

## Original Research

# Breast, cervical, and lung cancer: A comparison of real healthcare costs and INA-CBGs rates in the era of national health insurance

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### Abstract

**Background:** In Indonesia, the cost of cancer treatment has been determined by the Indonesian Case Base Groups (INA-CBGs) based on a code called the INA-CBG's rates. However, a fair claim should be based on the severity of the disease and the class of treatment in the hospital, not on the rates of code. In fact, the real cost of therapy for cancer is influenced by several factors including stage, comorbidity, and severity (INA-CBGs coding, type of hospital, hospital class, treatment grade, side effects, and length of stay), so in many cases, there are reported differences between the real costs and the INA-CBGs rates charged to patients. **Objective:** This study aims to investigate the difference between real treatment costs and INA-CBG's rates for cases of lung cancer, cervical cancer, and breast cancer at a cancer center hospital in Indonesia. **Methods:** This work uses an observational study, and the data were taken retrospectively from hospital financial data and patient medical records. The data were then analyzed using a one-sample t-test to determine the difference between real costs and INA-CBGs costs. **Results:** The results showed that there was no significant difference between real costs and INA-CBG's cost on stage II lung cancer treatment in grade 2 with a sig. value of 0.683; code C-4-13-II in grade 3 with a sig. value of 0.151; and code C-4-13-III in grade 3 with a sig. value of 0.650; where the significance level ( $t$  alpha) is more than 0.05. Furthermore, the treatment costs for cervical cancer with codes C-4-13-I and C-4-13-II in grade 1 had sig. values of 0.155 and 0.720 respectively. Lastly, the treatment cost for breast cancer patients with codes C-4-12-II in grade 3 had a sig. value of 0.145 and code C-4-13-II in grade 3 showed a sig. value of 0.091. **Conclusion:** Although statistical evaluation showed a significant difference for some cases and not significant for other cases, in real conditions, there is a difference between the INA-CBGs and the real costs that must be evaluated by the government and stakeholders to provide justice for cancer patients.

**Keywords:** real cost; INA-CBGs rates; breast cancer; cervical cancer; lung cancer

## INTRODUCTION

In the last decades, cancer has become the most common cause of death worldwide, and lung cancer is recognized as one of the top five cancers causing deaths.<sup>1-5</sup> In Indonesia, the prevalence of cancer in 5 years was reported to be 946,088 cases from a total population of 273,523,621 people, 396,914 new cases and 234,511 deaths. The prevalence of cancer in five years was reported to be 946,088 cases from a total population of 273,523,621 people, 396,914 new cases and 234,511 deaths.

In 2020, the number of new cancer cases based on age and sex encompassed 65,858 cases (16.6%) for breast cancer, 36,633 cases (9.2%) for cervical cancer, and 34,783 cases (8.8%) for lung cancer, respectively. Based on the new cases in women of all ages in 2020, the highest was breast cancer with 65,858 cases (30.8%); meanwhile, in men of all ages, the highest number of new cancer cases was lung cancer with 25,943 cases (14.1%).<sup>6</sup>

A study conducted in Spain described the economic consequences of implementing new clinical practice guidelines<sup>7</sup> based on the medical records of individual patients. Research related to cancer costs based on the condition of cancer patients including clinical stage, associated with variables from administrative and clinical databases, is still not widely done, both in Spain and other countries.<sup>8</sup> Experts have realized the importance of using administrative databases as a data source in healthcare research aiming to make decisions because it is influenced by organizational models and clinical practices applied in each country.<sup>9</sup>

Measurement of economic burden can contribute to cancer issues, not only as a clinical care issue for individuals but also as a public health problem. The impact of cancer is not only on the incidence but also on the diagnosis and treatment which require very high costs.<sup>10</sup> The use of healthcare resources is concentrated both in the early period after the diagnosis of non-metastatic cancer and at the end of the patient's life if recurrence occurs. If this is the case, patient costs over time

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follow the characteristics of disease progression.<sup>9</sup> Secondary prevention based on the results of screening and tertiary prevention involves new treatments that cause changes in the economic and epidemiological burden.<sup>11</sup> Efforts to evaluate cancer care policies are critical to measuring the stage-adjusted epidemiological and economic burden.<sup>12-14</sup>

