

# Cost-effectiveness of hemodialysis, peritoneal dialysis and kidney transplantation at dr Sardjito General Hospital in 2018-2020

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Received: 2021-09-24  
Accepted: 2021-11-02  
Published: 2021-11-08

## ABSTRACT

**Background:** Chronic kidney disease (CKD) is a non-communicable disease with high morbidity and mortality. Treatment options for CKD patients are kidney transplantation, hemodialysis, and peritoneal dialysis. Kidney transplantation remains the best option for CKD patients, which has the best Quality of Life compared to other therapies. The cost of therapy for CKD patients is relatively high. Even in developed countries, renal replacement therapy costs are still a burden on the health system and a public health problem. Therefore, this study aims to compare the cost of care for CKD patients undergoing kidney transplantation, hemodialysis, and peritoneal hemodialysis at dr. Sardjito General Hospital, Indonesia.

**Methods:** This study was a retrospective cohort study of patients who underwent kidney transplantation, continuous ambulatory peritoneal dialysis (CAPD) or hemodialysis from January 2018 to December 2020 at dr. Sardjito General Hospital. We reviewed the medical records, and the data collected was ordinal, numeric, and categorical data. The data was then coded and processed using SPSS version 25.0. The results are presented in descriptive form, tables, or diagrams.

**Results:** In this study, we found 87 CKD samples. Thirty patients underwent kidney transplantation, 27 patients underwent CAPD, and 30 patients were randomly assigned to undergo routine hemodialysis. Based on the data obtained from this study, the average cost incurred in the first year for patients undergoing kidney transplantation at dr. Sardjito General Hospital amounted to 384.6 million IDR. For CAPD patients, it was 93.7 million IDR, and the average cost for patients undergoing outpatient hemodialysis routinely was 104.1 million IDR. The estimated average cost incurred in the third year after the procedure for kidney transplant patients is 393.7 million IDR, CAPD patients 273.7 million IDR, and patients undergoing routine hemodialysis 307.8 million IDR. The estimated average cost incurred for CKD patients undergoing kidney transplantation was 402.7 million IDR in the fifth year. For CAPD patients was 273.7 million IDR, and for patients undergoing routine hemodialysis was 511.5 million IDR.

**Conclusions:** The results showed a difference in costs between kidney transplantation, CAPD and hemodialysis. The kidney transplant cost is much more expensive than CAPD and hemodialysis, but the monthly cost is much cheaper than the other two procedures. In the third year estimation, the costs incurred for CAPD and hemodialysis will be close to the costs incurred for kidney transplantation. In the fifth year, the costs for kidney transplantation will be smaller than the costs for CAPD and hemodialysis.

**Keywords:** CKD, kidney transplant, CAPD, hemodialysis, cost

**Cite this Article:** Prisnamurti, F.H., Ghinorawa, T., Tranggono, U. 2021. Cost-effectiveness of hemodialysis, peritoneal dialysis and kidney transplantation at dr Sardjito General Hospital in 2018-2020. *IJBS* 15(2): 135-139. DOI: 10.15562/ijbs.v15i2.345

## INTRODUCTION

Chronic kidney disease (CKD) has high morbidity and mortality in the world. Globally in 2017, there were 697 million CKD patients in the world. China and India are the two countries with the most CKD patients, China with 132 million CKD patients and India with 115 million CKD patients. It is estimated that more

than 10 million CKD patients in Indonesia. Globally, CKD has a mortality rate of 1.2 million people in 2017, so that one of the United Nations development goals by 2030 is to reduce deaths from CKD to one-third of the current number of deaths.<sup>1</sup> The treatment options for CKD patients are kidney transplantation, hemodialysis, and peritoneal dialysis. Kidney transplantation remains the best choice for CKD patients,

with the best quality of life results than other therapies.<sup>2</sup>

Based on the 8<sup>th</sup> Indonesian Renal Registry, the number of end-stage kidney disease (CKD) cases in Indonesia increases every year. In 2015, there were 21,050 new cases of kidney dysfunction, of which 89% were categorized as end-stage kidney disease (CKD).<sup>3</sup> The cost of therapy for CKD patients is relatively high. Even in

developed countries, renal replacement therapy costs are still a burden on the health system and a public health problem that requires good regulation.<sup>4</sup> Based on the Indonesian National Health Insurance (BPJS) reported, the costs for hemodialysis (HD) in Indonesia reached 4.61 trillion IDR with 4.66 million IDR hemodialysis procedures spread across all hospitals across Indonesia in 2019.<sup>5</sup>

The BPJS covers costs for kidney transplants of 157 million IDR to 416 million IDR depending on the class of hospital and co-morbidities of kidney transplant patients. BPJS bears the cost of hemodialysis twice a week, each hemodialysis session for 5 hours at the cost of 786 thousand IDR to 982 thousand IDR depending on the hospital class.<sup>5</sup> This study aims to compare the costs paid by CKD patients who undergo kidney transplantation, hemodialysis, and peritoneal hemodialysis at dr. Sardjito General Hospital from 2018 to 2020.

