Cost Analysis of Pediatric Pneumonia at Jogja Hospital Based on INA-CBG Tariffs in 2023

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Abstract. Pneumonia is the leading cause of global death for children under five years old. The cost incurred for the treatment of pneumonia is quite high. Hence, the government adjusted the INA-CBG tariffs listed in the Minister of Health Regulation No. 3 of 2023, allowing hospitals to improve the quality of care with cost-effective treatment. This study aims to determine the differences between the actual cost and the INA-CBG tariffs in 2023 at Jogja Hospital. This research belongs to an observational study with a cross-sectional design, taking the medical cost and pneumonia patients at Jogja Hospital from January to September 2023 as the data. One sample t-test and one sample Wilcoxon test were adopted for data analysis. The analysis of the differences between the actual cost and the INA-CBG tariffs obtained a significance value of higher than 0.05 in the J-4-16-I code for class 1 and 3 hospitalization, as well as the J-4-16-II code for class 3 hospitalization. Meanwhile, the J-4-16-I code for class 2 hospitalization acquired a significance value of less than 0.05. Overall, Jogja Hospital did not experience losses and has utilized the INA-CBG tariffs properly.

Keywords: pneumonia, pediatric, cost analysis, actual cost, INA-CBG tariffs in 2023

1 Introduction

Pneumonia is an infection of the respiratory system caused by viruses, bacteria, or fungi. This disease is spread through blood, air, or surfaces that have been exposed to the infection [1]. WHO data in 2019 unveiled that a total of 740,180 children died from pneumonia. Of all the causes of global deaths of children under five years old, 14% were due to pneumonia infection [2].

The treatment and hospitalization costs of pneumonia are quite high, especially if it is accompanied by other diseases [3]. Based on research conducted at Dr. Moewardi Hospital, the direct medical cost incurred by patients for the treatment of pneumonia in class 3 reached IDR 14,718,551, with the largest component being the costs of drugs and medical devices, reaching IDR 6,927,381 [4]. The high cost of treatment led the government to implement the Jaminan Kesehatan Nasional (JKN) system, expecting to reduce the economic burden of JKN participants [5].

The Indonesian government adjusted health service tariffs on January 9th, 2023, at both basic and referral levels for JKN participants. It is specified in the Minister of Health Regulation No. 3 for 2023. The goal of the new rule is to improve the quality of healthcare services by providing benefits to healthcare facilities like hospitals. The Indonesian-Case Based Group Tariffs (INA-CBG Tariffs) signify the payment amount issued by the Social Security Agency on Health (BPJS Kesehatan) to specialized referral health facilities. This payment covers service packages categorized by disease diagnoses and procedures and includes all hospital resources in both medical and non-medical services [6].

This study is crucial considering the high number of pneumonia cases and the high cost of treatment. This study was conducted to evaluate the INA-CBG tariffs in 2023. Previously, Maqfirah performed a cost analysis at Jogja Hospital by comparing the average actual cost with the INA-CBG tariffs listed in the Minister of Health Regulation No. 64 of 2016. The differences between the direct cost and the INA-CBG tariffs at Jogja Hospital disclosed that the hospital did not lose money and had established health services in accordance with government regulations [7]. After the establishment of the new INA-CBG tariffs in 2023, more research is required to discover the improvements made by the hospital with the new tariffs. This study's purpose is to determine the differences between the actual cost and the INA-CBG tariffs in 2023 at Jogja Hospital.

2 Materials and Methods

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2.1 Materials

This study utilized several instruments, encompassing pneumonia patient cost data, medical record data for pneumonia patients participating in JKN during their treatment, a logbook for recording patient data, and INA-CBG tariffs based on the codes listed in the Minister of Health Regulation No. 3 of 2023 for pneumonia.

2.2 Methods

This study was conducted under the ethical clearance No. 55/KEPK/RSUD/IX/2023 issued by Jogja Hospital. It belongs to an observational study with a cross-sectional design. The data were collected retrospectively by tracing the medical records and the treatment cost of pediatric pneumonia patients who participated in the JKN program from January to September 2023. A total sampling system meeting the inclusion and exclusion criteria was adopted. The inclusion criteria included pediatric pneumonia patients admitted to classes 1, 2, and 3 of the JKN program at Jogja Hospital who were diagnosed with mild pneumonia, mode tariff pneumonia, and severe pneumonia included in the J-4-16-I, J-4-16-II, and J-4-16-III codes of INA-CBGs; pediatric pneumonia patients who had therapy payment data completing the calculation of cost components with certainty; and pediatric pneumonia patients with medical records completing patient data. Conversely, the exclusion criteria comprised patients who died during hospitalization, forced or self-discharge patients, patients who changed treatment classes, and patients who were referred to other hospitals.

