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Calculation of Sectio Caesarea Procedure Cost with TDABC Method and Comparison with BPJS Claim Rates at Hospital X

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ABSTRACT

This study aims to compare the calculation of medical procedure costs using the Time Driven Activity Based Costing (TDABC) method with the claim rates set by BPJS Class 3 for type D hospitals. The calculation results using the TDABC method show a total cost of Rp 2.123.438,87, which includes all activities carried out during the medical procedure, from the preparation stage, surgery, to post operation. On the other hand, the BPJS Class 3 claim for similar services is Rp 4.567.700,00, which is higher than the TDABC calculation results. This significant difference indicates a discrepancy between the costs calculated by the hospital and the claims paid by BPJS. Although BPJS claims include administrative costs, overhead, and other factors, the TDABC method provides a more accurate picture of operational costs based on the time and resource capacity used in medical procedures. These findings provide important insights into hospital operational cost management and how to adjust service rates to cost realities more efficiently and transparently.

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INTRODUCTION

The cost accounting system in hospitals plays an important role in providing accurate financial information to support operational efficiency without reducing the quality of health services. Optimization ensures the use of resources is the key to sustainable, quality, and affordable services. One of the strategic approaches suggested by Porter is the implementation of a patient-oriented service model, supported by a cost based information system (Kohlbacher & Gruenwald, 2011).

In Indonesia, the implementation of a prospective payment system through the Indonesia Case-Based Groups (INA-CBGs) which has been in effect since 2014 aims to improve the efficiency and transparency of financing in health care facilities. This system groups patients based on diagnosis and type of action to determine claim rates. However, in practice, many hospitals still have difficulty calculating unit costs accurately, so that there is often a mismatch between real service costs and claims provided by BPJS Kesehatan (Andayani, 2014).

Hospital X, as a type D hospital, is still using a conventional approach in determining service rates, namely by calculating operational costs in aggregate without considering specific cost components per medical procedure. This risks creating an imbalance between income and expenditure and impacting the quality of services provided.

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The Time Driven Activity Based Costing (TDABC) method is here as an innovative solution in calculating more accurate medical service costs. This method allocates costs based on the time required to complete each activity in a medical procedure, multiplied by the capacity of the resources used. This approach is considered more practical than the conventional Activity Based Costing (ABC) method because it does not require complex surveys or interviews (Kaplan, R. S., 2007).

Several previous studies have shown the effectiveness of implementing TDABC in health services. A study by Da Silva Et Ges et al (2020) concluded that TDABC is able to provide a clearer picture of costs, support appropriate resource allocation, reduce waste, and help clinicians and managers increase service value transparently. Meanwhile, Shankar et al. (2020) applied TDABC in the field of radiology and found that this method was effective in assessing cost differences between processes, especially when patient clinical outcomes were similar. Another study by Koolmees et al. (2021) in the context of orthopedic surgery also showed that TDABC produces a more detailed and efficient cost mapping than standard accounting methods, with lower cost estimates.

By implementing the TDABC method, hospitals can obtain a more detailed and realistic picture of costs at each stage of medical procedures, including in Sectio Caesarea (SC) operations, which is one of the most common procedures at Hospital X. Thus, the hospital has strong baseline data to carry out operational efficiency and compile service rates that reflect the actual cost burden. This study aims to compare the calculation of the cost of Sectio Caesarea surgery procedures using the TDABC method with BPJS Class 3 claim rates at type D hospitals. The focus on Class 3 claims is considered relevant considering that this group represents the majority of BPJS participants from the lower middle class who require affordable health services. It is hoped that the results of this study can be a reference in making more rational and transparent medical service tariff policies, both at the hospital level and the national financing system.

