Effectiveness and Efficiency of Using LINAC Precise and Cobalt-60 Medical Devices at Dr. Mohammad Hoesin Hospital Palembang

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ABSTRACT

Hospitals are social institutions that provide quality health services to every customer. To meet expected service standards, hospitals should have effective procurement of medical equipment. This study aims to evaluate the effectiveness and efficiency of utilities in the use of medical devices in supporting services at RSUP Dr. Mohammad Hoesin Palembang, with descriptive analytical research using quantitative methods with a cross sectional research design. The research results show that there is a significant difference between the Break Event Point (BEP) value before and after purchasing the Cobalt 60 aircraft from the target of 90 patients per day to 87 patients per day, and there is a significant difference between the BEP value before and after purchasing the Precise LINAC aircraft from the target of 70 patients per day to 55 patients per day. Based on the calculation of the effectiveness and efficiency of the utility of using the Cobalt 60 and Linac Precise aircraft, it can be concluded that the utility of using the Cobalt 60 aircraft at RSUP Dr. Mohammad Hoesin Hospital Palembang is considered ineffective (50%) but efficient (70.88%) with a BEP value of 5.5 years; while the utility of using the Linac Precise aircraft at RSUP Dr. Mohammad Hoesin Hospital Palembang is considered effective (113%) and efficient (51.77%) with a BEP value of 4.1 years. The data above shows that hospitals experienced slight losses due to the Covid-19 pandemic because the number of patients using medical equipment did not reach the target, but hospitals were able to manage expenditure well so that there was a decrease in the efficiency ratio every year in the procurement of medical equipment.

1. Introduction

Dr. Mohammad Hoesin Palembang General Hospital as a referral center for the community, especially the Provinces of South Sumatra, Lampung, Jambi, Bengkulu, and Bangka Belitung which prioritizes services to improve the quality of patient safety by having supporting facilities and infrastructure, superior Human Resources (HR), and specialist doctors who are competent in their fields.1

In improving its services, the Hospital continues to improve the quality and provide services as much as possible. To support the services at Dr. Mohammad Hoesin Hospital Palembang, the availability of facilities and infrastructure of Medical Devices is required.

One of the focuses of the researcher is to see the effectiveness and efficiency of the utilization of state-owned assets, especially in the integrated oncology superior service at Dr. Mohammad Hoesin Hospital Palembang. To see the utilization of state property and see the Break Even Point (BEP) which is the point of income obtained by the agency equal to the capital that has been spent, the researcher is interested in seeing the Implementation of Effectiveness and Efficiency of Utilities for the Use of LINAC precise and Cobalt 60 Medical Devices at Dr. Mohammad Hoesin...
Palembang Hospital.

Effectiveness is a measure that states how far the target (quantity, quality and time) has been achieved, where the greater the percentage of targets achieved, the higher the effectiveness. Effectiveness is the result of achieving goals or targets. Measuring effectiveness using the effectiveness ratio formula, here is the effectiveness ratio formula:

\[
\text{Effectivity Ratio} = \frac{\text{Outcome}}{\text{Output}} \times 100\%
\]

Effectivity Ratio
Effectiveness was categorized based on:
- a. If the value obtained is less than 100% then it is not effective
- b. If the value obtained is equal to 100% then the effectiveness is balanced
- c. If the value obtained is more than 100% then it is effective

Efficiency is the ability to carry out tasks properly and precisely (by not wasting time, energy and costs). Efficiency is a measure of the level of resource use in a process. The more or less efficient the use of resources, the more efficient the process is said to be. In other words, efficiency is the achievement of the highest output from the lowest input. Efficiency measurement uses the efficiency formula, The following is the efficiency ratio formula:

\[
\text{Efficiency Ratio} = \frac{\text{Output}}{\text{Input}} \times 100\%
\]

Efficiency Ratio
Efficiency is categorized based on:
- a. If a value of less than 100% is obtained, it is efficient
- b. If the value obtained is equal to 100%, it means balanced efficiency
- c. If the value obtained is more than 100%, it means inefficient

Break Even Point (BEP) analysis is a method used by company managers to find out or to plan at what volume of production or sales volume the company concerned does not suffer a loss and has not made a profit. This BEP analysis is used to be able to facilitate company management in obtaining information about the amount of minimum sales and production volume that must be achieved at the expected profit. The BEP calculating formula is divided into 3 (three) options, namely:

