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Cost Analysis of Caesarean Deliveries under INA-CBG's Tariff System in Jogja Hospital, Indonesia

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ABSTRACT

Introduction: This study aimed to determine differences in the average real cost of caesarean section with INA-CBG's. This study is the first to use the latest INA-CBG's in 2023, so it can provide an overview of the implementation of INA-CBG's in 2023. The finding has the potential to provide recommendations for improving reimbursement policies and can guide the development of more effective financing models for hospitals and patients, particularly regarding caesarean section costs. In light of the growing global demand for cost efficiency in healthcare, this study provides valuable insights into optimizing financing structures and resource allocation.
Methods: The study uses a quantitative research approach with retrospective data from sectio caesarea patient medical records in Jogja Hospital during January-September 2023. A total of 30 patients were enrolled, and data were collected through total sampling. Ethical approval was obtained from the hospital director with number 56/KEPK/RSUD/IX/2023
Results: The study's primary outcome was that the average real cost of the Caesarea section is higher than the INA-CBG's 2023. Furthermore, it was found that there was a significant difference between the average real cost of sectio caesarea and INA-CBG's in class 1 INA-CBG's code O-6-10-I (sig.0.001), class 3 INA-CBG's code O-6-10-I (Sig.0.000) and class 3 INA-CBG's code O-6-10-II (Sig.0.028). There are results of insignificant differences in class 1 INA-CBG's code O-6-10-II (Sig.0.180), class 2 INA-CBG's code O-6-10-I (Sig.0.089), class 2 INA-CBG's code O-6-10-II (Sig.0.180).
Conclusion: This study shows that there is a significant difference between the real cost and the INA-CBG's on the payment of patient claims for inpatient services at Jogja Hospital. Our study contributes to understanding healthcare reimbursement issues by the difference between the average cost of sectio caesarea and INA-CBG's. Future research should address the evaluation of the factors that can cause the difference between the cost of sectio caesarea and INA-CBG's 2023, which will ultimately advance knowledge in the field of international health.

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INTRODUCTION

According to the World Health Organization (WHO), the use of caesarean sections continues to increase globally, with 1 in 5 deliveries worldwide involving a caesarean section. This number will continue to rise over the coming decades, with nearly a third of all births likely to occur via caesarean section by 2030 (1). According to the Riskesdas in 2018 (2), the caesarean delivery rate in Indonesia was 17.6%. In Yogyakarta, the prevalence of delivery by caesarean section reached 23.1%, an increase from the results of Riskesdas in 2013 (3q), which was 15%.

In addition to the increasing prevalence of caesarean section, caesarean section is also costly. Caesarean section requires more prolonged treatment compared to vaginal delivery, resulting in higher healthcare costs. Sectio Caesarea is one of the hospital's most extensive and costly services. Rising caesarean section costs present a significant challenge for Indonesia's healthcare system, where spending remains limited. As caesarean rates continue to rise, the financial burden on both the public and private sectors increases, exacerbating the country's healthcare challenges. Global studies have emphasized the growing costs associated with caesarean section, underscoring the need for more efficient healthcare delivery systems. The government established the *Badan Penyelenggara Jaminan Sosial* (BPJS) as a solution to high health costs. BPJS Kesehatan will implement the national health insurance program and health insurance system. Based on Presidential Regulation Number 12 of 2013, all people are entitled to health insurance benefits, or health benefits for everyone (4). Implementing INA-CBG's in hospital financing for sectio caesarea patients requires treatment planning and cost analysis (5).

In many Asia-Pacific middle-income countries, including Indonesia, healthcare spending is relatively low as a percentage of GDP, which amplifies the need for sustainable financing models. Countries like Australia and Singapore have successfully implemented DRG-based payment systems to enhance efficiency and control costs. Similarly, Indonesia's adoption of the INA-CBG system (Indonesian Case-Based Groups) could provide a crucial opportunity to manage healthcare expenditures more effectively, improve service quality, and reduce financial strain caused by rising caesarean section rates (6). Thus, researching the implementation of INA-CBGs in Indonesia is essential to identify how this system can address current healthcare financing challenges and improve the efficiency of health services in the country.