3 Data Analysis

Descriptive statistical analysis was performed to describe the average actual cost of treatment of pediatric pneumonia patients participating in JKN. It determined the suitability of the average actual cost of treatment of JKN pneumonia pediatric patients in the inpatient pharmacy installation of Jogja Hospital with the INA-CBG tariffs based on the Minister of Health Regulation No. 3 of 2023. Data are declared appropriate if the average actual cost is less than or equal to the INA-CBG tariffs. One-sample t-test and Wilcoxon test were utilized to analyze the differences between the average actual cost of treatment of pediatric pneumonia patients participating in JKN in the inpatient installation of Jogja Hospital and the INA-CBG tariffs based on the Minister of Health Regulation No. 3 of 2023.

4 Results and Discussion

4.1 Characteristics of Pneumonia Pediatric Patients at Jogja Hospital

From January to September 2023, there were 81 pediatric pneumonia patients at Jogja Hospital, fulfilling the inclusion criteria. Table 1 displays the characteristics of these pediatric pneumonia patients.

Table 1. Characteristics of Pediatric Pneumonia Patients Hospitalized at Jogja Hospital

Characteristics	Categories	Total	(%)
Age	<5 years	62	76.5
	>5 years	19	23.5
Gender	Male	51	63
	Female	30	37
Class	I	20	24.7
	II	11	13.6
	III	50	61.7
Length of stay	≤5 days	38	46.9
	>5 days	43	53.1
Comorbid	Without comorbid	46	51.7
	One comorbid	30	33.7
	>1 comorbid	13	14.6

The most common age category was children under five, vulnerable to infections like pneumonia and influenza due to the body's imperfect defense mechanism and narrower airways compared to adults [8]. A total of 63% of pneumonia patients at Jogja Hospital were male, which may be due to the different immune systems or because males have smaller respiratory tract diameters than females [9]. Class 3 inpatient had the largest number of patients due to the most affordable cost incurred, which was adjustable to the patient's ability or income level [10]. The length of stay (LOS) value affected the total actual cost incurred by the hospital because the length of treatment was directly proportional to the actual expenses [5]. According to another study by Satibi et al., LOS significantly affected actual expenses because the longer a patient stayed, the more expensive it was [11]. The most common comorbidity identified in patients admitted to Jogja Hospital was asthma, accounting for 11 patients. The research conducted by Widjanarko *et al.* discovered a relationship between asthma and pneumonia; particularly, toddlers who had a history of asthma had a 19.5 times increased risk of pneumonia compared to other toddlers who did not have it. Children with a chronic history of asthma have a decreased immune system, making them vulnerable to severe disease [12].

4.2 Treatment Cost Analysis

Patients were categorized by severity and treatment class to determine the average actual cost of each class in pneumonia treatment. Patients with the INA-CBG's code of J-4-16-III, whether treated in classes 1, 2, or 3, were not found at Jogja Hospital. It may be due to patients with high severity being directly referred to higher-level hospitals. Table 2 summarizes the actual cost components for each class.

Table 2. The Actual Cost Components of Pneumonia Pediatric Patients Hospitalized at Jogja Hospital

Cost Variable (IDR)	**Average Cost**											
	Class 1				**Class 2**				**Class 3**			
	Mean	**%**	**Mean**	**%**	**Mean**	**%**	**Mean**	**%**	**Mean**	**%**	**Mean**	**%**
	J-4-16-I	**n (19)**	**J-4-16-II**	**n (1)**	**J-4-16-I**	**n (10)**	**J-4-16-II**	**n (1)**	**J-4-16-I**	**n (46)**	**J-4-16-II**	**n (4)**
Room	1,470,263	31.3	2,445,000	25.4	687,000	19.1	2,268,000	40.2	541,130	15.3	777,000	18.1
Non-surgical procedure	391,144	8.3	756,400	7.9	306,016	8.5	214,000	3.8	337,695	9.6	348,550	8.1
Visit fee	293,447	6.3	525,000	5.5	305,550	8.5	346,500	6.1	305,870	8.7	388,550	9
Nursing	569,105	12.1	1,075,000	11.2	672,300	18.7	621,000	11	571,652	16.2	727,250	16.9
Emergency	66,053	1.4	70,000	0.7	67,500	1.9	70,000	1.2	65,000	1.8	57,500	1.3
Non-operative measures	217,763	4.6	364,000	3.8	194,500	5.4	174,000	3.1	229,554	6.5	200,500	4.7
Electromedical	444,868	9.5	2,257,500	23.5	246,750	6.9	105,000	1.9	372,065	10.5	393,750	9.2
Nutrition	425,474	9.1	589,000	6.1	286,500	8	550,000	9.7	265,522	7.5	331,750	7.7
Laboratory	78,553	1.7	401,000	4.2	150,450	4.2	295,500	5.2	101,326	2.9	191,875	4.5
Radiology	140,263	3	130,000	1.4	130,000	3.6	195,000	3.5	123,043	3.5	130,000	3
Medicine	597,760	12.7	998,550	10.4	548,286	15.3	804,748	14.3	622,052	17.6	750,167	17.5
Total	4,694,693	100	9,611,450	100	2,594,852	100	5,643,748	100	3,534,909	100	4,296,842	100