LITERATURE REVIEW

Time Driven Activity Based Costing (TDABC) is a new approach in hospitals that is used to calculate direct and indirect costs in providing certain services. Introduced by Professor Kaplan from Harvard Business School in the context of healthcare, TDABC is a way for organizations to understand the costs associated with healthcare services based on the resources used. In the Time Driven Activity Based Costing method, two parameters are required, namely the cost per unit of resource and the time required for each activity (McLaughlin et al., 2014). As explained above, the important components of TDABC can be described as follows:

Table 1. Time Driven Activity Based Costing Formula

Capacity Cost Rate	=	$\frac{Cost\ of\ Capacity\ Supplied}{Practical\ Capacity\ or\ Resources\ Supplied}$
Unit Time	=	*Actual Time Needed to do The Activity*
Unit Cost	=	*Cost per Activity*
	=	*Capacity Cost Rate x Unit Time*

In hospital cost management, traditional cost accounting methods often produce information that is not accurate enough because they only rely on dividing total costs based on service volume. The Activity-Based Costing (ABC) method then emerged as a more appropriate solution because it focuses on activities, but its implementation is considered complex and time consuming (Demeere et al., 2009). As a form of simplification, the Time Driven Activity Based Costing (TDABC) method was developed by only requiring two parameters: capacity cost level and activity time. This method helps hospitals obtain a more

accurate picture of the costs incurred in the care process. Accuracy of cost information in hospitals is a must to fully understand the cost of all resources used by patients during health care procedures (Cardoso et al., 2023). The application of the TDABC method in health services has been shown to provide a more realistic and accurate picture of costs. A research by Secinaro (2021) showed that this method is able to reveal actual expenditures on radiology services that are higher than the placement rates from the national health insurance system. TDABC can utilize hospital management to uncover internal cost structures and compare them with external rates. Meanwhile, Da Silva's (2022) study identified that service delivery practices between hospitals can differ in terms of duration and cost, so TDABC is useful in re-planning service flows and showing efficiency opportunities. From a health economics perspective, Rognoni (2023) emphasized that TDABC allows the gap between real costs and public spending to disappear, and supports more targeted financing policies in hospital management.

METHODS

This study uses a descriptive qualitative approach with a case study strategy that focuses on comparing the calculation of the cost of Sectio Caesarea (SC) surgery using the Time Driven Activity Based Costing (TDABC) method and BPJS Class 3 claim rates at Hospital X, which is a type D hospital. This study was conducted in the period December 2024 - March 2025, with the scope of analysis limited to Sectio Caesarea actions carried out during that period.

Data collection was carried out through a combination of direct observation, semi structured interviews, and documentation of medical records and internal hospital financial reports. Observations focused on the process flow of Sectio Caesarea, from preparation, surgery, to post-surgery. Interviews were conducted with hospital directors, specialist doctors, operating room nurses, emergency room nurses, midwife, administrative staff, and CSSD and laundry officers, to obtain data related to process time, workload, and division of tasks for each unit.

The implementation stages of the TDABC method in this study include six main steps, namely:

1. Process mapping to identify medical activities that SC patients go through,
2. Identification of resource groups (cost pools) such as direct labor, indirect labor, medical devices, and utilities,
3. Calculation of practical capacity based on effective working time in one year (in minutes),
4. Calculation of the capacity cost rate (CCR) of each cost group by dividing the total annual cost by the practical capacity,
5. Measurement of the duration of patient activity time (unit time) based on the results of observations and verification of medical record documents,
6. Calculation of unit costs by multiplying the CCR of each resource by the unit time of the related activity.

Data validation was carried out through triangulation techniques of sources and methods, namely by comparing data from interviews, hospital documents, and field observations. To minimize perception bias, interviews were conducted with a minimum of two respondents per work unit, and the results were confirmed with formal documents and real observations in the field. This study has obtained written permission from the management of Hospital X and was conducted with attention to research ethics, including verbal consent from respondents, data anonymity, and confidentiality of hospital information. All identities of individuals and institutions are kept confidential from appearing in the publication.

