workload and the incidence of overlooked nursing service in inpatient rooms. Hospitals must utilize the results as a foundation for managing nursing resources, including scheduling, workload distribution, and training services, all tailored to the specific needs of the patient population and their diagnoses. The objective is to ensure that nursing services are equitable and of the highest quality, regardless of disease diagnosis or type of service. Clinical pathways in nursing services are poised to address the discrepancy between hospital tariffs and INA-CBG tariffs, facilitating more efficient health services without compromising the nursing service quality for patients.

Length of Stay

The role of nursing is paramount in ensuring that patients experience a successful recovery period. Wilk et al. (2020) found that this objective can be accomplished by implementing effective interventions, optimizing nurses' knowledge, and facilitating efficient cross-professional coordination. The length of stay prediction index is a critical indicator within the hospital service system, as it estimates the length of stay for patients based on disease diagnoses, medical conditions, and required medical procedures. This index influences the management of nursing services by impacting resource allocation, monitoring intensity, and nurse workload. Baek et al. (2018) revealed that a range of indicators, including transfer patients, discharge delay time, operation frequency, diagnoses frequency, diagnoses complexity, bed grade, and insurance type, were significantly associated with length of stay duration. Patients with prolonged lengths of stay typically have more complex health conditions, which necessitate intensive and continuous nursing interventions. Conversely, patients with shorter

lengths of stay receive faster nursing services focused on meeting basic needs and stabilizing health conditions.

The analysis of the relationship between the length of stay and the nursing service quality reported an Odds Ratio (OR) of 26.5 (95% CI: 7.22–97.3). This value indicates that patients with a longer stay than 6 days are 26.5 times more likely to receive good nursing service quality than patients treated for 6 days or longer. The results are consistent with those reported by Cai et al. (2025), who demonstrated a correlation between prolonged lengths of stay and diminished nursing service quality. Contributing factors include fatigue among medical staff, overcapacity of patient beds and rooms, treatment delays, and reduced interdisciplinary medical team coordination effectiveness. Medical staff fatigue can be mitigated through staff augmentation; however, this approach is accompanied by an escalation in operational expenditures, a decline in service quality, and an elevated risk of financial losses for hospitals (Griffiths et al., 2023). Hospitals and medical staff must adjust service strategies based on the estimated treatment length to balance cost efficiency and service quality. Almeida et al. (2024)found that accurately estimating admissions of length of stay is notoriously difficult. However, this ability holds immense potential for improving healthcare system efficiency, reducing costs, and improving patient satisfaction.

According to Gokhale et al. (2023), the length of stay in an acute hospital has been identified as a significant influencer of hospital-based service costs. It is a key measure of hospital performance. Hospitals facing financing imbalances may encounter challenges such as shortages of nursing personnel and/or medical equipment, which can adversely impact the availability of adequate service quality. Patients with complex health conditions requiring prolonged treatment may experience reduced satisfaction due to hospitals' strategic focus on improving operational cost efficiency. Deschepper et al. (2025) obtained that non-clinical indicators, including demographics (age and sex), administrative data, disease diagnoses, and hospital characteristics, constitute 90% of the factors identified that influence length of stay. Furthermore, Symum & Zayas-Castro (2020) and Dineen-Griffin et al. (2019)demonstrated a correlation between patients' socioeconomic condition and self-care skills with the length of stay in hospital.

Optimalization

It is possible to optimize nursing practices based on the Watson and King models to improve nursing service quality. The Watson and King nursing models require the commitment of all nurses to provide compassionate, empathetic, holistic, communicative, and collaborative service within the medical team. Watson emphasizes the importance of the relationship between patients and the medical team, proposing a care model that integrates scientific knowledge with profound ethical and humanistic principles. Curcio et al. (2024) found that the medical team, particularly nurses, must be capable of managing their emotional well-being and maintaining good relationships with patients, regardless of the difficulties they are facing. Joseph et al. (2021) reported that the effective application of the King Model can serve as an alternative for optimal and cost-efficient nursing services because nurses are expected to possess sound knowledge and competent skills. Consequently, in the future, it may influence their perceptions, communication, and interactions in patient care. The Watson (2008) and the King (1981) can be applied in the BPJS *Kesehatan* financing system, are presented in Table 5.

Table 5. Recommended Strategy Based on Jean Watson, King Model and The Results of This Study

No.	Strategy	Description
1	Ensure Diagnostic Coding Accuracy	Accurate disease coding in INA-CBGs is essential for ensuring fair tariff claims and maintaining the quality of nursing care.
2	Develop Overcost Prediction Tools	Implement data-driven systems using historical data to anticipate tariff gaps, control hospital expenses, and inform financial planning.
3	Manage Length of Stay Efficiently	Shorter, appropriate hospital stays improve care quality and reduce nurse workload and fatigue.
4	Standardize Service Types via Clinical Pathways	Use structured protocols to align nursing services with the appropriate level of care (primary vs. secondary), ensuring consistency and cost control.
5	Minimize Unnecessary Procedures	Apply team-based decision making to prevent medical overutilization and reduce avoidable cost overruns.
6	Utilize Health Information Technology	Leverage Electronic Medical Records (EMRs) and AI to improve accuracy in service documentation and accelerate the BPJS claims process.
7	Strengthen Nursing Workforce	Address issues of burnout and workload through improved staffing ratios, scheduling, and professional development.
8	Revise National Tariff Policies	Adjust INA-CBG tariffs to reflect actual service complexity and regional needs better.
9	Enhance Monitoring & Evaluation	Track and analyze discrepancies between actual hospital costs and INA-CBG tariffs to support continuous service improvement and policy reform.
10	Promote Patient Self-Care Education	Educate patients to manage their health independently and prevent avoidable readmissions, improving outcomes and cost-efficiency.
11	Apply Joint Clinical Decision-Making	Collaborative decision-making among medical teams ensures clinical appropriateness of treatments and avoids unnecessary procedures.
12	Strengthen Interprofessional Communication	Improve communication among healthcare providers to ensure consistency between clinical actions and financial claims submitted.
13	Monitor and Evaluate Tariff Deviations	Establish internal systems to monitor cost-tariff gaps, supporting transparency and adaptive financial strategies.
14	Optimize Health Resources Holistically	Maximize the effectiveness of healthcare delivery by balancing patient needs, staff capacity, and financial sustainability.

CONCLUSION

This study concluded that a statistically significant relationship exists between the overcost prediction index, comprising hospital tariffs, disease diagnoses, types of service, and length of stay, and the quality of nursing services provided to BPJS *Kesehatan* inpatients at Dr. Loekmono Hadi Kudus General Hospital. The findings indicated that patients whose service profiles demonstrated greater alignment with hospital tariffs tend to receive nursing service of higher quality. The findings underscored the significance of accurate diagnostic coding, suitable classification of service types, and effective management of treatment duration in ensuring service quality within the constraints of the INA-CBGs payment system. From a scientific perspective, this study contributes to understanding how financial factors are associated with clinical service outcomes. From a pragmatic perspective, incorporating the overcost prediction index into hospital monitoring and evaluation systems can facilitate enhanced decision-making, cost control, and optimizing nursing service quality within the national health insurance scheme context.

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