Analysis of Cost Calculation System at X Hospital based on Traditional Costing and Time Driven Activity based Costing: Study at Unit Cost Hemodialysis Services

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Abstract: The purpose of this research was to show an analysis of unit cost calculation based on traditional costing and time driven activity based costing methods and also to analyze costs and benefits of time driven activity based costing method's implementation at X Hospital. This Hospital was chosen as a sample because it does not have a good cost system yet so far. X Hospital uses tariff which is determined by the regional government. This study was conducted using qualitative and study case approach. It focused on the unit cost of hemodialysis services at X Hospital. The result of the study showed that unit cost calculation using time driven activity based costing is higher than by using traditional costing. Both methods used a different driver, in which traditional costing method used the number of patients driver and time driven activity based costing method used time as driver. Time driven activity based costing system reflected more the activities that are consumed by hemodialysis services, and more importantly, human resources of X Hospital are ready to implement this method.

1 INTRODUCTION

A hospital's revenue from a certain service is a total of the unit cost of services and the expected surplus. Unit cost of a hospital consists of direct cost and indirect cost. A direct cost will be charged to each service, meanwhile, the indirect cost will be allocated later. There are some methods that can be used to allocate the indirect cost such as traditional method and activity-based costing method.

Traditional method and activity-based costing method are differed in their allocation aspect of indirect costs, in which activity-based costing uses activities as the base of its allocation. According to Popesko and Nová (2014) an organization that runs their operational activities with high complexity and high proportion of indirect costs such as hospital will be suitable to use activity-based costing method. This method will give a more detail costs information regarding the hospital's activities. Having known of this, yet health organizations such as a hospital rarely uses activity-based costing method; hospitals in Indonesia are not exception. Therefore, this study was motivated in analyzing the implementation of activity-based costing method in a hospital or a health unit in Indonesia. The chosen sample for this study is X hospital which is located in West Nusa Tenggara.

The activity-based costing method is also not yet implemented at X hospital. This hospital had experienced a deficit on their operational activities in the last couple of years, even though the recorded increase in their income is quite high. The number of patients at X hospital in 2017 is 160.757 patients. The highest number of patients that are received by the hospital is outpatients with the number of 125.403 patients, while services with the lowest number of visits received is intensive care unit with the number of 1.281 patients. X hospital offers various types of services in which every service uses different resources, therefore, it is advised that X hospital uses activity-based costing method that emphasizes the allocation of indirect costs on activities.

Additionally, X hospital does not have a clear system of costs accountancy because they are using a tariff format that is decided by the regional

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government. There are a lot of changes that have been experienced by X Hospital from 2015 to 2017, but unit cost and tariff calculation were last done in 2015. Based on the information gathered through interview, it showed that X hospital did not categorized the costs based on the general principles stated on the cost accounting, such as direct material, direct labor, and overhead. The fact that they are still using the traditional method in deciding the unit cost and in counting the proposed tariff to regional government has led the researcher to doubt the accuracy of the computation system that they use. Therefore, the time driven activity-based costing method is proposed as the method for computation.

Time driven activity-based costing method is simpler and easier to be applied compared to activity-based costing method. This method is considered easier and reasonably cheaper. Time driven activity-based costing method uses time driver to allocate resources to products. In addition, this study will also analyze the proposal to implement time driven activity-based costing method to calculate unit cost of hemodialysis services that is a part of one day care service of X hospital. There is no recorded health service unit in Indonesia that implements unit cost calculation using time driven activity-based costing method. Research that discusses the proposal to apply this method is also scarce and limited. The formulated questions for this study are as follow:

1. What is the existing system in determining tariff of services at X hospital and how is calculation of the total costs of hemodialysis services at X hospital based on traditional costing?
2. How is calculation of the total costs of hemodialysis services at X hospital based on time driven activity-based costing?
3. How is the calculation comparison of the total costs of hemodialysis services at X hospital based on traditional costing and time driven activity based costing?
4. How is the readiness of human resources as well as advantages and costs if time driven activity-based costing is implemented as method to calculate the unit cost of services at X hospital?

2 THEORICAL FRAMEWORK

Traditional Cost Accounting

There are five unit-level drivers which are generally used in traditional costing method i.e. unit produced, direct labor hours, direct labor dollar, machine hours, and direct material dollar. In this system, there are two methods in deciding cost driver for overhead cost, i.e. plantwide rates, which is deciding overhead cost rate using one driver. Another one is departmental rates, which is deciding overhead cost rate based on each production department. However, both methods do not function well and in truth they can cause a serious distortion in product costs, especially, for a company with significant overhead costs and for a company with high variety of products which consumes varied resources (Hansen and Mowen, 2015).