The payment method used by BPJS Kesehatan is the Indonesia Case Based Groups (INA-CBG's) tariff. The INA-CBG's package rate is the BPJS Health claim payment to hospitals or advanced referral health facilities for service packages based on a grouping of disease diagnoses and procedures performed. The system of implication of INA-CBG's in-service system can push hospitals to do quality control and cost control as well as provide efficient service to patients. INA-CBG's is the cost of health service paid by *Badan Penyelenggara Jaminan Sosial* (BPJS) Kesehatan, the one that manages national health insurance in Indonesia (7).

Most of the financing status of the caesarean section came from BPJS (8). according to Purnaningrum et al. (2020), who conducted research at XY Pati Hospital, caesarean sections for BPJS participants reached 80% of the total caesarean sections. Research conducted by Ayuningtyas (2018) found that 74% of births using the National Health Insurance (JKN) cost. Caesarean section rates under JKN are much different from the real cost at the hospital. Almost all INA CBG rates from JKN for cases with surgery, particularly obstetrics and gynecology, are on a mean lower than the real hospital tariffs. This has led hospital management to cross-subsidize between services that receive surplus funding and those with surgery (9).

Previous research by Miranti used the INA-CBG tariff in the Minister of Health Regulation Number 59 of 2014 and obtained the results of the hospital experiencing losses (10). So, it is necessary to conduct research using the INA-CBG tariff in 2023 to see the improved health services that Jogja Hospital has done with the new tariff. This study will determine the difference in the average cost of sectio caesarea patients with INA-CBG's tariffs using Permenkes No. 3 of 2023 in Jogja Hospital.

METHOD

This research is observational and uses a cross-sectional research design. This type of study may provide helpful insights into population characteristics and identify correlations for further research. Caesarean section patient data taken is data that has met the inclusion and exclusion criteria. The inclusion criteria were BPJS Kesehatan patients with first, second, and third-class caesarean delivery at Jogja Hospital with the criteria of mild, moderate, or severe caesarean surgery classified as INA-CBG's code and BPJS Kesehatan patients with caesarean delivery who

had complete medical records and treatment payment data. Exclusion criteria were BPJS Kesehatan patients with caesarean delivery who were forcibly discharged, and patients with caesarean delivery who died during treatment.

Data was collected retrospectively through medical record documents and patient medical cost data from January - September 2023 at Jogja Hospital. Medical record data is taken to see the severity class of patients, data on drugs used by patients, and patient characteristics. Cost data is taken to determine the costs of surgical procedures, drugs, treatments, non-surgical procedures, supporting components, nutrition, blood services, rooms, laboratories, radiology, and consultations. Data collection employed total sampling, resulting in a sample of 30 patients who met the inclusion and exclusion criteria. Total sampling was used due to the limited available population that met the criteria, and this decision was made to ensure a focused and specific analysis. Despite the small sample size, the findings provide valuable insights for further research with larger or randomized samples.

Analysis of the average difference in the real cost of BPJS Health patient sectio caesarea at Jogja Hospital based on the INA-CBG's tariff rate in 2023 using the one sample t-test and wilcoxon. Data analysis was conducted using a one-sample t-test to compare the actual treatment rates for class 1, class 2, and class 3 inpatients with the INA-CBGs rates. The one-sample t-test is employed when testing whether the sample mean significantly differs from a known value, assuming the data is normally distributed ($P > 0.05$). If the data does not follow a normal distribution, the Wilcoxon signed-rank test is used as an alternative statistical method ($P < 0.05$). One sample t-test was performed on INA-CBG's O-6-10-I class 1, 2, and 3 codes. Wilcoxon test was conducted on INA-CBG's O-6-10-II code class 1, 2, 3. The difference between the average real cost and the INA-CBG's tariff in 2023 is said to have a significant difference when the significance is <0.05, and there is no significant difference when the significance >0.05.