The cost of health services in Indonesia is steadily increasing every year with the cost of cancer therapy ranking 2<sup>nd</sup> out of the 10 largest costs for the catastrophic disease at 18%.<sup>15,16</sup> The total cost of cancer treatment and its development, as well as technological advances, lead to a large burden of disease (cancer incidence, prevalence, mortality). The increase in the number of new cancer patients causes an increase in the cost of care and treatment requiring additional healthcare expenses.<sup>17</sup> Meanwhile, changes in the cost of care and treatment determined by the Indonesian Case Base Groups (INA-CBGs) rates have not been able to periodically offset the real costs claimed by hospitals to the Health Care and Social Security Agency (BPJS), despite Presidential Regulation Number 12 of 2013 concerning Health Insurance as amended by Presidential Regulation Number 111 of 2013 mandating that the healthcare rates should be reviewed at least every two years.<sup>18</sup> Therefore, this study aims to measure the real costs based on clinical stage for the treatment of breast cancer, cervical cancer, and lung cancer at Dharmais Cancer Center Hospital as a Grade A hospital and to see the difference between the real costs of the hospital and the INA-CBG's rates.

## MATERIALS AND METHODS

### Materials

This is an observational (non-experimental) study. The data were taken retrospectively using data from patients in 2020 who were diagnosed with breast cancer, cervical cancer, and lung cancer. The study protocol was approved by the Research Ethics Committee of Dharmais Cancer Center Hospital (166/KEPk/VII/2022). The data were collected from medical records and the financial database of Dharmais Cancer Center Hospital as a Grade a Hospital. Inclusion criteria were inpatients of

National Health Insurance (JKN) participants diagnosed with lung cancer, cervical cancer, and breast cancer. Exclusion criteria were incomplete medical records, forced discharge, and death of the patient. Medical records that met the inclusion criteria were 197 lung cancer patients, 654 cervical cancer patients, and 989 breast cancer patients who were used as research objects.

### Methods

The data obtained were recorded in data collection sheets. From the hospital system data base, the data were tabulated in an Excel data sheet in the form of patient characteristics data including patients' age and gender, INA-CBG's code based on treatment grade and severity, radiotherapy, chemotherapy, real cost, and INA-CBG's package rate for inpatients. The data were then analyzed by using a one-sample t-test to determine the difference between the real healthcare cost and INA-CBGs rates. The Kruskal Wallis test was also administered to analyze the factors that affect the real costs, including medical costs, medical support costs, pharmaceutical costs, and supportive cost.

## RESULT

Table 1 showed that the 51-60 year-age group was the highest group suffering from lung cancer with 71 patients (36%) of 197 lung cancer patients. Cervical cancer occurred the most in patients aged 41-50 years with 231 patients (35%), and 51-60 years with 214 patients (33%). Meanwhile, the number of patients aged 61-71 years suffering from cervical cancer showed a declining trend. This was probably due to weakened patients' immune system due to old age causing patients unable to withstand the disease (the patients expired). Most breast cancer patients were in the 41-50 year-age group with 365 patients (37%) and the second highest age group suffering from breast cancer was the 51-60 year-age group with 302 patients (31%). This finding was also in line with the distribution of breast cancer patients in the United States in 2015 that the age of 40-69 years is the highest prevalence of

Table 1. Characteristics of patients with breast, cervical, and lung cancer

Variable		Number of Patients (N)			Percentage (%)		
		Lung Cancer	Cervical Cancer	Breast Cancer	Lung Cancer	Cervical Cancer	Breast Cancer
Patient characteristic: Age Group (Year)	<20	13	0	0	7%	0%	0%
	21-30	4	20	19	2%	3%	2%
	31-40	10	69	140	5%	11%	14%
	41-50	40	231	365	20%	35%	37%
	51-60	71	214	302	36%	33%	31%
	61-70	55	92	146	28%	14%	15%
	>71	4	28	17	2%	4%	2%
Total Number of Patients (N)		197	654	989	100%	100%	100%
Patient characteristic: (sex)	Male	147	0	6	75%	0%	1%
	Female	50	654	982	25%	100%	99%
Total Number of Patients (N)		197	654	988	100%	100%	100%



breast cancer.<sup>19</sup> The results of the study based on sex (male and female) showed that lung cancer occurred the most in male patients (75%), cervical cancer in female patients (100%), and breast cancer in female patients (99%).