1. Calculation of BEP to see how many units are sold and or the achievement of.

\[
\text{BEP} = \frac{\text{fixed cost}}{\text{price per unit} - \text{variable cost per unit}}
\]

2. BEP calculation to see how much profit by selling units/year.

\[
\text{BEP} = \frac{\text{fixed cost}}{\text{contribution} - \text{unit price}}
\]

3. BEP calculation to see how many units must be sold to be profitable
BEP Analysis is an analytical technique that explains the relationship between total costs, expected profit and sales volume.\(^9\)

2. Methods

This study is an analytic descriptive study, using quantitative research methods with a cross-sectional research design. This study was conducted at the Radiotherapy Installation of Dr. Mohammad Hoesin Hospital Palembang in November 2022.

The population in this study were medical records of patients who performed Cobalt 60 from September 2018 to November 2022 (±5 years) and medical records of patients who performed Linac from January 2021 to November 2022. To determine the sample to be used, the researcher used the total sampling method. The total sample of our study are 91,498.

3. Results

Table 1. Frequency Distribution of Number of Actions, and Total revenue of Cobalt 60 Period 2018-2022.

<table>
<thead>
<tr>
<th>Year of action</th>
<th>Number of actions</th>
<th>Total income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>%</td>
</tr>
<tr>
<td>2018</td>
<td>6372</td>
<td>10.2</td>
</tr>
<tr>
<td>2019</td>
<td>18111</td>
<td>29.1</td>
</tr>
<tr>
<td>2020</td>
<td>15341</td>
<td>24.6</td>
</tr>
<tr>
<td>2021</td>
<td>9434</td>
<td>15.1</td>
</tr>
<tr>
<td>2022</td>
<td>13029</td>
<td>20.9</td>
</tr>
<tr>
<td>Total</td>
<td>62287</td>
<td>100</td>
</tr>
</tbody>
</table>

Data source: Hospital management information system installation RSMH Palembang.

The total number of actions using the Cobalt 60 aircraft in the last 5 years was 62,287 actions, with the highest number of actions in 2019 at 18,111 actions (29.1%) and the lowest action in 2018 at 6,372 actions (10.2%). Based on the data above (table 1.), there was a decrease in the number of actions in 2020 and 2021 where a drastic decrease occurred in 2021 of 9,434 actions (15.1%). Moreover, the total revenue cost for Cobalt 60 treatment at Dr Mohammad Hoesin Hospital Palembang for the last 5 years is IDR 68,654,000,000.

Table 2. Frequency distribution of cobalt 60 action payment type period 2018-2022.

<table>
<thead>
<tr>
<th>Payment type</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPJS</td>
<td>60.915</td>
<td>97.8%</td>
</tr>
<tr>
<td>JKN/KIS</td>
<td>459</td>
<td>0.7%</td>
</tr>
<tr>
<td>Other Insurance</td>
<td>220</td>
<td>0.4%</td>
</tr>
<tr>
<td>General/Independent</td>
<td>693</td>
<td>1.1%</td>
</tr>
<tr>
<td>Total</td>
<td>62.287</td>
<td>100</td>
</tr>
</tbody>
</table>

Data source: Hospital management information system installation RSMH Palembang.
The total revenue costs for Cobalt 60 actions of Rp 68,654,000,000, was accepted from 4 sources with the majority of patients make payments using BPJS Health, namely 60,915 actions; 97.8% (Table 2).

Table 3. Frequency of patients taking Cobalt 60 by mode of care for the period 2018-2022.

<table>
<thead>
<tr>
<th>Payment type</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient</td>
<td>26112</td>
<td>41.9%</td>
</tr>
<tr>
<td>Outpatient</td>
<td>35827</td>
<td>57.5%</td>
</tr>
<tr>
<td>Executive Shrine</td>
<td>348</td>
<td>0.6%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>62,287</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Data source: Hospital management information system installation RSMH Palembang.

As can be seen from table 3, of the 62,287 Cobalt 60 actions’ frequencies at Dr. Mohammad Hoesin Hospital Palembang during the last 5 years were originated from outpatient clinics as many as 35,827 actions (57.5%).

