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Cost analysis and utility index in congestive heart failure patients in Hospital Dr. Moewardi Surakarta

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Abstract

Background*: Congestive heart failure is a progressive disease that causes a decreased quality of life, increases the need for medical expenses, and has a long treatment time. The purpose of this study is to analyze the cost of treatment and see the utility index in patients with congestive heart failure at RSUD Dr. Moewardi Surakarta.*
Method*: The research method used a cross-sectional design, data were collected retrospectively from medical records, financial data, and pharmaceutical installations to see data on direct medical costs and utility data using the EQ-5D-5L questionnaire during March-May. The subjects of the study were 78 outpatient heart failure patients at RSUD Dr. Moewardi Surakarta with inclusion criteria, namely heart failure patients aged > 40 years and complete medical record data including age, sex, comorbidities, degree of severity, and drug therapy.*
Results*: Data were analyzed using the Man Whitney U test and the Kruskal Walis H test. The results of this study showed direct medical costs, namely pharmacy (Rp. 2,837,328.00), service fees (Rp. 150,000.00), medical procedures (Rp. 89,717.95), and administrative fees (Rp. 10,000.00). Total direct medical costs Rp. 3,087,045.95. The results of the EQ-5D-5L questionnaire based on each dimension were 78.2% no problems with walking ability, 97.4% no problems with self-care, 59.0% no problems with activities, 34.6% little had problems with pain, and 57.7% had no problems with anxiety/depression. The utility index value is 0.803.*
Conclusion*: The conclusion is that the average direct medical cost is Rp. 3,087,045.95 and the utility index value is 0.803.*

Keywords: *congestive heart failure; utility index; medical expenses.*

INTRODUCTION

Heart failure is a clinical syndrome caused by abnormalities in the structure of the heart and functional abnormalities resulting in increased intracardiac pressure or inadequate cardiac output when resting or exercising (1). The prevalence of heart failure is increasing among the elderly and is the leading cause of death. This hurts the physical, mental, and social health of the patient leading to a decrease in quality of life (2).

According to data from *World Health Organization* (WHO) in 2019 as many as 17.9 million people died from cardiovascular disease (CVD) with 85% caused by heart attacks and strokes (3). According to the data Riskesdas 2018, the prevalence of Heart Disease based on a doctor's diagnosis in Indonesia is 1.5%, with the highest prevalence rating of North Kalimantan province 2.2%, DIY 2%, and Gorontalo 2%. Central Java Province is included in the top ten prevalence of heart disease in Indonesia with a percentage of 1.6% (4). *Sample Registration System (SRS)*Indonesia in 2014 showed CHD was the second highest cause of death after stroke, amounting to 12.9% of all causes of death in Indonesia (5).

The economic burden of treating heart failure globally is estimated at US$ 346.17 billion (6). In research, Lesyuk *et al* (2018) cost study of heart failure used a systematic study from 2004 – 2016 in which the cost of heart failure patients in South Korea was $868, in Germany as big as $25,532, and the

total lifetime cost for heart failure patients is estimated at $126,819 per patient (7). In Saudi Arabia, the direct medical cost for heart failure patients is $3,528,839 per year (2). BPJS data shows an increase in health costs for heart disease from 2014 heart disease spent BPJS funds of 4.4 trillion rupiahs, then increased to Rp 7.4 trillion in 2016 and continues to increase in 2018 amounting to 9.3 trillion (8).

With the increasing cost of health care, health technology is needed to compare and measure the cost of treatment with the *outcome* earned. The method used to assess health technology is pharmacoeconomic studies. Pharmacoeconomics is defined as the description and analysis of the cost of therapy in the health care system. One of the pharmacoeconomic studies used to measure and compare costs with *Outcomes* is *Cost-Utility Analysis* (CUA) with parameters *Outcome* The utility measurement used (*Utility*) (9).