The distribution of patient severity in breast cancer, cervical cancer, and breast cancer is grouped according to the INA-CBG's system which was divided into 3 codes for radiotherapy and chemotherapy: C-4-12-I, C-4-12-II, C-4-12-III for radiotherapy, and C-4-13-I, C-4-13-II, and C-4-13-III for chemotherapy, with the last digit in Roman numerals from the INA-CBG's code as an indicator of the severity of the disease.<sup>20</sup> Table 2 showed that most radiotherapy was performed on cervical cancer patients with a severity level of C-4-12-I for 535 patients. Meanwhile, the highest chemotherapy treatment was in lung and breast cancer patients with C-4-13-I severity with 105 lung cancer patients (53%) and 628 breast cancer patients (63%). Based on the results, chemotherapy for C-4-13-I was performed more than for C-4-13-II and C-4-13-III.

In this study, the cost components of lung cancer, cervical cancer, and breast cancer patients at Type A Hospitals in 2020 were divided into 4 real cost components: medical costs, medical support costs, pharmaceutical costs, and support costs (nutrition and supplement). Tables 3, 4, and 5 showed the highest cost component during chemotherapy treatment for lung, cervical, and breast cancer, respectively.

The average real costs were spent for Grade 1 treatments for stages I, II, and III with low-dose radiotherapy, moderate-dose radiotherapy, and high-dose radiotherapy with no lung cancer patients receiving radiotherapy. In grade 1, cervical cancer patients who received moderate-dose radiotherapy cost IDR 13,234,912. This was higher than the real cost for stages I and III. Meanwhile, no breast cancer patients received radiotherapy. Patients receiving Grade 2 treatment were cervical cancer patients only specifically for low-dose and moderate-dose radiotherapy; the highest cost for low-dose radiotherapy was IDR 12,819,838. In Grade 3 treatment, only lung cancer

Table 2. Radiotherapy and chemotherapy for patients with breast, cervical, and lung cancers

Variable (grade)		Number of Patients (N)			Percentage (%)		
		Lung Cancer	Cervical Cancer	Breast Cancer	Lung Cancer	Cervical Cancer	Breast Cancer
<b>Radiotherapy</b>	C-4-12-I	0	535	1	0%	<b>82%</b>	0%
	C-4-12-II	0	65	3	0%	10%	0%
	C-4-12-III	1	15	0	1%	2%	0%
<b>Chemotherapy</b>	C-4-13-I	105	26	628	<b>53%</b>	4%	<b>63%</b>
	C-4-13-II	51	9	251	26%	1%	25%
	C-4-13-III	40	4	106	20%	1%	11%

Table 3. Average real cost per treatment grade for lung cancer

Variable		Lung Cancer				
		Medical Cost (IDR)	Medical Support Cost (IDR)	Pharmaceutical Cost (IDR)	Support Cost (IDR)	Real Cost Total (IDR)
Grade 1	C-4-13-I	2,692,668	129,967	6,111,998	670,476	9,605,109
	C-4-13-II	2,736,034	209,783	7,471,248	647,612	11,064,677
	C-4-13-III	3,270,758	627,211	6,885,693	578,380	11,362,042
Grade 2	C-4-13-I	2,006,876	178,056	6,064,456	774,035	9,023,422
	C-4-13-II	1,964,039	437,071	7,339,078	422,689	10,162,877
	C-4-13-III	2,823,146	1,023,625	6,217,555	516,643	10,580,969
Grade 3	C-4-13-I	1,591,704	257,259	5,909,803	899,945	8,658,711
	C-4-13-II	1,390,000	411,714	6,903,701	933,858	9,639,273
	C-4-13-III	1,821,000	837,600	5,321,677	2,969,881	10,950,158

