

Cost Effectiveness Analysis Between Hemodialysis and Peritoneal Dialysis

Analisis Efektivitas Biaya Hemodialysis dan Peritoneal Dialysis

Elsa Novelia¹, Ryan Rachmad Nugraha², Hasbullah Thabrany²

¹The National Health Insurance Corporation of Indonesia, Jakarta, Indonesia

²Center for Health Economics and Policy Studies, Universitas Indonesia, Depok, Indonesia

Korespondensi: Elsa Novelia,

e-mail: elsa.novelia@bpjs-kesehatan.go.id

Abstract

The number of patients with End Stage Renal Disease (ESRD) in Indonesia is growing. Increasing prevalence of hypertension and diabetes mellitus contributes to higher prevalence of ESRD. The majority of patients (94%) with ESRD are undertaking hemodialysis (HD) at public and private hospitals. However, continuous ambulatory Peritoneal Dialysis (PD) has been prescribed to small portion of patients with ESRD. The aim of this study was to examine the cost effectiveness between HD and PD on ESRD patients. This study compared 78 HD patients at Hospital X in Bogor and 10 PD patients at Hospital Y in Jakarta. Patient's quality of life (QoL) was measured using SF 36 questionnaires. The costs were measured by direct medical costs using CBGs prices, direct non-medical costs (transportation, food for patient and family), and indirect medical costs (opportunity costs). The study found that the HD cost per year per patient was IDR 133.4 million and the comparative cost for PD was IDR 81.7 million. The study found lower QoL of HD patients (46.2%) compared to QoL of PD patients (90%). In addition, PD patients had significant better quality of physical activities, emotional states, social function, and sanity. The study found the incremental costs for to HD to reach similar emotional states was IDR 2.0 million compared to PD and IDR 1.8 million for extra physical role gained. It is concluded that PD was more cost-effective than HD in achieving a certain level of quality of life among patients with ESRD in two hospitals in Indonesia.

Keywords cost-effectiveness analysis, End stage renal diseases, dialysis

Abstrak

Jumlah pasien Gagal Ginjal Stadium Akhir (GGSA) di Indonesia terus meningkat. Meningkatnya prevalensi hipertensi dan diabetes mellitus (DM) berkontribusi terhadap prevalensi kasus GGSA. Mayoritas pasien (94%) dengan GGSA menjalani terapi hemodialisis (HD) baik pada Rumah Sakit (RS) swasta ataupun pemerintah. Bagaimanapun, dialisis peritoneal ambulatori berkelanjutan (continuous ambulatory peritoneal dialysis/CAPD) telah diberlakukan pada sebagian kecil pasien dengan GGSA. Tujuan dari studi ini adalah untuk mengukur efektivitas harga dari HD dan CAPD pada pasien GGSA. Studi membandingkan 78 pasien HD di RS X Bogor dan 10 pasien CAPD pada RS Y Jakarta. Kualitas hidup pasien diukur menggunakan kuesioner 36. Biaya diukur dengan biaya langsung medis (menggunakan harga CBGs), biaya langsung non-medis (transportasi dan biaya makan), serta biaya medis tidak langsung (biaya kesempatan). Studi menunjukkan bahwa HD membutuhkan biaya Rp 133,4 juta per orang per tahunnya, dibandingkan dengan CAPD sebanyak Rp 81,7 juta. Studi menemukan kualitas hidup yang lebih rendah pada pasien HD (46,2%) dibanding CAPD (90%). Selain itu, pasien CAPD memiliki kualitas yang lebih baik dari segi aktivitas fisik, status emosi, fungsi sosial, dan kejiwaan. Studi menemukan bahwa harga inkremental HD, untuk mencapai status emosional yang sama, dibanding CAPD yakni sebanyak 2 juta rupiah; dan 1,8 juta rupiah untuk mencapai peran fisik bila HD dibanding dengan CAPD. Dapat disimpulkan bahwa CAPD lebih efektif dari segi biaya dibanding HD dalam mencapai tingkatan kualitas hidup yang lebih baik pada pasien-pasien GGSA di dua RS di Indonesia.

