Unit Cost Calculation of Elective Caesarean section without Complications Based on The Time-Driven Activity-Based Costing Model

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ABSTRACT

The unit cost calculation method of services in hospitals is fundamental because its inaccuracy of its can lead to differences in the final result of the total service tariff. A private hospital in Yogyakarta is a special type C Mother and Child Hospital. This hospital service hasn’t implemented unit cost, so the tariff system for patients is vaguely based on hereditary rates from the owner. The research design used was qualitative, with a case study method approach. The subject was elective Caesarean Sectio (CS) surgery patients without complications. The object was to all activities in a series of elective CS surgery without complications from the patient’s initial admission until the patient could go home. The research instrument used a data collection form and interview guidelines. Data analysis used the TDABC calculation method. Qualitative analysis of interview results was conducted by reduction, presentation, analysis, and concluding the data. The results of the analysis’s CS unit cost used the TDABC model of 4,421,217.04 IDR. The difference between INA-CBG’s claims and the CS’s unit cost used the TDABC model of 553,983 IDR (11%).

Keywords:
TDABC
Biaya Operasional Operasi Caesar
Analisis Biaya

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**INTRODUCTION**

One of the special hospitals that provide care services in one field or type of disease based on its specificity is the Maternal and Child Hospital (Menteri Kesehatan Republik Indonesia, 2020). The Maternal and Child Hospital services will emphasize maternal and child health with actions including normal delivery, delivery with assistive devices (vacuum), and delivery of CS. According to Prawirohardjono (2000), CS is an artificial delivery, by making an incision in the abdominal wall and mother’s uterus to remove the fetus and the fetal weight must be above 500 grams. The National Basic Health Research (Riskesdas) states that there are various types of spontaneous normal delivery, CS surgery, and assisted vaginal delivery with tools including vacuum and forceps. The research results found that most deliveries in Indonesia were spontaneously normal at 81.5%. This was followed by 17.6% cesarean delivery and the remaining 0.9% through normal delivery with the help of a device (Riskesdas, 2018).

A hospital in its implementation requires a fee to produce a service. Cost is something that must be sacrificed; could be in the form of money, time, or goods. The sacrifices incurred are like money to produce a service at the hospital or it is called Unit Cost. This unit cost will later become the basis for determining a tariff for health services. The determination of hospital rates is based on unit cost, market (ability and willingness), and preference strategy (MARS UMY, 2014).

The selection of a base method for calculating the unit cost of services at the Hospital is very important because inaccuracy in the selection of the calculation method will cause a difference in the result of the total service tariff. There are three methods frequently used, namely the traditional method, Activity Based Costing (ABC), and TDABC. Kaplan, R & Anderson, S (2007) stated that the traditional unit cost calculation model can no longer be used to provide precise measurements when new machines and technologies replace human resources. The basic principle of ABC is that activities require resources, not products or services (or cost objects). This method has many advantages but is also quite difficult to implement (Nabelsi, V. & Plouffe, 2019; Kaplan, R & Anderson, S, 2007).

The ABC method has many obstacles, namely the process of interview and survey so it wastes time and money. This method will also be difficult to validate because the source of the interview can be subjective. In addition, the ABC method will be difficult to implement in a dynamic environment and with many changes or developments. They created a new method derived from ABC, namely TDABC (Nabelsi, V. & Plouffe, 2019). TDABC has only one step, namely allocating resource costs directly to products or services based on time units. It requires actions to find out the cost per minute for each resource group and determine the number of minutes for each activity carried out by the resource group. Thus, it no longer requires identifying a different cost drive in each of its organizational activities. By this method, it is quite easy to calculate the cost of a new activity. Managers simply need to estimate the time required to do it and multiply it by the cost of the group of resources involved in the activity. According to Kaplan, R & Anderson, S (2007), time is a shared cost driver and is usually easy to measure.

A private hospital in Yogyakarta is a type C special hospital that serves maternal and child health. One of the interesting things to discuss is that there was no unit cost, so the pricing system for patients was vague as it is only based on a hierarchy tariff from the owner. For this case, the rates are as follows, VIP class 12,500,000 IDR, 1st class 11,000,000 IDR, 2nd class 9,500,000 IDR, 3rd class 8,500,000 IDR. While the claims from INA-CBGs are as follows, for patients treated in class 1, INA-CBGs is 6,965,200 IDR, class 2 is 5,970,200 IDR while class 3 is 4,975,200 IDR.

**METHOD**

**Type and Design of Research**

The study was researched with a qualitative design and used a case study approach. Subjects of this study were elective CS patients without complications.