According to the results in Table 2, the average actual cost incurred by Jogja Hospital rose along with the high severity and class of patient care. The largest actual cost compilers were room costs, medicine or medical equipment costs, nursing costs, and electromedical costs. Similarly, the research conducted by Maqfirah disclosed that the largest cost components were medicine costs, nursing costs, and room costs [7]. The results indicate that the hospital has not evaluated the elements causing the actual cost to rise.

Throughout this study, room costs emerged as the most significant expense component across all classes and severity levels. The amount of room costs varied for each patient depending on the type of inpatient class and the length of time the patient was treated. The higher the level of the inpatient class, the greater the cost incurred; the class level affected the facilities of a room [13]. The total cost, including the room costs, was calculated starting from the patient's admission to the hospital. Hence, the longer the treatment time, the higher the cost incurred by the hospital. The high nursing costs were influenced by the length of treatment, the number of drugs received by the patient, and the accumulated frequency of drug administration [5]. Electromedical costs were the second largest constituent of the actual cost in patients admitted to class 1 with the J-4-16-II code because the patient was in the PICU for five days, causing the additional costs for electromedical monitoring. The cause of high medicine or medical equipment costs was the large variety of drugs prescribed to patients; the more drugs used to cure a disease boosted the total actual cost incurred by the hospital [14].

The average actual cost incurred by patients during their hospitalization served as a good indicator of the differences between the actual cost and the INA-CBG tariffs. The exact cost was compared with the INA-CBG tariffs based on class and severity. Table 3 lists the results of the differences between the actual cost and INA-CBG tariffs.

Table 3. Differences Between the Average Actual Cost and the INA-CBG Tariffs in 2023

INA-CBG's Code	Class	n	Total Cost		Average Cost (IDR)		Sig (normality)	p (2-tailed)
			Actual Cost (IDR)	INA-CBG Tariffs (IDR)	Actual Cost (IDR)	INA-CBG Tariffs (IDR)		
J-4-16-I	1	19	89,199,167	93,314,700	4,694,693±1,889,082	4,911,300	0.014	0.243
	2	10	35,948,520	43,020,000	3,594,852±606,745	4,302,000	0.832	0.005
	3	46	16,605,814	169,864,200	3,534,909±1,069,221	3,692,700	0.002	0.083
J-4-16-II	1	1	9,611,450	6,901,600	9,611,450	6,901,600	-	-
	2	1	5,643,748	6,405,400	5,643,748	6,405,400	-	-
	3	4	17,187,368	20,756,800	4,296,842±1,352,034	5,189,200	0.948	0.279
Total Cost			320,196,067	340,262,700				
Difference (+/-)			+20,066,633					

Table 3 exhibits that patients with the J-4-16-I code who were treated in classes 1, 2, and 3 and patients with the J-4-16-II code who were treated in classes 2 and 3 had an average actual cost smaller than the INA-CBG tariffs. Hence, BPJS Kesehatan could cover the actual cost, preventing the hospital from experiencing losses. Whereas patients with the J-4-16-II code treated in class 1 had an average actual cost greater than the INA-CBG tariffs. Accordingly, the fee from BPJS Kesehatan could not cover the actual cost of the hospital. Hence, the hospital, as a provider, must pay the shortage of cost, causing it to experience losses [15]. Some factors causing the actual cost to be greater than the INA-CBG tariffs were treatment in class 1, the moderate severity of patients, a secondary diagnosis of the patients, the eight days of treatment, several laboratory tests, various drugs administered, and numerous procedures performed.

It is reinforced by the study of Nisa and Rahardjo, which obtained a p-value of 0.028, indicating that the class of care affects the actual cost of the hospital. Each class of care has a specific tariff amount because it is adjusted to the actions and facilities the patient receives. Severity was the subsequent factor causing a negative difference in patients with the J-4-16-II code treated in class 1. Based on the results of ICD-10 and ICD-9 grouping, patients were categorized as having mode tariff severity. Complications and severity of a disease impacted the amount of health services obtained. Severity was determined by complications, secondary diagnoses, and procedures, thereby raising the actual cost. The more secondary diagnoses a patient has, the higher the patient's severity [10]. One secondary diagnosis of adult respiratory distress syndrome identified in the patients raised the actual cost of the hospital.