Kata Kunci: analisis efektivitas biaya, gagal ginjal stadium akhir, dialisis

Introduction

Chronic kidney disease (CKD) is now becoming a global concern. Globally, it affected 7% (approximately 488 million people) of total population in 2011, 1.6 million of which were in end-stage form, usually known as end-stage renal disease (ESRD) [HSCI, 2011]. In Indonesia, the number of CKD is staggeringly increasing. Almost 0.2% of total population, approximately 482 thousands, is believed to suffer from CKD [RISKESDAS, 2013].

It is estimated that 18,613 people are in ESRD in Indonesia [IRR, 2015]. ESRD patients are primari-

ly treated by replacing the function of renal system by two modalities; renal transplant or dialysis. Currently, there are two forms of dialysis; Hemodialysis (HD) and Peritoneal Dialysis (PD). Transplant is recommended for long-term perspective to have good quality of life (QoL) associated with it. Despite the benefit, there are requirements need to be fulfilled prior to transplantation, such as availability of a matching donor, goodness of body to receive the new organ, ethical issues, good knowledge, and the availability of experts and good equipped hospitals.

Another modality, Hemodialysis, is to filter out

blood from certain toxic, excess of salt, and fluid using a cleansing machine. In Indonesia, this treatment was introduced in 1967, and has been implemented to date to tackle patients with ESRD. By 2015, there were approximately 382 centers operating across the country. [IRR, 2015]

The other modality is Peritoneal Dialysis that utilizes peritoneal membrane function using dialysis solution. Continuous Ambulatory Peritoneal Dialysis (CAPD) is the most common Peritoneal Dialysis applied in Indonesia. The solution must be changed up to 4 times a day [NKUDIC, 2013].

The National Health Insurance of Indonesia, known as JKN, reimbursed IDR 157,542,900 – 416,780,100 for a renal transplant, depending on hospital classes (for severe case requiring transplant). The JKN covers twice a week HD that takes 5 hours treatment with reimbursements varied from IDR 786,200 to IDR 982,400, depending on hospital classes [MoH, 2016]. Despite higher cost-effectiveness from literatures, Peritoneal Dialysis is still under performed due to lack of dialysis centers that are willing to undertake PD throughout the country. The latest data showed that only 3% of 30,554 dialysis patients in the JKN were on PD [IRR, 2015].

Data from other countries showed that the proportion of PD of the total dialysis were much higher. In Hong Kong, the rate of PD compared to Hemodialysis is almost 3:1 (71.8% to 25.6%) [USRDS, 2013]. This is mainly due to, among developed countries, PD is considered more cost-effective than Hemodialysis. The primary difference lies on the incentives of healthcare staffs and machineries/logistical resources, of which Hemodialysis demands more than those of PD, with or without adjustment [Baboolal et al., 2008; Teerawattananon Y., et al., 2007]. However, there are several cases, especially in developing countries, where unit cost of Peritoneal Dialysis is slightly higher than HD. The difference mainly lies on delivery cost on the dialysis soluble in PD. [Abu-Aisha et al., 2010].

In Indonesia, limited patient's knowledge and reluctant of specialists to promote Peritoneal Dialysis is considered as the main reasons for low utilization of PD. In addition, limited information on costs and quality of life as well as limited supplies of professionals increase barriers to implement more PD. On the other hand, limited geographical access and transportation in a vast and widespread of Indonesia block access to dialysis for ESRD patients

in remote areas. Studies on life time costs and quality of life of patients with ESRD will help to convince decision makers to expand PD, especially for people living in remote areas where it is impossible to do weekly basis travel to HD centers. The main research questions are how much the costs and how good the quality of life of PD patients differ from HD patients.

Methodology

This study was an economic evaluation to compared costs and outcomes, in term of quality of life of PD versus HD. The study was taken in Hospital X in Bogor regency and Hospital Y in Jakarta. The detail of the unit cost per patient per year includes: direct medical costs, direct non-medical cost, and indirect costs of both PD and HD treatments. Both of these components were identified from patients' interviews and providers' interviews and then the total costs per component were calculated and grouped for one year of each HD and PD.