Table 4. Frequency distribution of number of actions, and total revenue of LINAC for the 2021-2022 period.

<table>
<thead>
<tr>
<th>Year of action</th>
<th>Number of actions</th>
<th>Total income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Rp</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>13424</td>
<td>22.395,500,000,000</td>
</tr>
<tr>
<td></td>
<td>46.0%</td>
<td>46.46</td>
</tr>
<tr>
<td>2022</td>
<td>15787</td>
<td>25.807,650,000,000</td>
</tr>
<tr>
<td></td>
<td>54.0%</td>
<td>53.54</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29211</strong></td>
<td><strong>48.203,150,000,000</strong></td>
</tr>
<tr>
<td></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Data source: Hospital management information system installation RSMH Palembang.

The total actions using LINAC aircraft in the last 2 years were 29,211 actions, with an increase in the number of actions in 2022 of 15,787 actions (29.1%). Based on the data above, the utility of Linac procedures at Dr Mohammad Hoesin Palembang Hospital have increased from the previous year after the COVID-19 pandemic era (table 4). The total revenue cost for LINAC treatments at Dr Mohammad Hoesin Hospital Palembang for the last 2 years was IDR 48,203,150,000.

Table 5. Frequency distribution of action payment types LINAC Period of 2021-2022.

<table>
<thead>
<tr>
<th>Payment type</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPJS</td>
<td>28207</td>
<td>96.6</td>
</tr>
<tr>
<td>JKN/KIS</td>
<td>89</td>
<td>0.3</td>
</tr>
<tr>
<td>Other Insurance</td>
<td>440</td>
<td>1.5</td>
</tr>
<tr>
<td>General/Independent</td>
<td>475</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29211</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Data source: Hospital management information system installation RSMH Palembang.

The total revenue costs for LINAC actions of IDR 48,203,150,000 are coming from BPJS Health, namely 28,207 actions (96.6%). While other parties such as JKN, other insurance companies and people with independent payment supported the rest of cost (Table 5).
Table 6. Frequency of patients who underwent LINAC by mode of care period 2021-2022.

<table>
<thead>
<tr>
<th>Payment type</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient</td>
<td>7858</td>
<td>26.9%</td>
</tr>
<tr>
<td>Outpatient</td>
<td>20758</td>
<td>71.1%</td>
</tr>
<tr>
<td>Executive Shrine</td>
<td>595</td>
<td>2.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29211</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Data source: Hospital management information system installation RSMH Palembang.

The data of table 6 showed that out of 29,211 LINAC procedures at Dr. Mohammad Hoesin Hospital Palembang during the last 2 years, the majority are coming from outpatient clinics as many as 20,758 procedures (71.1%).

Table 7. Analysis of BEP calculation of cobalt 60 and Linac Precise using estimated number of patients.

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Volume/ Month</th>
<th>Per Action (Rp)</th>
<th>Per Month (Rp)</th>
<th>Per year (Rp)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cobalt 60</td>
<td>Linac</td>
<td>Cobalt 60</td>
</tr>
<tr>
<td>1.</td>
<td>Revenue cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Service Income</td>
<td>1980</td>
<td>1.540</td>
<td>1.156.000</td>
<td>2.288.880.00</td>
</tr>
<tr>
<td></td>
<td>Total Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Operating costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BMHP (Thermoplast mask, marker, paper, plaster, tissue)</td>
<td>792</td>
<td>560</td>
<td>55.000</td>
<td>35.000</td>
</tr>
<tr>
<td></td>
<td>Remuneration</td>
<td>1980</td>
<td>1.540</td>
<td>462.400</td>
<td>462.560</td>
</tr>
<tr>
<td></td>
<td>Electricity</td>
<td>1980</td>
<td>1.540</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Water</td>
<td>110</td>
<td>100</td>
<td>750</td>
<td>110.000</td>
</tr>
<tr>
<td></td>
<td>Others 5%</td>
<td>22</td>
<td>22</td>
<td>57.800</td>
<td>57.820</td>
</tr>
<tr>
<td></td>
<td>Total Operating Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Depreciation expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cobalt 60 Aircraft Price</td>
<td>16.500.00</td>
<td>0.000</td>
<td>25.800.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>replacement of spare parts in the 8th year</td>
<td>7.000.000.000</td>
<td>0.000</td>
<td>7.000.000.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Service contract</td>
<td>200.000.00</td>
<td>0.000</td>
<td>2.940.000.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>23.700.00</td>
<td>0.000</td>
<td>35.740.000.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Economic life of 10 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 years investment</td>
<td>31.850.81</td>
<td>8.190</td>
<td>48.031.571.385</td>
<td>259.911</td>
</tr>
<tr>
<td></td>
<td>Value with 3% inflation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Depreciation Cost</td>
<td>3.185.081.819</td>
<td></td>
<td>4.803.155.280</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Expenses</td>
<td>14.734.765.019</td>
<td></td>
<td>13.621.108.560</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Net income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Income - Total Expenses</td>
<td>444.748</td>
<td>339.359</td>
<td>1.060.982.915</td>
<td>645.763.620</td>
</tr>
<tr>
<td></td>
<td>Total Net Income</td>
<td>12.731.794.981</td>
<td></td>
<td>7.749.163.440</td>
<td></td>
</tr>
</tbody>
</table>