Table 4. Average real cost per treatment grade for cervical cancer

Variable		Cervical Cancer				
		Medical Cost (IDR)	Medical Support Cost (IDR)	Pharmaceutical Cost (IDR)	Support Cost (IDR)	Real Cost Total (IDR)
Grade 1	C-4-12-I	1,877,471	9,945,989	227,136	86,476	12,137,072
	C-4-12-II	1,845,154	11,021,154	253,962	114,641	13,234,912
	C-4-12-III	1,779,323	10,262,333	693,284	88,488	12,823,429
	C-4-13-I	2,948,063	146,200	4,533,322	304,701	7,932,286
	C-4-13-II	2,810,313	78,500	3,450,449	9,951,474	16,290,735



Grade 2	C-4-12-I	1,439,975	9,977,778	121,873	78,676	11,618,302
	C-4-12-II	1,504,219	10,917,188	250,090	148,343	12,819,838
	C-4-13-I	2,189,491	770,933	5,988,550	149,336	9,098,311
	C-4-13-III	2,152,517	162,000	3,578,266	139,296	6,032,079
Grade 3	C-4-12-I	893,767	9,967,951	121,666	86,122	11,069,505
	C-4-12-II	967,275	11,228,944	256,287	83,995	12,536,502
	C-4-12-III	3,292,840	10,930,901	699,881	593,776	15,517,397
	C-4-13-I	1,674,400	149,600	3,719,212	244,159	5,787,371
	C-4-13-II	1,236,000	204,500	3,101,160	379,446	4,921,106
	C-4-13-III	1,974,000	108,500	2,490,620	741,555	5,314,675

Table 5. Average real cost per treatment grade for breast cancer

Variable	Breast Cancer					
	Medical Cost (IDR)	Medical Support Cost (IDR)	Pharmaceutical Cost (IDR)	Support Cost (IDR)	Real Cost Total (IDR)	
Grade 1	C-4-12-II	12,162,913	14,937,600	5,235,420	6,499,201	38,835,134
	C-4-13-I	2,545,131	698,301	3,469,706	289,717	7,002,856
	C-4-13-II	2,842,083	455,183	6,106,443	787,574	10,191,283
	C-4-13-III	3,289,493	756,455	6,066,893	967,574	11,080,415
Grade 2	C-4-13-I	2,064,410	229,732	4,292,830	213,258	6,800,231
	C-4-13-II	2,081,940	150,727	7,496,480	391,176	10,120,323
	C-4-13-III	1,894,959	515,357	3,745,602	622,151	6,778,070
Grade 3	C-4-12-II	6,208,865	9,387,100	11,052,870	625,381	27,274,215
	C-4-13-I	1,554,013	249,817	3,763,071	463,319	6,030,221
	C-4-13-II	1,656,160	554,736	4,774,382	900,124	7,885,402
	C-4-13-III	1,850,978	485,941	3,704,462	721,456	6,762,838

patients with stage III received high-dose radiotherapy for IDR 9,461,893. The highest cost of high-dose radiotherapy for patients with cervical cancer and breast cancer stage III were IDR 15,517,397 and IDR 27,274,21 respectively. The highest cost component for cervical cancer patients in Grade I, II, and III was medical support costs while for breast cancer patients, the highest cost component in real costs was pharmaceutical costs.

Table 6 showed that based on the results of statistical tests between the real costs and INA-CBG's rate on lung cancer, there was no significant difference in cost treatments C-4-13-II Grade 2 with a sig. value of 0.683; C-4-13-II Grade 3 with a sig. value of 0.151; and C-4-13-III grade 3 with a sig. value of 0.650; where the significance level (t alpha) is more than 0.05. Table 7 showed that there was no significant difference in cancer patients with real costs and INA-CBG's rates on treatment codes C-4-13-I and C-4-13-II grade 1 with sig. values of 0.155 and 0.720 respectively. Furthermore, in breast cancer patients, there was no significant difference for treatments code C-4-12-II Grade 3 with a sig. value of 0.145 and C-4-13-II Grade 3 with a sig. value of 0.091 as shown in Table 8. Another study by Santoso<sup>21</sup> also showed that INA-CBG's costs are lower than real costs.