The length of time for patient care in the hospital was eight days. It complies with the study by Faizah & Mildawati, indicating a substantial correlation between the length of treatment and the actual cost. The longer the patient is treated, the more drugs are required, and the more actions are taken, the higher the total actual cost [14]. Of the patient's total LOS of eight days, five days were spent in the PICU room, requiring close monitoring. The ICU utilizes high resources due to patients in a critical condition that requires complex drugs and actions, which, of course employ sophisticated tools [16]. Laboratory examinations performed on the patients included complete blood draw, checking for glucose, vena cava sampling, checking for chloride, potassium, and sodium levels in the blood, and blood gas analysis. More supporting examinations escalated the total actual cost [14].

The medicines given by the doctor to the patient consisted of dumin rect, invicolt injection, KAEN 1B, ceftriaxone injection, methylprednisolone injection, respivent, salbutamol, cefixime syrup, and ventolin. Drug costs were the second largest component after room costs, amounting to IDR 804,748. It aligns with the research of Faizah and Mildawati, stating that more drugs used to cure disease boosted the total actual cost incurred by the hospital [14]. Patients with the J-4-16-II code treated in class 1 received five procedures obtained from the ICD-9 code, including 93.94 (respiratory medication administered by nebulizer), 93.96 (other oxygen enrichment), 99.21 (injection of antibiotics), 90.59 (microscopic examination of blood, other microscopic examination), and 87.44 (routine chest X-ray, as specified). Research conducted at Dr. Moewardi Hospital obtained a procedure correlation value of 0.380, signifying a significant relationship between the actual cost and procedures [14].

The results listed in Table 3 disclosed that in patients admitted to class 1 with mild severity (J-4-16-I), patients admitted to class 3 with both mild severity (J-4-16-I) and mode tariff severity (J-4-16-II) had a p-value higher than 0.05. These results indicate no significant difference between the average actual cost and the INA-CBG tariffs. The absence of a substantial difference between the actual cost and the INA-CBG tariffs may be due to diverse comorbid factors, many procedures, and long length of stay values [4]. If compared to research conducted at Jogja Hospital in 2018, these results were inappropriate because they displayed a significant difference between the actual cost and the INA-CBG tariffs based on the Minister of Health Regulation No. 64 of 2016 [7].

In patients with the J-4-16-I code who were treated in class 2, the test yielded a significance value of 0.005 (less than 0.05), indicating a significant difference between the average actual cost and INA-CBG tariffs. These results are in line with the finding of a p-value of 0.000, exhibiting a substantial difference between the actual cost and the INA-CBG tariffs. It was due to the less severe patient's comorbid factors and the short average of LOS, resulting in the lower cost compared to the INA-CBG tariffs [14]. There were ten patients treated in this group, with only two patients having comorbid factors, while eight others did not have them. It may be the reason underlying the absence of a difference between the actual cost and the INA-CBG tariffs based on the Minister of Health Regulation No. 3 of 2023.

To discover whether the hospital has a surplus or minus, it was determined by analyzing the differences between the total actual cost and the total INA-CBG tariffs in 2023. It is a negative difference if the total actual cost of the patient is greater than the total INA-CBG tariffs, indicating that the hospital experiences a minus. On the other hand, a positive difference is when the total actual cost of the patient is lower than the total INA-CBG tariffs, signifying that the hospital is in a surplus. Table 3 exhibits the total actual cost of pneumonia inpatients at Jogja Hospital of IDR 320,196,067 and a total INA-CBG tariff in 2023 of IDR 340,262,700. The positive difference between the two was +IDR 20,066,633, implying that the hospital experienced a surplus or profit. In other words, the hospital has managed the budget provided by the government properly and could maintain service quality.

When compared to research conducted at Jogja Hospital in 2018, the positive difference obtained by the hospital was +IDR 38,232,955 [7]. The difference between research conducted in 2023 and 2018 amounted to IDR 18,166,322. Thus, even though the hospital did not experience a loss, the profit obtained in 2023 was not as much as in 2018. The possible cause was that the tariff changes contained in the Minister of Health Regulation No. 3 of 2023 are not too large; in the J-4-16-I and J-4-16-II codes for class 1, the tariff increase is only IDR 100, while in Indonesia, the cost of health services has been escalating [17]. Although the hospital did not experience a loss, it must evaluate especially the groups with a negative difference, allowing for optimal utilization of the cost provided by the government.

5 Conclusion

The research findings revealed an average actual cost lower than the INA-CBG tariffs, with a significant difference. Hence, the hospital has maintained its quality because BPJS Kesehatan could cover the actual cost of the hospital, thereby not causing losses.

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