**Population**

All patients with CS surgery activity in Maternal and Child Hospital, which used hospital instruments during CS surgery start from patients who come to the hospital until allowed to go home.

**Techniques of Data Collection**

Data collection was carried out by two techniques, namely primary and secondary. Primary data was obtained from observations and interviews. Secondary data was obtained from financial data containing rates per class of patients with CS surgery procedures, monthly expenses, and both direct and indirect hospital costs.

**Analysis Procedure**

The analysis procedure was conducted by using the TDABC method as a method to calculate the unit cost that matches to implement in the hospital, by applying seven steps:

1. Medical condition of the patient studied were patients with processed elective CS surgery from coming to the hospital until the patient went home.
2. Estimated the Care Delivery Value Chain (CDVC) of CS–s patient
3. Made a list of CS processes
4. Estimated time for each activity in the CS surgery based on a process listed
5. Estimated the total cost of resources used in the care of CS surgery services patient
6. Estimated the practical capacity for each resource, then calculate the Capacity Cost Rate (CCR) based on the total cost and practical capacity
7. Determined the total cost of CS surgical services, this total cost is the sum of the costs of CS surgery service activities and indirect costs (Haq et al., 2022). Data analysis was carried out through two data sources, namely primary and secondary. Primary data were obtained from interviews and observations. Secondary data was obtained from financial data containing rates per class of patients with CS surgery procedures, monthly expenses, and both direct and indirect hospital costs. Interviews were conducted with the head of the finance department, the head of the emergency room unit, the head unit of the Central Operating Room and inpatient room, nurses, and midwives as operating assistants.

This study was an observational case study using the TDABC method to estimate the cost of elective CS surgery on 30 women as a random sample of a total of 614 women who had birth delivery by elective CS between January and...
December 2021. The observation was conducted on patients who were planning for CS surgery, beginning from the initial admission until the patient could go home. The time of each activity of the patient was recorded as cost-driven in calculating unit costs using the TDABC method. The obtained data then were analyzed using the TDABC method.

**Ethical Clearance**

Before doing the research, this study through an ethical procedure by submitting the ethical application to the university ethics team. Then, the university will issue the ethical clearance which is used as a letter doing the research. Then, meet the hospital management to apply for a research permit. After getting research permission, conduct the research. The respondent was granted the right to state that agreed or disagreed is the data source.

**RESULTS AND DISCUSSION**

The TDABC system emphasizes the time consumption required by activities to produce a service. Calculating the cost of services for each type of delivery per class, this study conducted the following four steps:

a. **Activity identification to produce services of CS**
   
The first step in the TDABC system was to identify the main activities carried out during the labor process. These activities are those that use direct and indirect costs. It was impossible to identify all the activities that occurred in the labor process one by one in detail because the amount was too much. Therefore, this study summarizes the various activities in outline in the Value Chain & Process Map.

b. **The overhead costs related to CS surgery**
   
Overhead costs are additional costs or other costs, which were not directly related to business processes and production carried out. There were four categories of overhead costs, namely labor related, equipment-related, space-related, and service-related. Labor-related consists of employee costs such as salaries, overtime pay, transportation, and health funds. Equipment related consists of tool depreciation, tool maintenance, calibration, and tool repair. Space-related consists of depreciation, maintenance, and building repairs. Service-related costs consist of electricity, telephone, gas, water, and cleaning costs. Overhead costs were assigned to activities through indirect resources and direct resources, namely:

1) **Indirect resources**

Indirect costs are costs that come from several interrelated service units, but the use was indirect. The supporting units consist of units of directors, services and medical support, finance, medical records, personnel, information, public relations (PR), and marketing. Costs in support units would be allocated to production units. Basically, the calculation of indirect costs used the same principle as the calculation of direct costs, namely calculating investment costs, operating costs, and maintenance costs.

The cost of indirect resources was the assignment of indirect costs to activities on a proportion basis. Non-functional units include non-medical units such as the board of directors and administrative staff. Indirect costs in this study were as follows:
Table 4. About Activity Center of CS Surgery