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RESULTS AND DISCUSSIONS

1. Identify activities and time duration

Table 2 below details in a structured manner the sequence of activities, details of activities, rooms and duration of time in the cesarean section (CS) procedure from the preparation stage to post-operatively. Time estimates for each activity were obtained through interviews with medical personnel and hospital staff directly involved, and were reinforced by observations of procedures and patient medical records, so that the recorded duration was more accurate.

Table 2. Activities and Time Duration

Activities	Activity Details	Room	Time required (minutes)
Preparation	Patient Examination	Emergency Room	5
	Patient Registration	Registration and Cashier Room	7
	Consultation of specialist doctors	Emergency Room	5
	Medicine allergy test	Emergency Room	10
	Action (depending on the results of the consul)	Emergency Room	10
	Waiting for lab results	Emergency Room	30
	Consultation of specialist doctors	Emergency Room	5
Pre Operation	Preoperative skin preparation	Emergency Room	10
	Preparation of surgical tools and equipment	Surgery room	30
	Patient observation	Premedication Room	60
Operation	Anesthesia Procedures	Surgery room	2
	Surgical Procedures	Surgery room	30
Post Operation	Patient observation	Recovery Room	120
	Cleaning the operating room	Surgery room	45
	Sterile surgical instrument set	CSSD Room	115
	Laundry linen	Laundry Room	60

In the preparation stage for surgery, patients undergo several procedures starting with an examination in the ER by nurses and medical personnel, which takes 5 minutes. Patients then register in the registration and cashier room for 7 minutes, assisted by administrative staff. After that, patients consult with a specialist doctor in the ER for 5 minutes, followed by a drug allergy test for 10 minutes. If necessary, patients also undergo additional actions according to the results of the consultation for 10 minutes and wait for laboratory results for 30 minutes. Further consultation with the doctor is carried out for 5 minutes. In the pre-operative stage, patients undergo preoperative skin preparation in the ER for 10 minutes, and preparation of surgical instruments and facilities in the operating room for 30 minutes by the operating room nurse. Before surgery, patients are observed in the premedication room for 60 minutes by the OK nurse. In the surgical stage, the procedure begins with anesthesia that lasts for 2 minutes, followed by surgery that takes 30 minutes, carried out by a specialist doctor together with an operating room nurse. In the post-operative stage, patients will be observed in the Recovery

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Room for 120 minutes to ensure good recovery. Next, the operating room is cleaned for 45 minutes by the cleaning services staff. Surgical instruments are then sterilized in the CSSD Room for 115 minutes, and linens used in the procedure are washed in the Laundry Room for 60 minutes.

The following image presents a process map of medical procedures for Caesarean Section (CS) operations at Hospital X, which is compiled based on the results of field observations, interviews with medical personnel, and review of medical record documents.