Ethical Approval

The data taken has obtained permission with the issuance of ethical clearance by the Jogja Hospital with number 56/KEPK/RSUD/IX/2023.

RESULTS

This research involved 30 patient's medical record data conducted in Jogja Hospital. A total of 30 patients were enrolled, with complete medical record data and medical cost data. Patient data is divided into 3 BPJS classes: 7 patients in class 1, 7 patients in class 2, and 16 patients in class 3.

Table 1. Age Characteristics of Sectio Caesarea Patients

Age	Sectio Caesarea Patients	
	N=30	%
<20 Year	0	0
20-35 Year	25	83%
>35 Year	5	17%
Total	30	100%

Based on the age characteristics table, the highest percentage of patients giving birth by caesarean section is in the age range of 20-35 years. These results align with research conducted by Fadli (11) at Sitti Khadijah Hospital Makassar, which appeared that the most common age of caesarean conveyance was 20-35 a long time ancient, as numerous as 69% of all patients. The second place in this study is the age of more than 35 years, which is 17%. This can be due to reproductive decline and aging (12). Age over 35 years is also more at risk such as congenital abnormalities or complications at the time of delivery, which are caused by the muscle tissue of the uterus being insufficient to accept pregnancy (13).

The results from Table 2 show that the average real cost is higher than the INA-CBG's tariff in 2023 with a significant difference ($P < 0.05$) in class 1 code O-6-10-I, class 3 code O-6-10-I and class 3 code O-6-10-II. There was a higher average real cost than the INA-CBG's rate in 2023, with a non-significant difference ($P > 0.05$) in class 2 code O-6-10-I, code O-6-10-II, and class 1 code O-6-10-II. Based on Table 2, the total cost of 30 sectio caesarea patients from classes 1, 2, and 3 amounted to Rp286,538,242. The total INA-CBG's tariff for 30 patients is IDR179,466,600. The difference obtained from the total real cost and INA-CBG's tariff is IDR116,815,652, which means that the total

INA-CBG's tariff cannot cover the total cost of caesarean section surgery, so the hospital suffers a loss. In previous research by Miranti at Jogja Hospital in 2015, the hospital also suffered a loss of Rp35,065,761. Miranti's research used INA-CBG's tariff in 2014. Previous research results also show hospital losses. The results of Pradyantara at Panti Nugroho Hospital in 2021 show that the hospital suffered a loss of Rp227,764,153. Pradyantara's research used INA-CBG's tariff in 2016 (14). This substantial gap suggests the presence of inefficiencies or systemic issues in healthcare cost management, such as inaccuracies in cost estimation, misalignment between tariff rates and actual expenses, or suboptimal resource allocation. For policymakers, this finding underscores the urgent need to reevaluate and adjust the INA-CBG tariff system to reflect actual healthcare costs better. Aligning tariff rates with real service expenses would not only enhance the financial sustainability of hospitals but also improve the overall efficiency of the healthcare system, ensuring that resources are allocated more effectively and patient care is not compromised.

Table 2. Differences in the Real Costs Compared to the INA-CBG's 2023

INA-CBG's Code	Class	n	Total Cost		Average Cost		Sig (normality)	P (2-tailed)
			Real Cost (IDR)	INA-CBG's 2023 (IDR)	Real Cost (IDR)	INA-CBG's 2023 (IDR)		
O-6-10-I	1	5	50,274,00	33,902,500	10,054,804± 768,183	6,780,500	0.812	0.001
	2	5	41,539,160	29,696,500	8,307,832± 2,369,005	5,939,300	0.388	0.089
	3	9	76,810,051	45,882,900	8,534,450± 567,776	5,098,100	0.057	0.000
O-6-10-II	1	2	17,051,111	14,698,800	8,525,555± 101,374	7,349,400		0.180
	2	2	21,389,821	12,875,400	10,694,910± 1,376,720	6,437,700		0.180
	3	6	79,474,079	33,155,400	13,245,679± 12,977,809	5,525,900	0.000	0.028
O-6-10-III	1	0	-	-	-	-	-	-
	2	0	-	-	-	-	-	-
	3	1	9,744,010	9,255,100	9,744,010	9,255,100	-	-
Total Cost			296,282,252	179,466,600				
Difference (+/-)			116,815,652					