The utility is used to see the value of improved health status as measured by what both individuals and communities prefer. Instruments used to measure utility include the EQ-5L-5D. The EQ-5D instrument was developed by *EuroQol Group* and aims to collect descriptive HRQOL data on five dimensions: mobility, self-care, usual activities, pain/discomfort, anxiety/depression; followed by a self-assessment of overall health status on a visual analog scale (EQ VAS) ranging from 0 ('worst health condition imaginable') to 100 ('best health condition imaginable' (10). The purpose of this study was to determine the difference in medical costs and see the utility index in congestive heart failure patients at Dr. Moewardi Surakarta Hospital.

METHOD

This study used a type of observational study with a *cross-sectional* design. Data collection place at Dr. Moewardi Surakarta Hospital with a total sample of 78 patients. Data collection was carried out by distributing EQ-5D-5L and EQ VAS questionnaires to heart failure patients visiting Heart Poly and taking medical record data of congestive heart failure patients from March to May 2023 retrospectively. The EQ-5D-5L questionnaire has 5 dimensions: mobility, self-care, activity, pain/discomfort, and anxiety/depression. Each dimension has 5 levels: no problems, slight problems, moderate problems, severe problems, and unable/extreme problems. The completed EQ-5D-5L questionnaire will be calculated based on the level of each dimension using *the Indonesian value set utility*. EQ VAS is used to describe health status by assigning a value on a *visual analog scale* where 0 (describing the worst health status) and 100 (describing the best health status). The analysis used is the *Man Whitney you* test and *the Kruskal Walis H test.* The free variable is said to have no effect when the p-value < 0.001 while the free variable is said to have no effect when the p-value> 0.001.

RESULTS

Data collection was carried out on congestive heart failure patients at Dr. Moewardi Surakarta Hospital with a population of 350 patients seeking treatment at the heart poly during March-May 2023. The population number was obtained from medical record data of congestive heart failure patients whereas from the total population a sample number of 78 patients. The characteristics of outpatient congestive heart failure patients at Dr. Moewardi Surakarta Hospital can be seen in Table 1.

Table 1. Characteristics of congestive heart failure patients at Dr. Moewardi Hospital Surakarta.

Characteristics of the patient	Total (n = 78)	
	n	%
Age		
55-64	15	19,23%
65-74	31	37,74%
>75	32	41,02%
Gender		
Man	38	48,71%
Woman	40	51,28%
Education		
No school	6	7,69%
SD	7	8,97%
JUNIOR	24	30,76%
SMA	22	28,20%
College (Diploma, S1, and S2)	19	24,35%
Work		
Work	45	57,69
Does not work	33	42,30
Comorbid		
No comorbidities	4	5,12%
1 Comorbid		
CHD	25	32,05%
Hypertension	2	2,56%
Diabetes militus	2	2,56%
HHD	8	10,25%
2 Comorbids		
CHD + Hypertension	11	14,10%
CHD + Diabetes militus	8	10,25%
CHD + HHD	6	7,69%
CHD + Hyperlipidemia	2	2,56%
HHD + Hyperlipidemia	1	1,28%
Hyperlipidemia + Diabetes Mellitus	1	1,28%
3 Comorbidities		
CHD + HHD + Hyperlipidemia	1	1,28%
CHD + HHD + Diabetes Mellitus	2	2,56%
CHD + CKD + Hyperlipidemia	1	1,28%
CHD + Hypertension + Diabetes militus	3	3,84%
CHD + Hypertension + Hyperlipidemia	1	1,28%
Severity Classification (NYHA)		
NYHA I	20	25,64%
NYHA II	33	42,30%
NYHA III	14	17,96%
NYHA IV	11	14,10%

In Table 2, the total number of problem patients, most heart failure patients experienced pain problems at 65.4% with the highest percentage at the slightly problematic level of 34.6%. The health status defined by the EQ-5D-5L descriptive system is then converted into a single index value. The calculation of the utility index is done by calculating the domain results based on the level filled in by the patient using a *value set*. table 3 shows that the utility index value in congestive heart failure patients is higher in

the age range of 55-64 years by 0.93 while the lowest utility index value at the age of >75 years is 0.71. Analysis test results using *Kruskal Walis H* show that there is a significant difference between age and utility index values seen from p values < 0.001. From Table 4, the average result of the largest direct medical cost component is pharmaceutical costs of Rp 2,837,328.00 (53.57%). Then the second largest direct medical cost is a service fee of Rp 150,000.00 (27.89%).