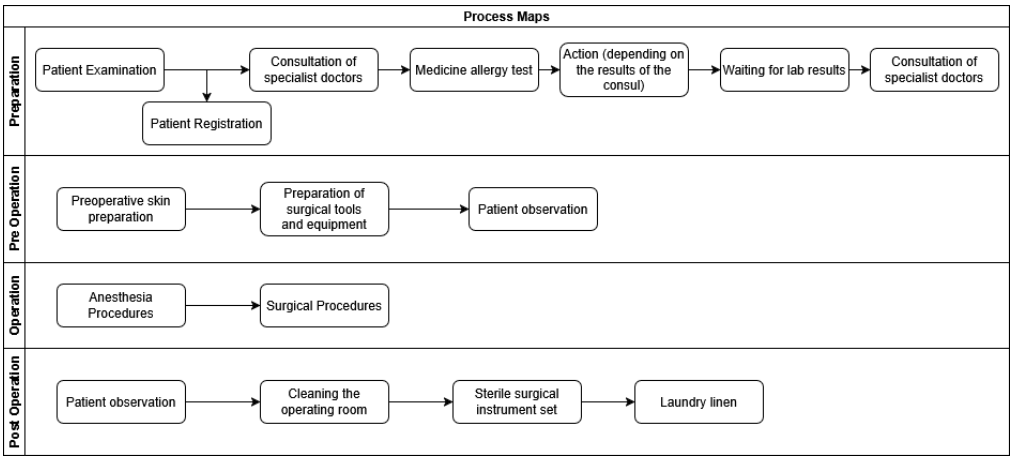

Figure 1. Process Map

2. Total cost and practical capacity of each resource group

The next step is to identify the total cost for each cost pool. Cost pool refers to a group of costs grouped by the type of resources used in a medical procedure. This step is followed by identifying the practical capacity and calculating the Capacity Cost Rate (CCR) for each cost pool. Practical capacity is calculated by analyzing the effective working time available for each activity in the medical process, such as cesarean section (CS) and inguinal hernia operations. The time required for each stage (preparation, pre-operative, surgical, and post-operative) is calculated based on the activity time and the number of effective working days in a year, then multiplied by the number of minutes per hour to determine the practical capacity in minutes.

2.1 Direct Labor

To calculate the percentage of a particular operation, first divide the number of cesarean operations by the total number of operations performed by obgyn specialists in the period 2024, then multiply by 100%. The result shows the percentage of that type of operation. Then, to calculate the salary and benefit costs associated with cesarean operations, divide the total salary and benefit costs by the relevant percentage of operations. The result is the specific cost allocated to cesarean operations. Next, to calculate the capacity rate per operation, divide the total cost allocated to cesarean operations by the total number of operations performed in the same period. This gives a capacity rate that shows the cost per unit for each operation. Likewise, to calculate the capacity rate for the operating nurse involved in the procedure, divide the total salary and benefit costs of the nurse by the total number of operations performed in 2024. The result is the capacity rate per operation for that operating nurse.

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Table 3. Capacity Cost Rate Direct Labor

No	Human Resources	Total Cost Salary and Allowances	Capacity Cost Rate per Operation (Rp)
1	Obgyn Specialist Doctor	Rp 921.306.600,00	Rp 1.061.413,13
2	Nurse Operation	Rp 342.921.971,39	Rp 246.706,45

2.2 Indirect Labor

The calculation of the capacity rate begins by calculating the total cost of salaries and benefits for indirect labor (TKTL). Anesthesiologists must determine the total working hours in a year, which is calculated based on the number of hospital operating days and working hours per day, taking into account the leave taken. Productive working hours are obtained by subtracting leave hours from the total annual working hours, then converting them into minutes. Furthermore, the capacity rate is calculated by dividing the total cost of salaries and benefits by the amount of productive working time in minutes.

The same process is applied to emergency room nurses, midwives, registration admins, CSSD officers, cleaning services, and laundry, each of which has a different work shift. The calculation of productive working hours is done by subtracting unproductive working time from the total annual working hours, then multiplying it by 60 to convert it into minutes. Finally, the capacity rate per minute is calculated by dividing the total annual salary cost by the productive working time in minutes. The result of this calculation provides a capacity rate that shows the cost per unit of working time involved in the cesarean section procedure.

Table 4. Capacity Cost Rate Indirect Labor

No	Human Resources	Total Cost Salary and Allowances	Capacity Cost Rate per Minutes (Rp)
1	Anesthesia Specialist Doctor	Rp 321.724.590,00	Rp 631,13
2	Emergency Room Nurse	Rp 85.673.567,12	Rp 776,03
3	Midwife	Rp 210.475.272,42	Rp 1.906,48
4	Registration Admin	Rp 167.291.538,28	Rp 1.515,32
5	CSSD Staff	Rp 46.700.147,15	Rp 423,01
6	Cleaning Services	Rp 142.928.116,35	Rp 1.294,64
7	Laundry Staff	Rp 27.814.457,69	Rp 839,81

2.3 Hospital Equipment Cost

The equipment cost per minute is calculated by dividing the total equipment cost per room by the total minutes available in a year, which is calculated as 439,200 minutes based on the effective working hours of hospital staff. The hospital operates with three shifts per day, where the morning and afternoon shifts are 6 hours each, while the night shift is 8 hours. The total effective working time per day is 20 hours, which if calculated for a leap year (366 days), results in 439,200 effective working minutes. Each room has a different equipment cost, depending on the type and complexity of the equipment used.