Data Source: RSMH Radiotherapy Installation.

Notes:
1. The estimated number of patients who have Cobalt 60 per day is 90.
2. Estimated number of patients performing LINAC precise per day is 70 patients
3. Number of working days = 22 days/month
4. Staff remuneration/salary is calculated per action.
Based on table 7 above, the estimated cost of revenue per year for buying a Cobalt 60 aircraft is IDR 27,466,560,000, - (Twenty-seven billion four hundred sixty-six million five hundred sixty thousand rupiah). While the estimated total expenditure of the Hospital calculated from the Operating Costs and Depreciation Costs of the Cobalt 60 aircraft in the 8th year is IDR 14,734,765,019 (Fourteen billion seven hundred thirty-four million seven hundred sixty-five thousand nineteen rupiah).

The total net income of the hospital for Cobalt 60 treatment according to the estimated calculation of Radiotherapy Installation of Dr Mohammad Hoesin Hospital Palembang is Rp 12,731,794,981 (Twelve billion seven hundred thirty-one million seven hundred ninety-four thousand nine hundred eighty-one rupiah) per year.

If the BEP calculation is made from a 10-year investment value with 3% inflation, the following calculation is obtained:

\[
\text{BEP} = \frac{\text{fixed cost}}{\text{price/unit} - \text{variable cost}} = \frac{\text{Rp 31,850,818.190}}{(\text{Rp 27,466,560.000} - \text{Rp 14,734,765.019})} = 2.5 \text{ years}
\]

Therefore, based on the above calculation, in 2.5 years, the hospital can return the capital purchase of the Cobalt 60 aircraft.

As can be seen from table 7, the estimated cost of revenue per year if buying a LINAC precise aircraft is IDR 21,370,272,000, - (Twenty-one billion three hundred seventy million two hundred seventy-two thousand rupiah). While the estimated total expenditure of the Hospital calculated from the Operating Costs and Depreciation Costs of the LINAC precise aircraft in the 8th year is IDR 13,621,108,560 (Thirteen billion six hundred twenty-one million one hundred eight thousand five hundred sixty rupiah).

The total net income of the Hospital for LINAC precise action according to the estimated calculation of Radiotherapy Installation of Dr Mohammad Hoesin Hospital Palembang is Rp 7,749,163,440 (Seven billion seven hundred forty-nine million one hundred sixty-three thousand four hundred forty rupiah) per year. If the BEP calculation is made from a 10-year investment value with 3% inflation, the following calculation is obtained:

\[
\text{BEP (LINAC)} = \frac{\text{fixed cost}}{\text{price/unit} - \text{variable cost}} = \frac{\text{Rp 48,031,571.385}}{(\text{Rp 21,370,272.000} - \text{Rp 13,621,108.560})} = 6.2 \text{ years}
\]

Based on the results of the BEP above calculation, hence, the hospital can return the capital purchase of the LINAC aircraft in 6.2 years.