<table>
<thead>
<tr>
<th>No</th>
<th>Process</th>
<th>Personnel</th>
<th>Allocated CCR</th>
<th>Location</th>
<th>Allocated CCR</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Emergency room activities</td>
<td>Laboratory, dr. general,</td>
<td>69,669</td>
<td>Emergency</td>
<td>3,155</td>
<td>72,823</td>
</tr>
<tr>
<td></td>
<td>Emergency room service fee</td>
<td>Paramedics, registration</td>
<td>16,278</td>
<td>departments</td>
<td>526</td>
<td>16,803</td>
</tr>
<tr>
<td>2</td>
<td>Operation Preparation</td>
<td>Paramedics, dr. Obgyn, dr.</td>
<td>141,074</td>
<td>Preoperative</td>
<td>25,608</td>
<td>166,682</td>
</tr>
<tr>
<td></td>
<td>Form filling</td>
<td>Obgyn, dr. anesthesia</td>
<td></td>
<td>room</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>IBS nurse, surgery preparation</td>
<td></td>
<td>883,412</td>
<td>Surgery room</td>
<td>211,452</td>
<td>1,094,865</td>
</tr>
<tr>
<td></td>
<td>surgery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Recovery</td>
<td>dr. Obgyn, dr. Child,</td>
<td>206,185</td>
<td>Recovery room</td>
<td>65,191</td>
<td>271,376</td>
</tr>
<tr>
<td></td>
<td></td>
<td>paramedic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>paramedic</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>paramedic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Table 5.**
**About Unit Cost Model Time-Driven Activity-Based Costing**

<table>
<thead>
<tr>
<th>No.</th>
<th>Cost</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Indirect Cost</td>
<td>1,406,774 IDR</td>
</tr>
<tr>
<td>2.</td>
<td>Direct Cost</td>
<td>3,014,443 IDR</td>
</tr>
<tr>
<td></td>
<td><strong>Total Cost of SC Service</strong></td>
<td><strong>4,421,217 IDR</strong></td>
</tr>
</tbody>
</table>

Based on the table, it can be read that the unit cost rate for the TDABC model based on calculations with CS surgery measures was IDR. 4,421,217.04.

**Table 6.**
**About the Total Cost of CS surgery**

<table>
<thead>
<tr>
<th>Cost</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Resource and Location costs</td>
<td>1,987,743 IDR</td>
<td>45%</td>
</tr>
<tr>
<td>Laboratory</td>
<td>101,000 IDR</td>
<td>2%</td>
</tr>
<tr>
<td>Cost of ABHP Medicine and Diet</td>
<td>925,700 IDR</td>
<td>21%</td>
</tr>
<tr>
<td>Indirect cost</td>
<td>1,406,774 IDR</td>
<td>32%</td>
</tr>
<tr>
<td>Total SC Cost</td>
<td>4,421,217 IDR</td>
<td>100%</td>
</tr>
<tr>
<td>BPJS</td>
<td>4,975,200 IDR</td>
<td>11% (Difference)</td>
</tr>
<tr>
<td>The average rate per patient in the hospital</td>
<td>7,900,000 IDR</td>
<td>59% (Margin)</td>
</tr>
</tbody>
</table>

Based on the average rate per patient in the hospital, the CS with a class III rate was 7,900,000 IDR. A margin of 59% of costs was calculated using the TDABC method. Meanwhile, the BPJS claim rate obtained by the hospital was 4,975,200.00 IDR, with a difference of 11%.

**DISCUSSION**

**Calculate Unit Cost of CS Surgery by TDABC Method**

The unit cost calculation based on the Clinical Pathway using the TDABC method was a cost analysis that uses the Clinical Pathway as the basis for service process activities. Asjanti et al. (2021) stated that the unit cost calculation based on the Clinical Pathway using the TDABC method utilizes the Clinical Pathway activity as an activity center. Hospitals must develop a Clinical Pathway that was outlined in operational procedures to get a clear patient management flow. Information on activities recorded in the Clinical Pathway was documented, measured, and used as basic data. Unit cost calculation based on the Clinical Pathway has an impact on cost reduction through activity management by eliminating non-value-added activities (Austin et al., 2017).

Based on the analysis results, it was known that the unit cost of CS surgery was 4,421,217.04 IDR. One of the main findings was that costs and overheads were arbitrarily divided as opposed to being distributed based on the relative consumption being measured. Alternative costing methods were assessed to demonstrate that patient-level episodic costing approaches such as Patient-Level Information and Costing Systems (PLICS) that incorporate aspects of ABC would be much more appropriate. According to Grant, P. (2015), PLICS has the added benefit of greater financial and clinical transparency, and this goes towards the holy grail of greater engagement with clinicians providing clinical care. The previous studies comprehensively considered almost all cost centers (both direct & indirect) associated with costs in CVD management including capital and machinery costs, while most studies focused only on direct costs. However, due to the limited availability of data sources and other resource constraints, ABC analysis could not be carried out (Kumar, A. et al., 2022).