Specifically for direct medical costs of HD and PD, this study took tariff of INA-CBGs, a DRG type reimbursement under the JKN. The CBG tariffs for HD and PD differ for different regions and hospital classes to represent costs of living and intensity of services in different class of hospitals. Information regarding non-medical costs (e.g. both patient's and caregiver's transportation costs and opportunity costs) was collected from the patients. The quality of life of each patient was measured using SF 36 questionnaire, a standard QoL.

The respondents selected in this study were all ESRD patients undertaking HD in Hospital X and all PD patients in Hospital Y. The inclusion criteria of age 18 and older, have been taken dialysis at least one year, and no mental health problem. Patients came to hospital X three times a week to undergo HD. At hospital X, most of patients were covered by the JKN, since the costs had been beyond the ability to pay of most Indonesians. No PD patients registered at hospital X. For PD patients, the data collection was performed in patients' residence, since patients come to the hospital only once a month for check up. They changed solution by themselves at home or at their office. Hospital Y provides both HD and PD since it is class A hospital, which higher than hospital X.

The data obtained from the study were collected and further analyzed for to compare cost-effectiveness of HD and PD in producing outcomes of quality of life (QoL). The total annual costs of HD and

Table 1. The Cost of HD and PD Per Year Per Patient, in IDR million

	Min	Max	Mean	Median
Hemodialysis				
<i>INA CBGs tariff*</i>	102	143	102	102
<i>OOP**</i>	-	25	4	1.4
Direct medical costs	102	169	106	104
Direct non-medical costs	1.2	53	5.6	3.1
Indirect costs	-	197	21.6	11
Total costs	103.4	419.6	133.9	117.8
PD				
<i>PD tariff</i>	71.8	71.8	71.8	71.8
<i>OOP**</i>	0.6	24	9.9	10
Direct medical costs	72.4	95.8	81.7	81.8
Direct non-medical costs	-	-	-	-
Indirect costs	-	-	-	-
Total costs	72.3	95.8	81.7	81.8

*The minimum tariff of hemodialysis in B-class hospital, maximum tariffs of A-class hospital, and mean tariffs of B-class hospital

**Not including the out-of-pocket payment for Cimino operation, as it is not yet covered under JKN

All costs are in million Indonesian Rupiah (IDR million). US\$ 1 = IDR 13,400 in 2017

PD were calculated on the perspective of patients. Therefore, the cost components cover indirect opportunity costs.

Result

This study collected costs and quality of life (QoL) data of about half the number of HD patients in hospital X and about half the number of PD patients in hospital Y. Those who did not meet inclusion criteria or refuse to participate were excluded. The data collection was conducted in March-April 2014. This study collected costs and QoL data from 78 HD patients and 10 PD patients who met the inclusion criteria. Non-parametric statistics was applied to test differences in costs and QoL.

The gender distribution of the HD respondents was 56% males while in PD patients 50% were males. The proportion of HD patients below 40 years of age was 23% while no PD patients aged below 40 years of age. About two third of HD patients had consultation with a specialist monthly while all PD patients met their doctor monthly. Almost 80% of the HD patients in this study had household expenditure per month below IDR 5 million, which consider low income, while 40% of PD patients belong to this income groups.

The distribution of costs of HD and PD is shown in Table 1. As seen from the Table 1, the average annual total costs HD patients was larger than those

of PD patients., As shown in the table, the mean was larger than the median of HD patients due to higher direct medical costs in higher indirect costs.

After measuring QoL, this study calculated the total scores of all variables and scores per types of QoL. The total scores were then grouped into good and not good.

Table 2. The Frequency Distribution of Quality of Life (QoL) HD and PD patients

Variables	n	Percentage (%)
Overall Score for all patients		
Not good	43	48.9
Good	45	51.1
Score of HD patients		
Not good	42	53.8
Good	36	46.2
Score of PD patients		
Not good	1	10
Good	9	90

There were significant differences in QoL between HD and PD patients. Only 46% of HD patients had good QoL compared to 90% of PD patients ($p < 0.015$). The study tested the differences in QoL among various groups such as employment, education, age, comorbidity of diabetes mellitus and hypertension, and length of dialysis. We found that only employment status made difference of QoL.