Results of the average cost component of sectio caesarea for BPJS patient's Health at Jogja Hospital can be found in Table 3. Average results the highest component of sectio caesarea patients is the surgical procedure component, followed by drugs. These results align with research conducted by Miranti (2016) at Jogja Hospital, which found that the highest cost component is surgical procedures, followed by the drug component. There is a difference in the profile of prophylactic antibiotic use in Jogja Hospital in 2015 and 2023. In 2015, the Jogja Hospital used ceftriaxone, while in 2023, the Jogja Hospital used cefazolin. Cefazolin has a higher price than ceftriaxone (15), which may be responsible for the higher cost of the drug. The use of prophylactic antibiotics is appropriate based on the research that has been done and based on the clinical practice guidelines for antimicrobial prophylaxis in surgery; the ASHP report is a class of penicillins and cephalosporins, especially first-generation cephalosporins (cefazolin) which have been shown to have the same efficacy in preventing surgical wound infections.

The high cost of surgical procedures can be due to surgical procedures involving several things, including the cost of anesthesia procedures and sectio caesarea surgery. In addition, surgical procedures involve specialist doctors and additional needs such as ECG monitors and oxygen (16). The high cost of drugs may be due to the wide variety of drugs required for caesarean section treatment. The highest use of drugs in the caesarean section are antibiotics, analgesics, obstetrics, and gynecology (17). In addition, the high cost of drugs and medical materials is influenced by differences in complaints and actions experienced by patients so that the drugs and medical materials prescribed by doctors have different prices (17).

Table 3. Real Cost Mean Component

Cost Variable (IDR)	Real Cost Mean													
	Class 1				Class 2				Class 3					
	Mean (IDR)	%	Mean (IDR)	%	Mean (IDR)	%	Mean (IDR)	%	Mean (IDR)	%	Mean (IDR)	%	Mean (IDR)	%
	O-6-10-I	N (5)	O-6-10-II	N (2)	O-6-10-I	N (5)	O-6-10-II	N (2)	O-6-10-I	N (9)	O-6-10-II	N (6)	O-6-10-III	N (1)
Non-surgical Procedures	366,200	4	193,500	2	400,000	5	780,100	7	344,000	4	766,555	6	611,600	6
Surgical Procedures	4,040,200	40	3,759,750	44	3,548,250	43	3,789,250	35	3,845,666	45	3,418,083	26	4,161,500	43
Nursing	678,400	7	329,500	4	617,700	7	750,250	7	647,611	8	1,058,583	8	927,000	10
Laboratory	655,200	7	612,500	7	505,700	6	739,000	7	583,888	7	1,196,166	9	526,500	5
Radiolagy	132,000	1	165,000	2	132,000	2	395,000	4	110,000	1	545,000	4	0	0
Drug	1,862,904	19	1,865,805	22	1,566,782	19	1,752,810	16	1,793,339	21	3,589,541	27	1,806,410	19
Blood Service	258,400	3	50,000	1	60,000	1	1,240,000	12	77,777	1	166,000	1	0	0
Consultation	270,500	3	233,250	3	292,400	4	176,000	2	304,944	4	734,250	6	549,000	6
Nutritionist	296,069	3	265,000	3	296,000	4	295,000	3	217,000	3	346,000	3	217,000	2
Supporting Components	168,000	2	171,250	2	268,000	3	145,000	1	204,444	2	550,833	4	370,000	4
Room	1,258,000	13	880,000	10	621,000	7	632,500	6	405,777	5	874,666	7	575,000	6
Total	10,054,804±768,183	100	8,525,555±101,374	100	8,307,832±2,369,005	100	10,694,910 ±1,376,720	100	8,534,450 ±567,776	100	13,245,679±12,977,809	100	9,744,010	100