## DISCUSSION

The main contribution of this study is to show the cost of

healthcare for patients with cancer in a cancer center hospital selected based on the stage and type of resources in the recorded database. Table 1 showed that the 51-60 year-age group was the highest group suffering from lung cancer with 71 patients (36%) of 197 lung cancer patients. This is because, during the aging process, there is a decrease in the body's ability to repair cell damage and changes in metabolism occur, which can lead to carcinogenesis. Meanwhile, the number of patients aged more than 71 years suffering from lung cancer showed a declining trend. This is because, during the aging process, there is a decrease in the body's ability to repair cell damage and changes in metabolism occur. Cervical cancer patients mostly occurred in patients aged 41-50 years with 231 patients (35%), followed by the 51-60 year-age group with 214 patients (33%) while in the 61-71 year-age group, a declining number of cervical cancer patients occurred. This was probably due to weakened patients' immune system due to old age causing patients unable to withstand the disease (the patients expired). Most breast cancer patients were in the age range of 41-50 years with 365 patients (37%) followed by patients aged 51-60 years with 302 patients (31%). This finding was in line with the distribution of breast cancer patients in the United States in 2015 that the age of 40-69 years is the highest prevalence of breast cancer.<sup>19</sup>

The results of the study based on sex (male and female) showed that lung cancer occurred the most in male patients (75%). This



Table 6. Real cost comparison with INA-CBGs lung cancer claims

Variable		Lung Cancer			
		Number of Patients (n)	Real Cost (IDR)	INA-CBGs Cost (IDR)	Sig, t
Grade 1	C-4-13-I	60	9,605,109	6,505,500	0.000*
	C-4-13-II	23	11,064,677	12,243,400	0.060
	C-4-13-III	19	11,362,042	16,573,400	0.000*
Grade 2	C-4-13-I	18	9,023,422	5,576,100	0.000*
	C-4-13-II	14	10,162,877	11,254,044	0.683
	C-4-13-III	16	10,580,969	14,205,700	0.002*
Grade 3	C-4-13-I	27	8,658,711	4,646,800	0.000*
	C-4-13-II	14	9,639,273	8,745,300	0.151
	C-4-13-III	5	10,950,158	11,838,100	0.650

Table 7. Real cost comparison with INA-CBGs cervical cancer claims

Variable		Cervical Cancer			
		Number of Patients (n)	Real Cost (IDR)	INA-CBG'S Rate (IDR)	Sig, t
Grade 1	C-4-12-I	162	12,137,072	8,653,200	0.000*
	C-4-12-II	13	13,234,912	17,043,500	0.000*
	C-4-12-III	3	12,823,429	43,772,500	0.000*
	C-4-13-I	10	7,932,286	6,505,500	0.155
	C-4-13-II	2	16,290,735	12,243,400	0.720
Grade 2	C-4-12-I	90	11,618,302	7,417,100	0.000*
	C-4-12-II	16	12,819,838	14,608,700	0.000*
	C-4-13-I	6	9,098,311	5,576,100	0.023**
	C-4-13-III	2	6,032,079	14,205,700	0.003*
Grade 3	C-4-12-I	283	11,069,505	6,180,900	0.000*
	C-4-12-II	36	12,536,502	12,173,900	0.022**
	C-4-12-III	12	15,517,397	31,266,100	0.000*
	C-4-13-I	10	5,787,371	4,646,800	0.081
	C-4-13-II	6	4,921,106	8,745,300	0.000*
	C-4-13-III	2	5,314,675	11,838,100	0.004*