\[
\text{BEP (COBALT)} = \frac{\text{fixed cost}}{\text{price/unit} - \text{variable cost}} = \frac{\text{Rp 31,850,818.190}}{(\text{Rp 13,730,800.000} - \text{Rp 9,732,848.219})} = 8 \text{ years}
\]

In addition, the BEP realization of the Cobalt 60 action for the 2018-2022 period (table 8), in year 8th, made the hospital has been able to return the capital purchase of the Cobalt 60 aircraft. To see the effectiveness of the utility of using Cobalt 60 equipment, the researchers performed the following calculations:

\[
\text{Effectivity Ratio} = \frac{\text{Outcome}}{\text{Output}} \times 100\% = \frac{13,730,800.000}{27,466,560.000} \times 100\% = 50\%
\]

Description:
- Outcome: Revenue Realization, Output: Revenue Target (Budget)
Table 8. Analysis of cobalt 60 break even point calculation using real data for the period 2018-2022.

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Volume/ Month</th>
<th>Per Action (Rp)</th>
<th>Per Month (Rp)</th>
<th>Per year (Rp)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cobalt 60 Linac</td>
<td>Cobalt 60 Linac</td>
<td>Cobalt 60 Linac</td>
<td>Cobalt 60 Linac</td>
</tr>
<tr>
<td>1.</td>
<td>Revenue cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Income in the last 2 years</td>
<td>62.287</td>
<td>29.211</td>
<td>90,000 - 7,500.00</td>
<td>1,100.00</td>
</tr>
<tr>
<td>b</td>
<td>Average income per year</td>
<td>12.457</td>
<td>14.606</td>
<td>90,000 - 7,500.00</td>
<td>1,100.00</td>
</tr>
<tr>
<td></td>
<td>Total Income per year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Operating costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>BMHP (Thermoplast mask, marker, paper, plaster, tissue)</td>
<td>1038</td>
<td>1217</td>
<td>60,000</td>
<td>60,000</td>
</tr>
<tr>
<td>b</td>
<td>Remuneration</td>
<td>1038</td>
<td>1217</td>
<td>462,400</td>
<td>462,400</td>
</tr>
<tr>
<td>c</td>
<td>Electricity</td>
<td>1038</td>
<td>1217</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>d</td>
<td>Water</td>
<td>1038</td>
<td>1217</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>e</td>
<td>Others 5%</td>
<td>584.400</td>
<td>584.400</td>
<td>545.647.20</td>
<td>639,514.80</td>
</tr>
<tr>
<td></td>
<td>Total Operating Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Depreciation expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Cobalt 60 Aircraft Price</td>
<td>16,500.00</td>
<td>00,000</td>
<td>25,800,000</td>
<td>.000</td>
</tr>
<tr>
<td>b.</td>
<td>replacement of spare parts in the year 8th</td>
<td>7,000.00</td>
<td>000</td>
<td>7,000,000.00</td>
<td>000</td>
</tr>
<tr>
<td>c.</td>
<td>Service contract</td>
<td>200,000.00</td>
<td>000</td>
<td>2,940,000.00</td>
<td>000</td>
</tr>
<tr>
<td>Jumlah</td>
<td>23,700.00</td>
<td>000</td>
<td>35,740,000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Economic life of 10 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 years Investment Value with 3% inflation</td>
<td>31,850.8</td>
<td>18.190</td>
<td>48,031.571.385</td>
<td>134,052</td>
<td>259,911</td>
</tr>
<tr>
<td></td>
<td>Total Depreciation Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Operating Cost + Total Depreciation Cost</td>
<td>718,452</td>
<td>844,311</td>
<td>811,070.68</td>
<td>1,039,777.740</td>
<td>9,732,848.21</td>
</tr>
<tr>
<td>Total Expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Net income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Net Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data Source: RSMH SIMRS Installation.
Based on the calculation of the effectiveness of the Cobalt 60 aircraft usage utility above, it can be concluded that the Cobalt 60 aircraft usage utility at Dr. Mohammad Hoesin Palembang Hospital is considered ineffective with an effectiveness value under 100% (50%). In this study, we also identify the efficiency of the Cobalt 60 aircraft usage utility. The calculation formula for the efficiency of the Cobalt 60 aircraft usage utility includes the following:

\[
\text{Efficiency Ratio} = \frac{\text{Output}}{\text{Input}} \times 100% = \frac{9,732,848.219}{13,730,800.000} \times 100% = 70.88%
\]