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Table 5. Hospital Equipment Cost

No	Room Name	Price Per Room (Rp)	Capacity Cost Rate
1	Registration and Cashier Room	Rp 5.367.500,00	Rp 85,55
2	Emergency Room	Rp 10.257.125,00	Rp 238,98
3	Premedication Room	Rp 375.000,00	Rp 51,23
4	Operating Room	Rp 74.805.000,00	Rp 669,85
5	Recovery Room	Rp 6.152.500,00	Rp 1.681,01
6	CSSD Room	Rp 43.750.000,00	Rp 11.455,49
7	Laundry Room	Rp 2.875.000,00	Rp 392,76
Total		Rp 143.582.125,00	Rp 14.574,86

2.4 Hospital Utility Cost

These costs are calculated by multiplying the area of the room by the utility cost per square meter, then divided by the total minutes available in a year (439,200 minutes). The hospital operates with three shifts per day, with the morning and afternoon shifts each having 6 effective hours, and the night shift having 8 effective hours, so the total effective working time per day is 20 hours or 1,200 minutes. Each room has a different utility cost, depending on the size and type of room.

Table 6. Utility Cost

No	Room Name	Utility Cost (Rp/m²)	Total Minutes Available per Year	Cost per Minutes (Rp)
1	Registration and Cashier Room	Rp 4.358.914,83	Rp 439.200,00	Rp 9,92
2	Emergency Room	Rp 17.911.523,37	Rp 439.200,00	Rp 40,78
3	Premedication Room	Rp 3.481.932,18	Rp 439.200,00	Rp 7,93
4	Operating Room	Rp 27.952.177,75	Rp 439.200,00	Rp 63,64
5	Recovery Room	Rp 6.538.294,86	Rp 439.200,00	Rp 14,89
6	CSSD Room	Rp 3.991.068,04	Rp 439.200,00	Rp 9,09
7	Laundry Room	Rp 19.344.067,65	Rp 439.200,00	Rp 44,04

2.5 Building Maintenance Cost

The maintenance cost per minute is calculated by dividing the total building maintenance cost by the total effective annual working minutes, which is 439,200 minutes. The effective working time per day is calculated based on a three-shift system, with a total of 20 effective working hours per day. Building maintenance varies from room to room, depending on the size and type of room requiring maintenance.

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Table 7. Building Maintenance Cost

No	Room Name	Building Maintenance Cost (Rp/m²)	Total Minutes Available per Year	Cost per Minutes (Rp)
1	Registration and Cashier Room	Rp 568.741,42	Rp 439.200,00	Rp 1,29
2	Emergency Room	Rp 2.337.055,37	Rp 439.200,00	Rp 5,32
3	Premedication Room	Rp 454.314,70	Rp 439.200,00	Rp 1,03
4	Operating Room	Rp 3.647.137,42	Rp 439.200,00	Rp 8,30
5	Recovery Room	Rp 853.102,04	Rp 439.200,00	Rp 1,94
6	CSSD Room	Rp 520.745,60	Rp 439.200,00	Rp 1,19
7	Laundry Room	Rp 2.523.970,53	Rp 439.200,00	Rp 5,75

2.6 Building Depreciation Cost

The depreciation cost per minute is calculated by dividing the total building depreciation cost by the total minutes available in a year, which is calculated as 439.200 minutes based on the effective working time of hospital staff. The hospital's three shift work system per day results in an effective working time per day of 1.200 minutes, which is multiplied by 366 days in a leap year, resulting in a total of 439.200 minutes per year.