Activity based Costing System

Activity based costing is a system of costs determination by allocating indirect costs toward a cost object based on activity driver, not the volume driver. This is because it is believed that the cause for the rise in costs is the activity, not the quantity of the product. Baker (1998) stated that an activity can have some cost drivers which relate to that activity. In a world of health services, an activity almost always possesses many cost drivers. The right implementation of cost driver will have a positive influence toward the success of an organization. However, activity-based costing method is considered quite difficult because it requires detailed interview and survey. It also needs substantial costs in its implementation (Kaplan and Anderson, 2007).

Time Driven Activity based Costing

Time driven activity-based costing method assumed that time is the prime mover of costs since most of resources such as personnels and equipments have the capacities that can be easily measured with the number of available times to do the job (Kaplan and Anderson, 2007). Time driven activity-based costing method is the most agreeable with companies dealing in service industry. This is because service industry focuses more on providing services which will be more accurately calculated with the time spent to do the service activity (Szychta, 2010).

Time driven activity-based costing method in its calculation needs predictions from two components i.e. unit costs for the available capacity and the time that is needed to do the transaction or activity (Kaplan dan Anderson, 2007).

Formula for calculating costs based on time driven activity based costing method:

$$\text{capacity cost rate} = \frac{\text{cost of capacity supplied}}{\text{practical capacity of resources sepplied}}$$

3 RESEARCH METHOD

This study used qualitative and case study approaches. The data collection techniques used in this study were interview and field study. Primary data that was used in this study was the finance reports period 2016 and 2017, installation data recapitulation of patients' medical records period 2017, and data from the field study and interview which were conducted since May 2018 until October 2018.

This study was a single case study that was conducted on a single unit analysis; a hemodialysis unit at X hospital. The period that was used to calculate the unit cost at X hospital was one year; a year of 2017.

Based on the results of the interview and the primary data that had been gathered, researcher did an analysis about the system of tariff determination which was currently used by the hospital. After that, the researcher designed a traditional costing system to calculate the unit cost of hemodialysis services and compared them with the existing costs calculating system. Next is designing time driven activity-based costing system to the same unit cost service and compared the calculation results of traditional costing method dan time driven activity based costing method. The researcher did the calculation of unit cost using time driven activity based costing method by referring to Kaplan and Anderson (2007).

4 ANALYSIS

4.1 The Current Tariff Determination System at X Hospital in Relation to Their Unit Cost Calculation of Hemodialysis Service using Traditional Method

X hospital has established a specific tariff team to formulate the unit cost calculation and the selling price or the real tariff which are applied to general patients. The real tariff has included the 20% surplus and the real unit cost. There are some changes in the X hospital from 2015 to 2017 which supposedly influence the changes in the unit cost formulation and the tariff of services. Some of them are the rise in the number of patients' visit, followed by the trend of the rise in number of the average patients' visits which is 3.5% per year, the development of heart services and integrated blood vessels/cathlab center which was inaugurated on November 9th 2016, the enhancement of the supporting service facilities, the number of new services at the Radiology unit, the inauguration of independent policlinic facility, education-training unit (skill lab), research unit (Litbangkes Institution), and accommodation (guest house).

Table 1: Hemodialysis Services Tariff at X Hospital 2017

No.	Types of Services	Class and VIP (IDR)		
		Service Facilities	Service	Tariff
1	HD single-use Service	960,000	408,000	1,368,000
2	HD Reuse Service	840,000	240,000	1,080,000

Source: X Hospital (2017)

Referring to the result of the interview, service facilities consist of direct material for one treatment or one service, overhead cost, and mark-up. Meanwhile, service consists of direct labor cost and indirect labor cost.

Unit cost of hemodialysis services based on the calculation of X Hospital is as follow:

Unit cost = Real tariff – *mark up* 20%

Based on the above formula, then unit cost for each hemodialysis service which was taken as sample in this study was:

a. Unit cost of HD single-use service = IDR 1,140,000
b. Unit cost of HD re-use service = IDR 900,000

The following is the calculation of hemodialysis services unit costs based on traditional costing method which was designed by the researcher. The calculation would be done based on one-year data to eliminate the possibility of numbers' fluctuation each month. This calculation was based on the analysis result of finance reports year of 2017, interview, and observation that has been conducted.