Table 8. Real cost comparison with INA-CBGs breast cancer claims

Variable		Breast Cancer			
		Number of Patients (n)	Real Cost (IDR)	INA-CBG's rate (IDR)	Sig, t
Grade 1	C-4-13-I	287	7,002,855.51	6,505,500	0.037**
	C-4-13-II	120	10,191,283	12,243,400	0.000*
	C-4-13-III	41	11,080,415	16,573,400	0.000*
Grade 2	C-4-13-I	111	6,800,231	5,576,100	0.001*
	C-4-13-II	44	10,120,323	10,494,300	0.697
	C-4-13-III	14	6,778,070	14,205,700	0.001*
Grade 3	C-4-12-II	2	27,274,215.00	12,173,900	0,145
	C-4-13-I	230	6,030,220.52	4,646,800	0.000*
	C-4-13-II	87	7,885,402	8,745,300	0,091
	C-4-13-III	51	6,762,838	11,838,100	0.000*



was probably because men have a high frequency of smoking habits. Cigarettes are 80% of the causes of lung cancer in men (BUK, 2013). Other factors that trigger lung cancer are air pollution factors (asbestos, silica, nickel, chromium, etc.) as well as genetic susceptibility factors. For females, the risk factors for lung cancer were being passive smokers and being exposed to air pollution in the long term resulting in the accumulation of carcinogenic substances.<sup>22</sup> In terms of cervical cancer, 100% of cases occurred in female patients and 99% of breast cancer cases were suffered by female patients.

In this study, the highest cost was found in the real cost of breast cancer patients (C-4-12-II). This was in line with Ibarrodo's study in Spain in 2022 because the cost of chemotherapy is greater.<sup>9</sup> The second highest treatment cost was for cervical cancer patients (C-4-13-II) in Grade 1, and the lowest treatment cost was for C-4-13-II cervical cancer patients in Grade 2. The two main cost components are radiotherapy and chemotherapy with the cost of radiotherapy being relatively different in the three cancers. The highest radiotherapy cost was for breast cancer patients (C-4-12-II) in Grade 3 with IDR 27,274,215. Meanwhile, the lowest cost of radiotherapy was for cervical cancer patients (C-4-12-I) in grade 3 patients with IDR 11,069,505.29. The highest cost of chemotherapy was for cervical cancer patients (C-4-13-II) in grade 1 with IDR 16,290,735. On the other hand, the lowest chemotherapy cost was for cervical cancer patients (C-4-13-II) in grade 3 with IDR 11,069,505.29.

## CONCLUSION

From the observation and data analysis, we found that there is a difference between statistical and calculated analysis. Statistical evaluation showed a significant difference between real prices and INA-CBGs for lung cancer for grade 1 at codes C-4-13-I and C-4-13-III; grade 2 on codes C-4-13-I and C-4-

13-III; and grade 3 on code C-4-13-I. In addition, there is no significant difference for grade 1 in code C-4-13-II; grade 2 on code C-4-13-II; and grade 3 on codes C-4-13-II and C-4-13-IV. Cervical cancer showed significant differences for grade 1 at codes C-4-12-I, C-4-12-II, and C-4-12-III; grade 2 on codes C-4-12-I, C-4-12-II, C-4-13-I, and C-4-13-III; grade 3 on codes C-4-12-I, C-4-12-II, C-4-12-III, C-4-13-II, and C-4-13-III. No significant cost difference was found for grade 1 on code C-4-13-I and C-4-13-II, and grade 3 on code C-4-13-I. In breast cancer there are significant differences for grade 1 in the code C-4-13-I, C-4-13-II, and C-4-13-4; grade 3 on codes C-4-13-I and C-4-13-III; and grade 3 on the code C-4-13-I, C-4-13-III. Meanwhile, there is no significant difference in cost for grade 2 on code C-4-13-II, grade 3 on code C-4-12-II and C-4-13-II. Although statistical analysis can conclude the significance level of comparison of real costs with INA-CBGs rates, in reality, there are differences between INA-CBGs rates and real costs that must be evaluated by the government and stakeholders to provide justice for cancer patients.

## AUTHORS CONTRIBUTION STATEMENT

Conceptualization: FY, TMA; Data curation: FY, DE, SAK; Formal analysis: FY, SAK; Methodology: FY, DE, TMA, SAK; Supervision: TMA; Writing—original draft: FY, DE, TMA, SAK; Writing—review & editing: FY, DE, TMA, SAK.

## CONFLICTS OF INTEREST

The authors have no conflicts of interest regarding this research.

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