Table 8. Building Depreciation Cost

No	Room Name	Building Depreciation Cost (Rp/m²)	Total Minutes Available per Year	Cost per Minutes (Rp)
1	Registration and Cashier Room	Rp 454.109,41	Rp 439.200,00	Rp 1,03
2	Emergency Room	Rp 1.866.012,90	Rp 439.200,00	Rp 4,25
3	Premedication Room	Rp 362.745,83	Rp 439.200,00	Rp 0,83
4	Operating Room	Rp 2.912.040,86	Rp 439.200,00	Rp 6,63
5	Recovery Room	Rp 681.155,58	Rp 439.200,00	Rp 1,55
6	CSSD Room	Rp 415.787,04	Rp 439.200,00	Rp 0,95
7	Laundry Room	Rp 2.015.253,19	Rp 439.200,00	Rp 4,59

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2.7 Supplies and Medicine

In caesarean section (CS) operations, the use of supplies and medicines plays an important role in determining the total costs that must be incurred for each operation.

Table 9. Supplies and Medicines

No	Supplies and Medicines	Amount	Unit	Price
1	Regivel Inj	1	ampul	Rp 99.000,00
2	Tranec 500 mg inj	1	ampul	Rp 18.700,00
3	Ondansetron inj	1	ampul	Rp 8.800,00
4	Noprostol	1	tablet	Rp 11.000,00
5	NS 500	1	botol	Rp 7.700,00
6	Tramadol inj	1	ampul	Rp 6.105,00
7	Santagesik inj	1	ampul	Rp 5.493,00
8	Ketorolac inj	1	ampul	Rp 7.260,00
9	Nairet inj	1	ampul	Rp 31.900,00
10	T-Plain 1	1	vial	Rp 97.900,00
11	T-Plain O	1	vial	Rp 74.800,00
12	Aqua Pro inj/wfi 25 ml	1	botol	Rp 7.337,00
13	Methylergometrine 200 mcg	1	ampul	Rp 2.235,00
14	Underpad	1	lembar	Rp 8.132,00
15	Kasa Steril Husada 16X16	15	lembar	Rp 97.350,00
16	Spinocant 27	1	pcs	Rp 88.000,00
17	Bloodset BPJS	1	set	Rp 24.420,00
18	RL	2	botol	Rp 10.560,00
19	Spuit 5 cc	1	pcs	Rp 1.392,00
20	Spuit 3 cc	1	pcs	Rp 1.222,00
21	Venicath 18	1	pcs	Rp 25.300,00
22	Skiren	1	tube	Rp 5.500,00
23	Urine Bag	1	pcs	Rp 13.200,00
24	Mess no 10	1	pcs	Rp 6.083,00
25	Spuit 10 cc	1	pcs	Rp 1.843,00
26	Intouch Steril no 7,5	1	pasang	Rp 14.850,00
27	Handscoon	3	pasang	Rp 72.600,00
28	Folley Cath 2way-ch16	1	pcs	Rp 20.757,00
TOTAL				Rp 769.439,00

3. Identify unit cost based on time used

To calculate the unit cost, the first step is to determine the practical capacity for each activity in a medical procedure, such as a cesarean section (CS) operation. After the practical capacity is calculated, the next step is to calculate the unit cost for each activity involved in the operation process. The formula used to calculate the unit cost is to multiply the previously calculated capacity cost rate by the time per unit of capacity. The time per unit of activity refers to the duration required to complete each stage in a medical procedure, such as the time for

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examining the patient in the ER, registering the patient, performing anesthesia, and performing surgery in the operating room.

Table 10 shows that the cost of a cesarean section (CS) operation is calculated by taking into account all costs related to the procedure, including direct costs and overhead costs that apply to each step in the operation process.