Description:
Output: Expenditure Realization, Input: Revenue Realization

Therefore, it can be concluded that the Cobalt 60 aircraft usage utility at Dr. Mohammad Hoesin Palembang General Hospital is considered efficient with an efficiency value of 70.88%.

\[
\text{BEP (LINAC)} = \frac{\text{fixed cost}}{\text{price/unit} - \text{variable cost}} = \frac{48,031,571.385}{(24,101,575.000 - 12,477,332.880)} = 4.1 \text{ years}
\]

Based on the results of the BEP calculation of the realization of the LINAC action for the 2021-2022 period above, it is known that in 4.1 years, the hospital can return the capital for purchasing the LINAC aircraft. To see the effectiveness of the utility of using the LINAC equipment, the researchers performed the following calculations:

\[
\text{Effectivity Ratio} = \frac{\text{Outcome}}{\text{Output}} \times 100% = \frac{24,101,575.000}{21,370,272.000} \times 100% = 113%
\]

Description:
Outcome: Revenue Realization, Output : Revenue Target (Budget)

Based on the calculation of the effectiveness of the utility of using the LINAC aircraft above, it can be concluded that the utility of using the LINAC aircraft at Dr. Mohammad Hoesin Palembang Hospital is considered effective with an effectiveness value was over 100% (113%). In this study, researchers also identify the efficiency of the utility of using the LINAC aircraft. The calculation formula for the efficiency of the LINAC aircraft usage utility includes:

\[
\text{Efficiency Ratio} = \frac{\text{Output}}{\text{Input}} \times 100% = \frac{12,477,332.880}{24,101,575.000} \times 100% = 51.77%
\]

Description:
Output: Expenditure Realization, Input: Revenue Realization

Based on the calculation of the efficiency of the LINAC aircraft usage utility above, it can be concluded that the LINAC aircraft usage utility at Dr. Mohammad Hoesin Hospital Palembang is also considered efficient with an efficiency value of under 100% (51.77%).

4. Discussion

The reason for the decline in the number of Cobalt 60 actions, it is known that in June 2020 the Covid-19 pandemic occurred and according to the rules issued by the Government, all people were required to stay at home (lock down) so that health services...
were limited, and people were lazy to go to the hospital because they did not want to do a PCR swab. Based on the results of Pangoempia’s research analysis in 2021, with the decrease in the number of patients during the pandemic, it had a positive impact on the Puskesmas in reducing the buildup of patient queues at the Ranotana Weru Puskesmas and Teling Atas Puskesmas. This study is not in line with the results of Pangoempia’s research analysis because with the decrease in the number of Cobalt 60 actions at Dr. Mohammad Hoesin Palembang Hospital, the Hospital suffered financial losses due to the decrease in the number of patients before and during the Covid-19 pandemic.

According to the results of data analysis on the number of LINAC precise actions, it is known that in the last 2 years LINAC precise actions have increased after the Covid-19 pandemic. Based on the data analysis above, it is known that in 2022 the number of LINAC precise actions has increased by 53.54% compared to 2021. Despite the pandemic conditions, the number of patient actions has increased slightly after the Covid-19 pandemic even though it still has not reached the BEP calculation target at the beginning of the purchase of the LINAC precise aircraft. The results of this study are in line with Tsaqif’s research in 2021 which states that there was a decrease in the number of patients by 1401 patients. The factor that affects patient visits is the level of patient confidence during the Covid-19 Pandemic, patients feel worried that if they visit the Puskesmas, they will contract Covid-19.

Based on the results of the analysis of the BEP calculation before the purchase of the Cobalt 60 aircraft with the calculation of the BEP after 5 years of using the Cobalt 60 aircraft, there is a significant difference between the BEP figure before purchase and BEP after the purchase and use of the aircraft, where during the current month, the number of Cobalt 60 actions has decreased from the target of 90 patients per day to 87 patients per day. The data above shows that the hospital suffered a slight loss due to the Covid-19 pandemic because the number of patients using the Cobalt 60 aircraft in a day did not reach the target. This can be seen from the BEP calculation before the purchase of the Cobalt 60 aircraft, which should have been able to return capital within 2.5 years, it turned out to be able to return capital in more than 5.5 years.