Kurniawansyah. D. (2021), stated that TDABC is a new method that uses time as the main cost driver, and it allows management to charge resource costs directly to cost objects. TDABC should be a simpler, faster, and cheaper method because it does not need to carry out surveys and employee interviews which are expensive, time-consuming, and subjective. TDABC is able to provide a solution because of the estimated time required for each activity as a trigger called the time driver.

According to Tjajadi, B. (2010), empirical results showed that the integration of the TDABC method has an effect on increasing cost savings, data validity, speed of decision-making, quality management decisions, data depth, availability of information for operational managers, trust in information, and leverage of the two systems. A study showed that the calculation of inpatient rates for each type of room according to the calculation method with TDABC was higher than the calculations made by the hospital management (Pramitasari, D.A., 2021). While the calculation of TDABC Activities Cost of Performing can be known that the inpatient service only engages about 3%-6% of the total capacity.

The research showed that activity-based costing in hospitals to determine the hospitalization rates and tariff CS was also relevant to this study (Baikole & Paridah, 2017; Purwaningsih, D., 2015; Supriyatno, S. & Dairo, A., 2022). In their research findings, it was also found that there was a disparity between the cost of the n CS surgery determined by the hospital and the unit cost calculated through activity-based costing. The application of TDABC might help to eliminate problems experienced by companies that have implemented or will implement the ABC system, including service companies. The number of costs charged according to the TDABC system was based on the time used by the company to carry out activities in producing a product or service. Ely, M. et al. (2020) stated that the cost assignment with this method is much simpler, cheaper, and faster to implement than the ABC system. ABC is a cost information system oriented to providing complete information about activities to enable companies to manage activities. This information system uses activities as a basis as well as cost reduction and accurate determination of product/service costs as a goal (Javid, M. et al., 2015).

The derivative of ABC, namely TDABC has one step, namely allocating resource costs directly to products or services based on time units. It is required to find the cost per minute for each resource group and determine the number of minutes for each activity carried out by the resource group. Thus, it no longer requires the identification of a different cost driver in each of its organizational activities (Nableli, V. & Plouffe, 2019).

According to Allin, O. et al (2020), there are eight practical recommendations from the Society for Perioperative Assessment and Quality Improvement (SPAQI) which aim to outline the principles of TDABC, namely, create process maps for patient workflows, understand payment structures, establish alignment of doctors across service lines to create an integrated practice unit to facilitate the development of evidence-based pathways for specific patient risk groups, establish consistent care delivery, minimize variability between physicians and departments, utilize data analytics and information technology tools to track progress and obtain actionable data and use TDABC to create cost transparency.
Bayati, M. et al. (2015), stated that the advantages of this method not only provide more accurate information about product costs but also provide information for hospitals about activities that cause costs, especially indirect costs, which are important for hospitals in decisions making both products and in terms of costs in managing activities so as to improve the efficiency and effectiveness of hospital performance.

The Differences in the Unit Cost of CS Surgery between TDABC and BPJS Claims received.

The tariff values determined by the TDABC model have differences, namely:

Table 7. About Claim Value and Unit Cost Model TDABC

| Type of Examination | BPJS Claim 4,975,200.00 IDR | Unit cost model TDABC 4,421,217.04 IDR | Difference 553,983 IDR (11%) |

The difference calculation between hospital claims and calculations using the TDABC examination method was 553,983 IDR (11%). Based on the data above, it showed that the calculation of the unit cost of delivery with a CS gave a lower difference compared to the claims obtained. Several researchers studied the application of the TDABC method in outpatient services and other services in hospitals such as comprehensive cancer centers to reduce the processing time by 16% (Propat, K., 2018). Similarly, an international study showed a manager using TDABC to measure the capacity of unused resources in a private hospital (Öker, F. & Özyapici, H., 2013).

Based on table 5, it was known that the average rate per patient in the hospital, CS with class III rates was 7,900,000 IDR. A margin of 59% of costs was calculated using the TDABC method. Meanwhile, the BPJS claim rate obtained by the hospital was 4,975,200.00 IDR, with a difference of 11%. This study was supported by the study that showed the cost of an elective cesarean section was on a TDABC method of 4,576,182.72 IDR, which had a positive margin for BPJS claims of 8% and hospitals by 40% (Haq, F. A. et al., 2021).

Hospitals could reduce postoperative costs by 25% by reducing the use of drugs and antibiotics. Also stated that has a difference between the results of this study and the previous research, namely the previous research did not include the cost of the baby in the calculation, but it was known that the difference in positive values was smaller than the positive difference from this study of 4.2% (209,017.28 IDR). This might be due to different overhead costs and other lower costs such as nutrition costs, and human resource costs that did not use pediatricians to perform infant resuscitation and did not use physiotherapists in the CS surgery service series. In addition to this, it could also be influenced by differences in the area of the hospital under study, the location of the hospital, and the condition of the area where the hospital was established.