Table 10. Unit Cost

No	Cost Categories	Cost	Total
1	Supplies and Medicine	Rp 769.439,00	
2	Direct Labor:		
	Obgyn Specialist Doctor	Rp 1.061.413,13	
	Nurse Operation	Rp 246.706,45	
	Total		Rp 2.077.558,59
	Overhead Cost:		
3	Indirect Labor:		
	Anesthesia Specialist Doctor	Rp 20.196,15	
	Emergency Room Nurse	Rp 19.400,72	
	Midwife	Rp 85.791,55	
	Registration Admin	Rp 10.607,25	
	CSSD Staff	Rp 48.645,99	
	Cleaning Service	Rp 58.258,74	
	Laundry Staff	Rp 50.388,51	
4	Depreciation Equipment	Rp 14.574,86	
5	Utility Cost	Rp 15.887,72	
6	Building Maintenance Cost	Rp 2.072,99	
7	Building Depreciation Cost	Rp 1.655,17	
	Total		Rp 327.479,66
	Unit Cost		**Rp 2.405.038,24**

4. Cost Difference Analysis between TDABC and BPJS

The significant difference between the TDABC calculation results and BPJS claims can be explained by the following factors:

1) TDABC only calculates the costs of medical activities that actually occur, based on actual time and capacity, without including administrative markup components, risk reserves, and clinical risk management.
2) BPJS claims are prepared based on the INA-CBGs system, which combines a number of national average cost assumptions, including institutional overhead costs, risk margins, variations in patient severity, and financing of the health insurance system.
3) TDABC also does not include inpatient costs, whereas BPJS claims cover the entire episode of care from outpatient to inpatient care.
4) In practice, BPJS provides package payments, while TDABC produces actual costs per activity based on workload and time, which tend to be lower if there are no medical complications.

CONCLUSION

The Sectio Caesarea (SC) surgical procedure involves a series of activities from the preparation stage, implementation, to postoperative care. The time required for each activity was obtained through observation and interviews, which were then confirmed with hospital medical documents. The total duration of the activities recorded was 799 minutes, with the following details: premedication observation (60 minutes), surgical action (30 minutes), and recovery observation (120 minutes). Cost calculations were carried out using the Time Driven Activity Based Costing (TDABC) approach, where each activity is multiplied by the capacity cost rate of the resources used. The total costs calculated include direct costs, such as medical personnel (doctors, nurses), drugs and medical materials, as well as indirect costs, which include room utilities, building depreciation, equipment, and supporting personnel such as CSSD officers and cleaning services. Based on calculations using the TDABC method, the total cost per CS procedure is Rp 2.123.438,87. Meanwhile, the BPJS Class 3 claim rate for the same action was recorded at Rp 4.567.700,00, so there was a difference of Rp 2.444.261,13.

The large difference between the TDABC calculation results and BPJS claims can be explained by several factors. First, TDABC only calculates the costs of medical activities that actually occur, based on actual time and capacity, without including the administrative markup, risk reserves, and clinical risk management components contained in BPJS claims. Second, BPJS claims are prepared based on the INA-CBGs system, which combines a number of national average cost assumptions, including institutional overhead costs, risk margins, variations in patient severity, and financing of the health insurance system. In addition, TDABC does not include inpatient costs, whereas BPJS claims cover the entire episode of care from outpatient to inpatient care. In practice, BPJS provides package payments, while TDABC produces actual costs per activity based on workload and time, which tend to be lower if there are no medical complications.

These differences in results highlight the importance for hospitals to understand their actual cost structure in detail, rather than relying solely on external rates. Information obtained through TDABC can be used as a basis for developing accurate internal cost standards, identifying time consuming or resource intensive activities, and developing strategies for negotiating rates or cross-subsidizing services that are not fully covered by BPJS. In addition, these results also demonstrate the importance of transparency and updates in the INA-CBGs based claim mechanism to better reflect the current hospital cost burden, especially for small and type D hospitals.

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