Those patients who were employed and used PD significantly had better QoL compared to those who had HD. There was a significant difference of QoL between HD and PD ($p < 0.01$).

The Table 3 shows distribution of QoL score by components and the differences between HD and PD. We applied t-test to examine the differences of mean scores of various dimension of QoL between HD and PD patients. The table shows significant differences in dimensions of physical activity ($p < 0.001$), emotion ($p < 0.001$), pain ($p < 0.001$), social function ($p < 0.001$), and mental health ($p < 0.001$).

The Cronbach's alpha analysis also applied to examine the order of QoL that made higher differences. Ordered by the biggest to the smallest Cronbach alpha, the dimensions were: 1) emotional role, 2) physical role, 3) mental health, 4) energy, 5) pain, and 6) social function. Then, we calculated the costs of to reach a unit gain of each dimension for HD and PD patients.

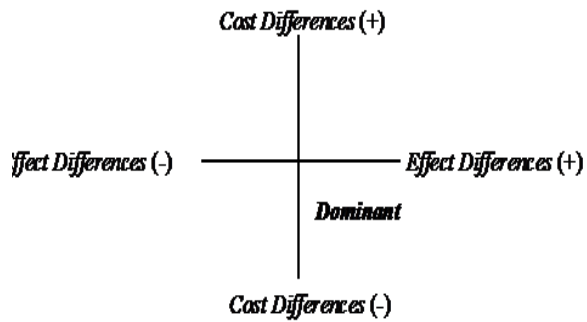
Table 3. The Differences on component of QoL between HD and PD patients, T-test

Dimensions of QoL		Mean Score	P-value
General	PD	257	0.212
	HD	298	
Physical Function	PD	540	0.777
	HD	514	
Physical Role	PD	300	<0.001*
	HD	98	
Emotional Role	PD	270	<0.001*
	HD	111	
Pain	PD	182	<0.001*
	HD	124	
Energy	PD	324	<0.001*
	HD	275	
Social Function	PD	180	<0.001*
	HD	131	

The authors calculated the Average Cost Effective Ratio to reach the score of good QoL for HD and PD patients. To reach a good QoL, HD patients required IDR 2.9 million while the PD patients required only IDR 0.91 million. We then calculate the incremental cost-effectiveness ratio (ICER) resulting in PD was more cost effective by IDR 1.2 million per extra QoL gained. The cost to achieve good physical role for HD was IDR 3.2 million, while the cost to achieve the similar QoL for PD was only IDR 1.2 million. The ICER for PD as compared to HD was IDR 1.8

per extra physical role gained. The plot of cost-effectiveness analysis, comparing PD and HD, displayed that PD occupied the 2nd quadrant, which means desired dominant from the cost and outcome perspectives as shown in Figure 1 below.

Figure 1. Cost-effectiveness plane



Discussion

Everywhere in the World, treating ESRD needs that are costly. At present, three options of treating ESRD are available: HD, PD, and renal transplant. Since renal transplant confronts supply problems, especially in low-income countries where donors are scarce, HD and PD remain the dominant practices. Countries have different priorities in undertaking HD and PD. It is paradoxical for low and middle countries where financial resources are scarce, but practices of HD and PD have been lack of economic evaluation. Under the current UHC, the ESRD consumed the third largest expenditures. However, many ESRD patients in remote areas or islands have not received fair access due to very low proportions (less than 5% currently) of ESRD patients receiving PD. Evaluation of cost-effectiveness is needed to convince the policy makers to promote more PD or to make a policy of PD first, such as implemented in Thailand.