Several factors can cause high real costs. The first factor that affects real costs is LOS (Length of Stay) because the longer the LOS, the more medical procedures/actions will be carried out, the more drugs needed to treat the disease so that it will increase the cost of supporting examinations, drug costs, and accommodation costs, therefore overall it will affect the total real cost. The second factor that affects real costs is secondary diagnoses because the more secondary diagnoses a patient has, the slower the patient's recovery, the longer the patient's LOS, the more supporting examinations, and the higher the cost of treatment, thus increasing real costs. The third factor affecting real costs is procedures because the more procedures performed, the more the cost of supporting examinations increases, thus affecting total real costs (18).

Several factors cause this difference, namely the accuracy in coding the diagnosis and action of surgical cases, the package system in the payment of BPJS Health claims based on the type of hospital, the amount of tariff components included in hospital financing, and the process of running the clinical pathway (CP) (14). In the process of patient care, hospitals have good patient management rules by standard operating procedures and clinical pathways. These rules must be followed by the starting officer, doctors, nurses, and other health workers in patient care. The gap against the real cost or the excess difference against the INA-CBG's tariff is assumed to be a hospital loss, although this must be examined further because it is also related to hospital tariffs that are too high.

Coding and claim rates are closely interconnected, as the claim rates submitted by hospitals rely on the accuracy and precision of INA-CBGs rate coding. Incorrect or improper coding can lead to claims that do not align with the intended rates, resulting in payment discrepancies and potential challenges in managing healthcare costs. Therefore, accurate coding is crucial to ensure that the claims submitted by hospitals correspond to the rates established within the INA-CBGs system, thereby promoting transparency and efficiency in the healthcare financing system. One of the coding solutions is forming a claims verifier team. Forming a claims verifier team is a strategic step because, in addition to preventing fraud, the team's presence is expected to optimize coding, which positively impacts the fulfilment of optimal start/claim rates. The Verifier Team also evaluates claim files returned by the coding team if there are significant differences, and the result is a coding process in accordance with the factual conditions of patient management (19).

The finding of a significant gap between real costs and INA-CBG (Indonesia Case-Based Groups) rates reflects a number of broader implications in Indonesia's healthcare system. This gap not only indicates a mismatch between the costs hospitals incur to deliver care and the rates set by the INA-CBG payment system, but may also indicate inefficiencies or systemic problems in healthcare cost management. Directly, this gap may cause additional burden on hospitals, especially those in resource-constrained areas. Hospitals that have to bear higher costs than the set tariffs will face difficulties in maintaining operational sustainability, which may impact the quality of services provided to patients. In the long run, this could potentially lead to an imbalance between the quality of care and the ability of hospitals to survive financially, which could be detrimental to patients, medical personnel, and the healthcare sector as

a whole. For policymakers, these findings provide valuable insights to formulate policies that are more responsive to the cost realities on the ground. To reduce this gap, there are several steps that can be taken, such as adjusting INA-CBG tariffs to be more realistic and reflect the actual cost of care, or introducing incentive mechanisms to encourage efficiency in hospital management. In addition, improvements in supervision and cost management systems are also needed to ensure more efficient use of resources and reduce wastage.

In addition, the findings provide an opportunity to explore improvements in cost management and budget allocation within the health sector. Policymakers can identify vulnerable points in the supply chain and hospital administration that lead to cost inefficiencies, and thus, take steps to improve the system more comprehensively. For example, digital technology and data-driven management systems can be implemented to improve cost transparency and optimize resource use in hospitals. Overall, these findings illustrate the importance of periodic evaluation of payment policies and systems within the healthcare sector to ensure that the care provided to the public is not only quality, but also financially sustainable.