Based on the results of the analysis of the effectiveness and efficiency of Cobalt 60 aircraft, it can be concluded that the Break Even Point (BEP) figure from the realisation of the utility of the use of Cobalt 60 aircraft does not reach the planning target. This is evidenced by the results of the utility evaluation of the use of Cobalt 60 medical devices in Radiotherapy Installation which is not effective but efficient.

This research is in line with Azizah’s research on Analysis of Revenue Effectiveness and Expenditure Efficiency to Measure the Financial Performance of the Ahmad Ripin Regional General Hospital, Muaro Jambi Regency during the Covid 19 Pandemic, where the results showed that revenue effectiveness had a positive and significant effect on hospital financial
performance where the results of data analysis showed that the level of effectiveness of hospital revenue during covid 19 was classified as tending to decrease and was ineffective, namely an average of 75 percent. Meanwhile, expenditure efficiency has no effect on hospital financial performance and hospital expenditure efficiency is classified as less efficient, namely an average of 93.85 percent. Based on the BEP calculation before the purchase of the LINAC precise aircraft with the calculation of the BEP after 2 years of using the LINAC aircraft, there is a significant difference between the BEP figure before purchase and BEP after the purchase and use of the aircraft, where during the current month, the number of LINAC actions has decreased from the target of 70 patients per day to 55 patients per day.

The data above shows that the hospital suffered a slight loss due to the Covid-19 pandemic because the number of patients using the LINAC aircraft in a day did not reach the target. Even so, the hospital was able to recoup the capital in 4.1 years, 2 (two) years faster than the estimated BEP target before the purchase of the LINAC aircraft.

Based on the results of the analysis of the effectiveness and efficiency of the LINAC precise aircraft, it can be concluded that the BEP figure of the realisation of the LINAC aircraft usage utility exceeds the planning target. This is also supported by the results of the evaluation of the utility of using LINAC medical devices in the Radiotherapy Installation which is effective and efficient.

This research is in line with Agustian’s research on Evaluating the Performance of Hospital X Before and During the Covid-19 Pandemic Using Balance Scorecard where in 2019 the effectiveness ratio was 98.5% then decreased in 2020 by 86.9% and in 2021 increased to 129.4%. Meanwhile, the efficiency ratio value in 2019 was 98.5%, then decreased in 2020 by 51.7% and in 2021 by 36.8%. The decrease in the efficiency ratio every year shows that the hospital can manage expenses well.

This study is not in line with Priyotomo’s research on the Analysis of the Impact of Covid-19 on Hospital Efficiency, Effectiveness, and Productivity (Case study: RSU Mitra Paramedika D.I. Yogyakarta), where the results of efficiency calculations were more than 100% in conditions before and during the COVID-19 pandemic, so there was no impact of COVID-19 on hospital efficiency. The calculation of the effectiveness ratio in conditions before the COVID-19 pandemic was in the effective category (effectiveness ratio > 100%), but in conditions during the COVID-19 pandemic it was in the ineffective category (effectiveness ratio < 95%), so there was an impact of COVID-19 on hospital effectiveness.

5. Conclusion

The hospital was suffered a slight loss due to the Covid-19 pandemic because the number of patients using the LINAC aircraft in a day did not reach the target. However, the hospital was able to recoup the capital in 4.1 years, two years faster than the estimated BEP target before the purchase of the LINAC aircraft. While the Cobalt 60 aircraft usage at Dr Mohammad Hoesin Hospital Palembang is considered ineffective with an effectiveness value of only 50%. Nevertheless, it was considered efficient with an efficiency value of 70.88%.

The number of LINAC actions has decreased from the target of 70 patients per day to ± 55 patients per day. Although the BEP calculation before the purchase of the LINAC precise aircraft, the hospital can return to capital in 4.1 years, the fact that it was only about two years faster than the estimated BEP target. Therefore, the utility of using the LINAC precise aircraft at Dr Mohammad Hoesin Hospital Palembang is considered effective with an effectiveness value of 113%. It also considered efficient with an efficiency value of 51.77%.
6. References