This study tried to answer how good PD in economic evaluation compared to the current dominant PD and found that the average total costs for HD was IDR 133.4 million or about US\$ 10,000 per patient per year. On the other hand, the total annual costs of PD was only IDR 81,7 million (around US\$6,000). Considering the cost only, the cost of PD was 39% cheaper compared to HD. This finding was similar to that of study by Phillip et al. that found the cost PD to be 10-40% lower than those of HD in almost all countries. In the USA, HD had 30% higher costs than PD. In Hong Kong, where PD as a first-policy choice, it is reported that PD and HD have quite

similar costs. In developing countries such as in Bangladesh, India, Pakistan, and Sri Lanka, the medical costs of PD were relatively higher than the costs of HD, because the cost of labors were relatively lower than imported solutions for PD. Although the medical costs of PD were higher, counting the total costs of HD (including direct non-medical costs and indirect cost) resulted in costs of HD were relatively higher than costs of PD. [Philip et al., 2001]

The cost calculation is not adequate to evaluate how good a medical intervention compared to other alternatives. These studies also compared the outcomes and evaluate cost-effectiveness of HD compared to PD. The study finding was similar with other studies reported by Noshad et al. for both diabetic and non-diabetic HD patients. In every aspect of QoL, PD patients showed better score than HD patients [Noshad et al., 2009]

This study measured quality of life using SF 36 questionnaire with 8 (eight) dimensions. The study showed significant higher quality of life of those treated with PD for dimensions of physical role, emotional role, pain, energy, social function, and mental health. Another study showed higher scores of in dimension of family life, self-dependency, spiritual condition, energy level, and overall life condition. Higher QoL of PD patients, mainly related to additional energy and self-dependency acquired by PD patients, since the patients can do dialysis at home or at work. This study is consistent with a finding in Hong Kong that showed higher score in emotional role and mental health [Thong and Kaptein A, 2008]

In contrast, many HD patients experienced troublesome coping with sleep disturbances and anxiety due to feeling of high emotional burden for routine dialysis to health care facilities [Coccosis et al., 2008]. The symptoms were due to stress related dialysis procedure, high frequency of visit to hospital, long waiting time in HD unit, and ill-treatment from the medical personnel during HD in hospital. Studies found that HD patients were more prone to develop depressive symptoms and tend to attempt suicide. On the other hand, PD patients showed less stress and better QoL [Thong and Kaptein A, 2008].

This study dig more on costs and QoL to compare the two most common options in tackling ESRDs. The study found that ICER of PD compared to HD was IDR 1.2 million to gain additional score of QoL. That amount of saving is about a quarter of monthly

family income of the household surveyed. The ICER of PD compared to HD was IDR 1.8 for every extra physical role gained. This study affirmed study by Philip and by Karin who also PD was found that the costs of PD relatively lower than HD to achieve similar quality of life. [Karin S., Magnusson M., Carlsson P., 2002]

More thorough studies and or pilot project to implement PD First are required due to limitation inherent in this study. Limited sample of patients and study sites involved (only two hospitals) become the biggest concern. Although, the results are consistent with findings from various studies elsewhere in the world, precaution is advised before expanding PD.

Conclusion

It is concluded that from payer and patients perspectives, PD is much more efficient and effective to manage ESRD patients. The study suggested that PD should be given the 1st priority in treating ESRD patients, subject to the fulfillment of the medical requirements. The authors recommended that the government and the National Social Security Council (DJSN) conduct more thorough studies to evaluate CEA and ICER of PD versus HD in a larger scale. In addition, budget impact analysis for the Indonesian UHC (JKN) should be performed before the PD First policy is applied nationwide. A pilot prospective study is considered to be the best way to implement the PD First policy. In the end, the JKN will benefit and the ESRD patients in many regions with difficult physical access will benefit the most.

Acknowledgement

Author would like to express the outmost gratitude to the Hospital X and Hospital Y for approving the data collection at the sites.