As a country with a national insurance system, Canada operates Medicare, a public health insurance program that significantly influences the access to and quality of healthcare for its citizens. The Canadian healthcare system is primarily financed through public revenue, with the majority allocated to providing universal coverage for hospital and medical services, as well as subsidizing medical expenses. Additional services are offered by provinces and territories to specific groups, such as seniors, children, and low-income residents, covering services not included in the public healthcare system. These supplementary benefits include out-of-hospital prescription drugs, dental care, eye care, medical equipment and appliances (such as prosthetics and wheelchairs), as well as other health professional services like physiotherapy. Coverage levels vary across the country. Individuals who do not qualify for additional benefits under the public program may either pay for these services out-of-pocket or through private health insurance. This program fosters equity in healthcare by ensuring that all citizens have equal access to necessary services, ultimately contributing to the improvement of public health overall (20).

DISCUSSION

Interpretation of Key Findings

This research revealed that hospitals still incurred losses despite the INA-CBG's 2023 update. The observation of high costs in the surgical procedure and drug components could potentially lead to high caesarean section costs. These results are consistent with the previous study with Miranti and support the idea that these two components should be evaluated. Specifically, our research contributes to the existing evidence base that the new INA-CBGs do not fully cover real costs and that hospitals have not yet changed managing hospital costs, so hospitals still experience losses. Also, cost control needs to be done by the hospital when there is a mismatch between the real hospital tariffs and INA-CBG's tariffs so as not to cause inflation through cost containment efforts. Inflation through cost containment efforts are carried out by rationalizing the costs required for certain services. Cost containment efforts include increasing efficiency, payment systems, and standardization of services (21).

The practical implications of these findings suggest the need for concrete actions at both the hospital operational and government policy levels. Hospitals can optimize INA-CBG coding practices to ensure that medical procedures performed are recorded accurately and in accordance with applicable tariffs, reducing the potential for coding errors that could affect reimbursement. In addition, hospitals need to improve cost control by improving resource management, operational efficiency, and closer monitoring of costs, especially for high-cost procedures such as caesarean sections. On the policy side, the government needs to consider adjusting INA-CBG tariffs to better reflect the real cost of care, to ensure the financial sustainability of hospitals and optimal service quality for patients. These measures, if implemented together, can help create a healthcare system that is more efficient, sustainable and responsive to the needs of the community.

Comparison with Previous Studies

Comparing our findings with past studies is vital for contextualization. Miranti's findings are in line with our results, confirming that the INA-CBG's rates do not yet cover real costs. The significant difference in costs between the hospital's real cost and the INA-CBG's rates may be due to the standardization of medical services that have not been implemented to the fullest, both medical and administrative services, which have an impact on the difference in hospital real cost and INA-CBG's rates and on the care and treatment procedures provided by each doctor are different

and have not been controlled effectively and efficiently, so far medical practitioners are only guided by existing medical service standards. Without clear standards, it will be difficult to predict and control costs, meaning that uncertainty will be more significant because the nature of health services is a need that cannot be programmed (22).

Implications for Public Health

The suggestions of our results extend to the field of public health with the result that the latest INA-CBG's rate has not been able to cover the real cost of the hospital, so this result can be considered for government policy regarding the next INA-CBG's tariff and hospitals regarding the management of caesarean section costs.

Limitations and Cautions

Despite the meaningful contribution, our study has some limitations that must be acknowledged. This study has not been able to analyze the causes of the difference between real costs and INA-CBG's 2023. Several factors cause this difference, namely the accuracy in the process of coding the diagnosis and action of surgical cases, the package system in the payment of BPJS Health claims based on the type of hospital, the number of tariff components included in hospital financing, and the process of running the clinical pathway (CP) (13). These four factors must be analyzed and evaluated to get the right solution to improve the difference between real costs and INA-CBG's 2023 at Jogja Hospital. These limitations may have affected the generalizability of our findings and should be considered in interpreting the results. Future research should address these limitations to refine our understanding of caesarean section cost analysis based on these INA-CBG's rates.