Table 2. Descriptive EQ-5D-5L congestive heart failure patient at Dr. Moewardi Hospital Surakarta.

Level	Variable EQ-5D-5L (%)				
	Walking ability	Self-care	Activity	Pain	Anxiety/sadness
No problem	78,2	97,4	59,0	34,6	57,7
A little problematic	10,3	0,0	14,1	34,6	37,2
Quite problematic	10,3	1,3	25,6	29,5	5,1
Problematic	1,3	1,3	1,3	1,3	0,0
Very problematic	0,0	0,0	0,0	0,0	0,0
Total problem patients	21,9	2,6	41	65,4	42,3

Table 3. Differences in Utility Index Values of Congestive Heart Failure Patients at Dr. Moewardi Hospital Surakarta.

Characteristic	n	Average ± SD	*p-value*
Age			
55-64	15	0.93 ± 0.044	<0.001
65-74	31	0.84 ± 0.128	
>75	32	0.71 ± 0.246	
Gender			
Man	38	0.83 ± 0.152	0,293
Woman	40	0.77 ± 0.228	
Education			
No school	6	0.39 ± 0.259	
SD	7	0.58 ± 0.086	
JUNIOR	24	0.81 ± 0.159	<0.001
SMA	22	0.85 ± 0.123	
College (Diploma, S1, and S2)	19	0.90 ± 0.085	
Work			
Work	45	0.83 ± 0.152	0,355
Does not work	33	0.76 ± 0.240	
Comorbid			
No comorbidities	4	0.91 ± 0.073	
1 Comorbid	37	0.77 ± 0.229	0,383
2 Comorbids	29	0.84 ± 0.158	
3 Comorbidities	8	0.76 ± 0.177	
Severity Classification (NYHA)			
NYHA I	20	0.92 ± 0.105	
NYHA II	33	0.83 ± 0.102	<0.001
NYHA III	14	0.69 ± 0.303	
NYHA IV	11	0.61 ± 0.167	
Utility Index	**78**	**0.803 ± 0.195**	

Table 4. Direct bed unit cost (per patient) of outpatient congestive heart failure at Dr. Moewardi Hospital Surakarta.

Cost component	Total (Rp)	Average±SD	%
Administration	780.000	10,000.00±0.00	1,86
Medical treatment	6.998.000	89,717.95±161,422.36	16,68
Pharmacy	22.476.000	2,837,328.00±386,041.69	53,57
Service	11.700.000	150,000.00±0.00	27,89
Total	**41.954.000**	**3,087,045.95±547,464.06**	**100**

Table 5. Differences in Direct Medical Costs Against Comorbidities and NYHA Classification of Congestive Heart Failure Patients at Dr. Moewardi Hospital Surakarta.

Characteristic	n (78)	Average±SD	*p-value*
Comorbid			
No comorbidities	4	466,097.25 ± 307,113,611	
1 Comorbid	37	568,080.27 ± 532,634,984	0,977
2 Comorbids	29	490,183.24 ± 253,725,483	
3 Comorbidities	8	617,947.25 ± 483,820,547	
Severity Classification (NYHA)			
NYHA I	20	531,234.70±342,586.23	
NYHA II	33	464,069.63±327,764.81	0,695
NYHA III	14	253,662.10±713045	
NYHA IV	11	609,086.09±370,305.02	

The average results of direct medical costs against comorbidities are obtained in Table 5, the most costs incurred are patients with 3 comorbidities amounting to Rp 617,947.25. The average cost incurred in the disease severity group was Rp 564,752.08. Patients with the most NYHA classification spend an average of Rp 609,086.09 NYHA IV.