TDABC has several advantages and advantages compared to the ABC method, including the TDABC method being more cost-effective, timesaving, and has a less subjective opinion in data collection in recent years TDABC is increasingly being used in the health sector. TDABC is a revolutionary costing method because it produces a cost calculation that is simpler, more accurate, easy to develop, and saves more time than the ABC method.

According to Ahmad, E. et al. (2021) the calculating the unit cost per procedure in the dental clinic, it was seen that the TDABC system imposed indirect costs in calculating unit cost at the Pratama X Clinic. The tariff for dental examination and treatment services per action at the Pratama X Clinic was too small because the Pratama X Clinic did not classify direct and indirect costs accurately. Pratama X Clinic was not accurate in allocating the costs, number, and working hours of the Pratama X Clinic employees which is ineffective. The research showed the application of TDABC as costing and the application of lean management to reduce activities that were useless or not value-added, by adopting or implementing TDABC and lean management simultaneously would achieve the goals in terms of reducing resources and time to increase productivity in hospital services (Maulidiah, S. N. A., 2022).

Khem, C. & Kritchanchai, D. (2021), stated that the calculation using TDABC is a major concern because it is effective in reducing logistics costs, resulting in an increase in the quality and efficiency of transportation of medical care products they provide services to patients. Costing based on TDABC can dynamically model changes in our healthcare delivery as outcomes of process improvement interventions. It is an effective tool for continuously assessing the impact of these interventions on the value of care services (Yu, Y. R. et al., 2020). Previous studies found that TDABC offered a new and generalizable approach to cost accounting that accurately measures resource utilization. There were more than 20% cost reduction opportunities compared to traditional accounting. Bodar, Y. J. L. et al. (2020), stated that TDABC offered a roadmap for several changes that can lower costs and increase the value of care. Furthermore, in another study, the TDABC methodology had been shown to be a more accurate cost account for Total Joint Arthroplasties (TJA) than the traditional method (Fang, C. et al., 2021).

According to Anzai, Y. et al. (2017) potential opportunities for reducing costs include increasing the efficiency of service utilization, substituting lesser resources when appropriate, and streamlining ordering systems to clarify medical needs and clinical indications. In the previous study had shown that calculations using TDABC provide more detailed information that could be beneficial for nurses to improve their work environment and use their time efficiently. Although the TDABC system had some difficulties, we found that it was implemented successfully in outpatient nursing units and makes a difference in human resource cost management (Al Amiri, N. & El Khmidi, S., 2019).

The unit cost of sterilization in the CSDS unit of a private hospital in Yogyakarta with the ABC method was 2,049,388.00 IDR, with a total unit cost of one sterilization procedure, averaged in CSSD units (Syifa, A. et al., 2021). The unit cost of ORIF Femoral Fracture at the Central Surgical Installation of a private hospital in Yogyakarta with the ABC method was lower and more in line with the activity (Firdaus, R. N. & Pribadi, F., 2015).
Some of the disadvantages of calculating costs using TDABC are that they do not separate costs into fixed and variable costs. They were allocating activity costs including fixed costs by considering the time required by each patient can lead to inaccurate results. This is due to the fact that the time required per patient should always be independent of the fixed costs within the relevant range. For health care settings implementing TDABC, findings suggest that fixed costs should be excluded from the cost of unused capacity (Özyapıcı, H. & Tanış, V. N., 2017).

CONCLUSIONS AND SUGGESTIONS

The unit cost of the CS used a calculation based on the TDABC model of 4,421,217.04 IDR. Based on the average rate per patient in the hospital, the Caesarean section with a class III rate was 7,900,000 IDR. Margin 59% of costs was calculated using the TDABC method. Meanwhile, the BPJS claim rate obtained by the hospital was 4,975,200.00 IDR, with a difference of 11%. Compiled more specific and detailed data per functional unit. Changes in unit costs certainly had an impact on tariff changes, so detailed data per functional unit. Changes in unit costs with a difference of 11%. Compiled more specific and detailed data per functional unit. Changes in unit costs certainly had an impact on tariff changes, so in setting rates, hospital management should take into account competitiveness with competing hospitals. Allocate resources appropriately analysis of tariff calculations with the TDABC method.

REFERENCES


MARS UMY. Perhitungan unit cost rumah sakit di era JKN. (2014).