To address the small sample size, we used the total sampling method as it allows for more comprehensive data collection without losing important information and helps to reduce bias that can arise if only a portion of the population is sampled. To reduce potential variations in regional differences, we only analyzed relevant components that affect costs, such as drug costs, treatment costs, surgery costs, nutrition costs, laboratory costs, and other components listed in Table 3. This approach allows us to focus on cost factors directly related to medical care, while minimizing the impact of any regional differences that may exist.

Addressing potential biases in retrospective designs, such as variations in INA-CBGs coding or patient management, is essential for enhancing the credibility of the study. In this analysis of caesarean section costs in Yogyakarta, we aimed to minimize bias by ensuring accurate INA-CBGs coding across the participating hospitals and by ensuring that patient management procedures adhered to standardized guidelines, with assistance and oversight from hospital medical record specialists. Data verification was conducted to ensure consistency between diagnoses, medical procedures, and coding, thus reducing the likelihood of discrepancies in cost recording. This approach is intended to improve the validity of the cost analysis and provide a more objective representation of caesarean section costs.

Recommendations for Future Research

Based on the insights gained from this study, future research should focus on specific questions, such as exploring the relationship between clinical practices and cost discrepancies or evaluating the impact of updated INA-CBG tariffs on hospital finances over time. One key area for further investigation could be analyzing the causes of the difference between INA-CBG's 2023 rates and actual costs to help hospitals identify practical solutions to address financial losses. Additionally, expanding the scope of future research by involving a more extensive and diverse sample of hospitals, including large and small hospitals from various regions and service types, would offer a more comprehensive understanding of the gap between actual costs and INA-CBG rates. A larger sample size could improve the generalizability of the findings, yield more representative results, and help identify factors influencing cost differences in greater depth. This leads to more actionable recommendations for hospital policies and management practices, improving the overall effectiveness of the INA-CBG system.

CONCLUSION

In conclusion, this study sheds light on the INA-CBG's 2023 by providing valuable insights into the differences between the real cost tariff and the 2023 INA-CBG's tariff. The comprehensive analysis of our results in the context of existing literature contributes to knowledge in international health. Our findings have implications for

financial management in hospitals and INA-CBG's 2023 policy, and future research efforts should build on this foundation to further advance our understanding of INA-CBG's 2023.

This study shows that higher real costs compared to INA-CBG tariffs require policy changes and managerial management. To address this gap, it is recommended that the government revise INA-CBG tariffs to better reflect the real costs incurred by hospitals, thus supporting operational sustainability and service quality. Meanwhile, hospitals can take practical steps such as optimizing INA-CBG coding, improving cost control through operational efficiency, and improving resource management. By implementing these measures, both hospitals and policymakers can contribute to a more efficient and sustainable healthcare system.

AUTHOR'S CONTRIBUTION STATEMENT

Author Contribution Statement: The first author has an important role as the main supervisor in this study. As a supervisor, the first author is responsible for guiding and overseeing the entire data collection and processing process, ensuring that the methods used are in line with the research objectives. In addition, the first author also reviewed the research results periodically, provided critical analysis, and made constructive suggestions for improvement or further development. On the other hand, the second author focuses on practical tasks, which is responsible for collecting and processing data in accordance with the directions and suggestions given by the first author. The second author carried out each stage of data collection and processing meticulously, following the established guidelines and suggestions to ensure the accuracy and quality of the desired results.

CONFLICTS OF INTEREST

We, the authors, hereby declare that there are no conflicts of interest that need to be disclosed in relation to this study. All creators of this study confirm that they have no personal, financial, or professional relationships or interests that could influence the results and objectivity of this study. No sponsors or third parties were involved in the funding, design, data collection, analysis or publication of the findings of this study. As such, we guarantee that the entire research and writing process was conducted with full integrity, without any bias or external influence that could affect the conclusions reached.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

No generative AI or AI-assisted technologies were used in the writing, editing, data analysis, or any other stage of the preparation of this manuscript.

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