Unit cost = direct labor + direct material + overhead

Below is the explanation of each costs which was used to calculate hemodialysis services unit cost period of 2017:

1. Direct labor

The total direct labor cost of hemodialysis unit in one year which is the year of 2017 was IDR

661,412,000. If this figure were to be divided by the number of hemodialysis services in one year which is 12.123, then the direct labor costs for one-time hemodialysis service, either for single use or re-use is IDR 54,558.

2. Direct Material

Direct material consists of consumables material, other equipment, medicines, safety equipment, machinery equipment and HD set. The difference between the single use and re use hemodialysis services is only in the HD set that is used, meanwhile, other components from the two types of services consume the same resources.

a. The total number of consumables goods, medicines, and hemodialysis unit equipment for the year of 2017 is IDR 2,092,938,966. If this number were to be divided with the number of hemodialysis services in a year which is 12.123, then the cost of consumables goods for one-time hemodialysis service is IDR 172, 642 for both single use or re-use hemodialysis services.
b. HD Set package for each types of hemodialysis services:
   1) Single Use package is IDR 517,550. -
   2) Reuse package is IDR 373,830.-

3. Overhead Cost

Overhead costs and indirect costs are the costs that do not directly influence the service activities and are consumed by variety of production activities. The total overhead cost of X Hospital in the year of 2017 is IDR 92,847,527,177.

Table 2 : Unit Cost of Hemodialysis using Traditional Costing

No	Types of costs	Single Use	Re-Use
1.	Direct Labor	54.558	54.558
2.	Direct Material	690.192	546.472
3.	Overhead	577.564	577.564
4.	Total	1.322.314	1.178.594

Table 2 above showed the total unit cost for each hemodialysis services using traditional costing calculation method by applying components of the hospital's costs for the year of 2017. The difference in both services is only found in the direct material components, specifically for the HD set that is used.

Table 3 : Comparison of Hemodialysis services Unit Cost (Traditional Costing) with the Hospitals' Tariff

Calculation Method	Single Use (IDR)	Re-use (IDR)
Hospital Unit cost calculation	1.140.000	900.000
Unit cost traditional costing	1.322.314	1.178.594
Gap	(182.314)	(278.594)
Tarif RS	1.368.000	1.080.000
Traditional costing tariff (unit cost traditional costing + mark up)	1.586.776	1.414.313
Gap	(218.000)	(334.313)

Source: X Hospital (2017), has been reprocessed

4.2 Design of Hemodialysis Services Unit Cost using Time Driven Activity based Costing Method

Time driven activity based costing method would be used as the method for the allocation of indirect costs or overhead costs. The first phase is the activities' grouping in hemodialysis unit's service, and then counting the capacity cost rate.

Table 4 : Grouping Activities of Hemodialysis Services

No	Outlines of Activities	Time
1	Administration	30 minutes
2	Pre Dialysis	55 minutes
3	HD Process	302 minutes
4	Post HD	30 minutes
	Total	417 minutes

Source: Respondent Interview (2018), has been reprocessed

Capacity cost rate or cost per unit of time can be counted by dividing the costs of the available capacities with practical capacities. The available capacity cost is a total cost of overhead, meanwhile the practical capacity in this study refers to indirect labor hours in a year.

The practical capacity of one indirect staff in a year is 108.060 minutes. The number of the indirect staffs is 532 people, then the total practical capacity is 54.487.920 minutes.

$$\text{cost per unit time} = \frac{\text{Rp } 92.847.527.177}{54.487.920 \text{ minutes}}$$

$$\text{cost per unit time} = \text{Rp } 1.704/\text{minute}$$

Based on the group of activities, the hemodialysis service is divided into 4; they are administrative group, pre-dialysis, HD process, and post HD.

Table 6 : Unit Cost of Hemodialysis Services Based on Time Driven Activity Based Costing

No	Cost	Single Use	Re Use
1.	Direct labor	54.558	54.558
2.	Direct material	690.192	546.472
3.	Administration	327.504,92	327.504,92
4.	Pre HD	54.481,58	54.481,58
5.	HD Process	298.905,58	298.905,58
6.	Post HD	29.675,92	29.675,92
	Total Unit Cost	1.455.318	1.311.598
	Tariff (mark-up 20%)	1.746.381	1.573.917

Table 7 : Comparison of Hemodialysis Services Unit Cost (Time Driven Activity Based Costing) with the Hospital's Tariff