DISCUSSION

Table 1 shows that the percentage of age of congestive heart failure patients occurs at the age of >75 years, which is 32 patients with a percentage of 41.02%. According to Riskesdas data (2018), heart failure patients at the age of >75 years amounted to 4.7% compared to the age of 65-74 years (4.6%), and at the age of 55-64 years (3.9%). Research conducted by Harikatang *et al* (2016) The age group that experiences the most heart failure is the age group of 60-70 years with a percentage of 50%(11). Heart failure experienced by old age is caused by a decrease in heart function. With age, the oxygen demand of the myocardium with oxygen supply throughout the body decreases. The most congestive heart failure patients in women were 40 patients with a percentage of 51.28%. The incidence of heart failure in men doubled from age 65 to 85, but the incidence of heart failure tripled in women between the ages of 65 to 74 and 75 to 84 (12). In Table 3, the characteristics of congestive heart failure patients showed more employment status in the working group by 57.69% compared to those who did not work by 42.30%. A total of 45 patients are still working and 33 patients are IRT/non-working and retired. Increased work ethic can cause stress it causes the risk of developing hypertension. Hypertensive disease can cause left ventricular hypertrophy associated with diastolic dysfunction and increase the risk of heart failure (13).Heart failure patients with the most comorbidities in group 1 where as many as 25 (32.05%) patients have coronary heart disease (CHD) while heart failure patients with HHD have as many as 8 (10.25%). Coronary heart disease (CHD) which is also known as *Coronary artery disease* (CAD) is a disease caused by plaque buildup in the lining of the coronary arteries. This buildup of plaque can block blood flow in the heart's large arteries (14). In group 2, the most comorbidities in heart failure patients with

CHD comorbidities and hypertension were 11 (14.10%) patients. Based on research conducted by Harikatang *et al* (2016) where heart failure patients with CHD have a percentage of 51.6% and HHD as much as 6.5%. In the severity class group according to the *New York Heart Association* (NYHA), as many as 33 (42.30%) heart failure patients fall into class NYHA II. This is in line with research conducted by Boczor *et al* (2021) where as many as 50.6% of heart failure patients fall into class NYHA II (15).

These results are supported by research conducted by Tito *et al* (2022) found that pain/discomfort was the most influential dimension at 75.5% whereas in patients with cardiovascular disease could adversely affect the physical component of the patient's quality of life (16). The pain experienced by heart failure patients is commonly experienced by the elderly caused by coronary artery disease, coronary obstructive pulmonary disease, cancer, anxiety disorders, peripheral vascular disease, and diabetes mellitus (17).

The anxiety/sadness dimension is the second most commonly reported problem. As many as 42.3% of congestive heart failure patients with the most at the level of slight problems at 37.2%. According to research by Boczor *et al* (2021) As many as 53.8% of women experience anxiety. Depression or anxiety can contribute to dysregulation of the autonomic system, with a decrease in parasympathetic and increased sympathetic tone and an increase in heart rate, a decrease in heart rate variability that can affect health in patients with heart failure (18). The dimension of physical activity is the third problem experienced by heart failure patients where as much as 41% and most experienced at a fairly problematic level of 25.6%. This is related to comorbid factors that can aggravate patients with heart failure. Research conducted by Boczor *et al* (2019) Where the problems experienced by heart failure patients are the most physical activity dimensions of 0.82% (19).

In the sex group, men have a utility index value of 0.83 compared to women who have a utility index value of 0.77. This is supported by research by Tito *et al* (2022) Where the average value of the utility index in men is 0.70 compared to women's 0.82. Results of analyses performed using tests *Man Whitney U* By looking at the difference between sex and the utility index, a p-value of 0.293 was obtained. In the education group, the highest utility index score at the college level was 0.90, followed by the high school level of 0.85 and the junior high school level of 0.81. Results of analyses performed using tests *Kruskal Walis H* Between education to the utility index, a p-value of <0.001 was obtained, which showed that there was a significant difference between the education group and the value of the utility index in congestive heart failure patients. In the occupational group, the highest utility index value in the working subgroup was 0.83 compared to the non-working subgroup, which was 0.76. Results of analysis using test *Man Whitney U* Between the occupational groups against the utility index, a p-value of 0.355 was obtained, which means that there was no significant difference between the occupational group and the value of the utility index in congestive heart failure patients. Research conducted by Akhmad (2018) Where the education group with quality of life has a difference with a p-value of < 0.001 while the work and quality of life group has no difference with a p-value of 0.561 (20).