References

- Albert W Wu, Nancy E Fink, Jane VR, Marsh Manzi, 2004. "Changes in quality of life during haemodialysis and peritoneal dialysis treatment." *J Am Soc Nephrol.* 15: 743-753.
- Chonchol, M Spiegel DM., 2005. *The Patient with Chronic Kidney Disease.* Philadelphia: In Schrier, RW 6th ed Manual of Nephrology.
- Coccosis, M Ginieri, P Theofilou, C Synodinou, V Tomaras, and C Soldatos, 2008. "Duality of life, mental health and health beliefs in haemodialysis and peritoneal dialysis patients: Investigating

- differences in early and later years of current treatment." *BMC Nephrology*. p9-14.
- Harvard Stem Cell Institute (HSCI). "Kidney Disease Program." 2011. <http://www.hsci.harvard.edu/node/905>. Diakses 15 Januari 2014.
- Indonesia Renal Registry. 2013. "List Renal yang terdaftar." http://www.indonesianrenalregistry.org/renal_tabel.php. Diakses 15 Januari 2014.
- Ministry of Health (MoH) Government of Indonesia (GoI), 2016. *Permenkes No. 52 Thn. 2016 tentang Standar Tarif Pelayanan Kesehatan dalam Penyelenggaraan Program Jaminan Kesehatan*. Jakarta.
- Indonesian Nephrologist Association. 2015. *8th Report Indonesia Renal Registry*. http://www.indonesiarenalregistry.org/renal_tabel.php. Diakses 1 April 2017.
- Baboolal K., McEwan P., Sondhi S., Spiewanowski P., Wechowski J., Wilson K. 2008. The cost of renal dialysis in a UK setting—a multicentre study. *Nephrol Dial Transplant* 23 (1): 1989–89.
- Teerawattananon Y., Mugford M., Tangcharoensathan V., 2007. Economic Evaluation of Palliative Management versus Peritoneal Dialysis and Hemodialysis for End-Stage Renal Disease: Evidence for Coverage Decisions in Thailand. *Value in Health*. 10: 61–72.
- United States Renal Data System (USRDS), 2015. *USRDS Annual Data Report*.
- Abu-Aisha, et al., 2010. Peritoneal Dialysis in Africa.
- Karopadi., et al., 2013. "Cost of Peritoneal Dialysis and Haemodialysis Across the World." *Nephrol Dial Transplant* http://www.medscape.com/viewarticle/812610_1. Accessed on January 15th, 2014.
- Noshad, Sadreddini S, Nezami N, Salekzamani Y, and Ardalan M. R., 2009. "Comparison of outcome and quality of life: haemodialysis versus peritoneal dialysis patients." *Singapore Med*. 185-192.
- National Kidney and Urologic Diseases Information Clearinghouse (NKUDIC), 2013. "Kidney Failure: Choosing a Treatment That's Right For You." http://kidney.niddk.nih.gov/kudiseases/pubs/choosing_treatment/. Accessed on January 15th, 2014.
- Prodjosudjadi, and W Suharjono., 2009. "End Stage Renal Disease in Indonesia, Treatment Development." *Ethnicity and Disease*. S1-33,S1-36.
- Philip, 2001. "The Cost Barrier to peritoneal dialysis in the developing world—an asian perspective." *Peritoneal Dialysis International*.
- Peeters P, rublee D, Just PM, Joseph A., 2000. "Analysis and interpretation of cost data in dialysis." *West European Literature, Health Policy*. 54: 209-27.
- Thong, Mellisa SY, and Adrian a Kaptein, 2008. *Quality of life in patients on peritoneal dialysis*. Springer, USA: Nolp and Gokald Textbook on Peritoneal Dialysis.
- Sennfalt, Karin, Martin Magnusson, and Per Carlsson, 2002. "Comparison of Hemodialysis and Peritoneal Dialysis- A Cost Utility Analysis." *Peritoneal Dialysis International*. 22: p39-47.
- Sherwood, Lauralee, 2001. *Fisiologi Manusia dari Sel ke Sistem, Edisi 2*. Jakarta: Penerbit Buku Kedokteran EGC.
- Suhardjono, 2009. "Penyakit Ginjal Kronik adalah Suatu Wabah Baru (Global Epidemic) di Seluruh Dunia." *Annual Meeting Perhimpunan Nefrologi*. Jakarta.