Calculation Method	Single Use (IDR)	Re-use (IDR)
Hospital calculation of Unit cost	1.140.000	900.000
Unit cost time driven activity based costing	1.455.318	1.311.598
Gap	(315.318)	(411.598)
Hospital Tariff	1.368.000	1.080.000
Tariff of time driven activity based coting (unit cost traditional costing + mark up)	1.746.381	1.573.917
Gap	(378.381)	(493.917)

Source: X Hospital (2017), has been reprocessed

4.3 Comparison of Unit Cost and Tariff based on Traditional Costing dan Time Driven Activity based Costing

Table 8 : Comparison of Unit Cost and Tariff Based on Traditional Costing dan Time Driven Activity Based Costing

Method	Single use	Re-use
Traditional Costing	1.322.314	1.178.594
Time Driven Activity Based Costing	1.455.318	1.311.598
Gap	(133.004)	(133.004)
Traditional Costing	1.586.774	1.414.313
Time Driven Activity Based Costing	1.746.381	1.573.917
Gap	(159.603)	(159.604)

4.4 The Readiness of Human Resources, Advantages, and Costs of Implementing Time Driven Activity based Costing as a Calculation Method of Service Unit Cost in a Hospital

X hospital has possessed SPO for treatment at every service that is provided in every unit, accompanied with normal time or standard realization time of every activity at that service. This indicates that X hospital is ready to use time driven activity based costing method when we looked at its human resources aspect since they have gotten used to the existing SPO. The SPO that they have had included the understanding of action (treatment), objectives, policies and procedures that are detailed in steps, and the relevant units i.e. unit or installation as well as labors who work in the activity.

The benefit of time driven activity based costing method to X hospital is it gives information about the costs of hemodialysis services more accurately and gives information about the activities of every service product. Meanwhile, in term of cost, if this method is implemented, the tariff cannot be changed directly. There are some things that need to be considered such as getting approval from relevant stakeholders, considering the purchasing capability of the community around the area, and the dependency toward the external stakeholders in relation to the regional government regulations.

Even though it is quite complicated, at the end, the calculation of unit cost for every service has to be done in order to increase the finance management of X hospital. Holding status as BLUD, X hospital is expected to manage its own finance.

5 RESULTS

There was a difference calculation result of unit cost between X hospital calculation and the traditional costing calculation that was conducted in this study. This difference might happen because X hospital did not have cost system and did not do any cost analysis. Also importantly, the unit cost calculation formula that the hospital has been using was obsolete and was not suitable anymore with the current condition of the hospital.

In terms of comparison of unit cost and hemodialysis services tariff using time driven activity based costing method with unit cost, it showed that there was undercosting case based on the result of hospital's calculation i.e. at the single use and re use hemodialysis service. This needs to

be X hospital's concerns since the interview has shown that the number of patients subjected to the re-use hemodialysis was higher than single use hemodialysis patients in 2017.

There was a significant difference in the result of calculation using traditional costing and time driven activity based costing for both types of hemodialysis services. The result of unit cost calculation using both methods had a significant difference in which the result of the unit cost calculation using traditional costing was IDR 133.004 lower than the result of unit cost calculation using time driven activity based costing method. The difference laid on the overhead cost calculation only, meanwhile the charges calculation for direct material and direct labor used the same calculation. This difference was caused by the use of different allocation methods for both methods i.e. traditional costing used number of patient driver and time driven activity based costing method allocated the overhead cost based on the time for every group of activities in hemodialysis services which consumed the overhead cost component.

6 CONCLUSIONS

From the tariff calculation by adding mark-up 20%, traditional costing and time driven activity based costing methods had resulted in a higher tariff compared to the current hospital's tariff for both types of hemodialysis services i.e. single use and re-use. X hospital is highly advised to apply a better unit cost calculation. The unit cost calculation will be useful in making an informed decision regarding the tariff that will be charged to the consumers. The unit cost calculation is proven to be executed better using time driven activity based costing method. It is believed that by using the method, the resources' allocation will be more accurate. Moreover, the implementation of time driven activity based costing is considered easier than activity based costing method, which will also cost significant time and money.

From the human resources point of view that are available at X hospital, they can be considered ready to implement the time driven activity based costing method. This is supported by the existing SPO system, in which every unit has informed counts of the standard time to perform the given services. Therefore, when the time driven activity based costing method is introduced to them, it will not change their regular activity drastically. The implementation of time driven activity based costing as a method for calculating the unit cost of services also gives benefit to X hospital i.e. giving information about hemodialysis services cost more accurately and giving information about activities of every service products. However, we need to keep in mind that the changes in the tariff of services, when time driven activity based costing method has been implemented, cannot be done abruptly without considering relevant factors and stakeholders.

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