The comorbid group with the highest utility index value was the group without comorbidity of 0.91 and the lowest in the group with 1 comorbid of 0.77. In research, Andonian *et al* (2021) Heart failure patients with comorbidities are at risk of problems with all dimensions of EQ-5D (21). From the results of the analysis carried out with the test *Kruskal Walis H* There was no significant difference between the comorbid and utility index values where the p-value was 0.383. In the NYHA group, the largest utility index value in the NYHA I group is 0.92 and NYHA II is 0.83. This is in line with research conducted by Gandhi *et al* (2022) where the value of NYHA I is 0.987, NYHA II is 0.955 and NYHA III/IV is 0.829 (22). The results of the analysis looked at the difference between the severity classification group (NYHA)

against the utility index using the test *Kruskal Walis H*, there is a significant difference with a p-value of <0.001. The average total value of the utility index is 0.80 with a standard deviation value of 0.195 which means that the quality of life of heart failure patients who visit the heart poly is good.

In the research conducted by Ong *et al* (2022) the average cost of clinic visits for heart failure patients was USD 114 (5.8%), the cost of medicines was USD 209 (10.6%) and the cost of diagnostic tests was USD 174 (8.8%) with a total average of all outpatient costs of USD 498 (23). Research conducted by Ong *et al* (2022) The average costs incurred for comorbidities include type 2 diabetes mellitus USD 2,406, dyslipidemia of UDS 2,238, hypertension of USD 1,893, and chronic kidney disease USD 2,417. Results of research conducted by Ong *et al* (2022) In NYHA class the costs incurred are NYHA class I USD 2,011, NYHA II class USD 2,044, NYHA III class USD 1,944, and NYHA IV class USD 1,762. The results of the study in Table 5 by looking at the difference in comorbidity to direct medical costs using the *Kruskal Walis H test* obtained a p-value of 0.977 (p-value > 0.001) which means there is no difference between comorbid and direct medical costs. The results of the analysis of differences in severity classification characteristics (NYHA) on direct medical costs using the *Kruskal Walis H test* stated that there was no difference in severity classification (NYHA) on direct medical costs seen from the p-value of 0.695 (p-value > 0.001). In this study, there was no difference between direct medical costs on comorbidities, disease severity, and NYHA classification of congestive heart failure patients at Dr. Moewardi Hospital Surakarta. In the study, there are several limitations where researchers only look at the value of utility and cost of treatment without looking at the effect of cost with clinical outcomes (QALY), so prospective research is needed to see the cost of treatment with clinical *outcomes* seen from quality-adjusted *life years* (QALY).

CONCLUSIONS

Congestive heart failure patients had an average utility index value of 0.803 and were highest at ages 55-64 years (0.93), male (0.83), college (0.90), working category (0.83), no comorbidities (0.91), NYHA I (0.92) and therapy pattern 2 drug combinations (0.91). The average value of medical expenses is IDR 3,087,045.95 and the highest in the components of pharmaceutical costs (IDR 2,837,328.00), medical service costs (IDR 150,000.00), and medical treatment costs (IDR 89,717.95). From the results of *the Man Whitney You* test and Kruskal walis H *test,* it is stated that age group, occupation, and severity classification (NYHA) have an influence on the utility index with *a p-value* of < 0.001. In the direct medical cost test using *Man Whitney you* and *Kruskal walis H test* seen in the comorbid group, disease severity, severity classification (NYHA), and therapy pattern had no effect on direct medical costs with *a p-value* of > 0.001.

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