## METHOD

This study was a cohort retrospective study design. The data was taken from the patient medical record dr. Sardjito General Hospital, Yogyakarta, from April 1 to March 31, 2021. This study has been approved by the Ethics Committee, Faculty of Medicine Universitas Gadjah Mada (study number KE/FK/0745/EC/2021).

All patients who met inclusion criteria were included in the study sample. The inclusion criteria consisted of having a medical record, having a clinical diagnosis CKD patients who undergo kidney transplantation, hemodialysis, and peritoneal hemodialysis at dr. Sardjito General Hospital during 2018 to 2020.

The data was collected and then coded and processed using SPSS version 25.0 by comparing the costs of kidney transplantation, continuous ambulatory peritoneal dialysis (CAPD), and hemodialysis. The results are presented in descriptive form, tables, or diagrams.

## RESULTS

In this study, a sample of 87 CKD patients underwent kidney transplantation, CAPD or hemodialysis during the period January 2018 to December 2020 at dr.

Sardjito General Hospital. Thirty patients underwent kidney transplantation, twenty-seven underwent CAPD, and thirty others were randomly assigned to undergo routine hemodialysis (**Table 1**). Based on the payment method, 26 kidney transplant patients used National Health Insurance (JKN) BPJS, while four patients did not use JKN payments. All patients undergoing CAPD procedures at dr. Sardjito General Hospital uses the National Health Insurance (JKN) BPJS. For hemodialysis, there are one private patient and 29 patients using JKN BPJS.

Thirty patients underwent kidney transplantation, the average cost of treatment and surgery for donors and recipients of kidney transplants that must be paid by JKN and patients was 380.1 million IDR. The smallest fee paid for JKN class III was 296.7 million IDR, while the cost for JKN class III was from 296.7 million IDR to a maximum 415.4 million IDR for JKN class I. After kidney transplantation, the patient was routinely monitored at the renal polyclinic of dr. Sardjito General Hospital once every month with an average cost of 377 thousand IDR (**Table 2**).

The cost of installing CAPD that JKN or patients must pay 2.97 million IDR. Seven patients had to undergo revision

or reinsertion of CAPD due to CAPD impotence. The monthly fee for dialysate fluid that JKN must pay 7.5 million IDR. The cost for installing HD catheter was 2.3 million IDR, while the cost of hemodialysis for a month was 8-9 times, which was 8.81 million IDR. The cost for one time for outpatient hemodialysis was 982 thousand IDR for JKN patients and 885 thousand IDR for general patients (**Table 2**).

Based on the data obtained from this study, the average cost incurred in the first year for patients undergoing kidney transplantation at dr. Sardjito General Hospital amounted to 384.6 million IDR, for CAPD patients 93.7 million IDR, and the average cost for patients undergoing routine outpatient hemodialysis was 104.1 million IDR. The estimated average cost incurred in the third year after kidney transplant patients is IDR 393.7 million. For CAPD patients was IDR 273.7 million and for patients undergoing routine hemodialysis was IDR 307.8 million. The estimated average cost incurred for CKD patients undergoing kidney transplantation was 402.7 million IDR in the fifth year. The payment for CAPD patients was estimated at 273.7 million IDR and for patients undergoing routine hemodialysis was 511.5 million (**Table 3; Figure 3**).

**Table 1. The total of CKD patients based on the type of treatment and payment**

Type of treatment	Number (%)	National Health Insurance payment (%)	Private payment (%)
Kidney transplantation	30 (34.5%)	26 (86.7%)	4 (13.3%)
Continuous ambulatory peritoneal dialysis (CAPD)	27 (31.0%)	27 (100.0%)	0 (0.0%)
Hemodialysis	30 (34.5%)	29 (96.7%)	1 (3.3%)

**Table 2. The total cost based on the type of treatment**

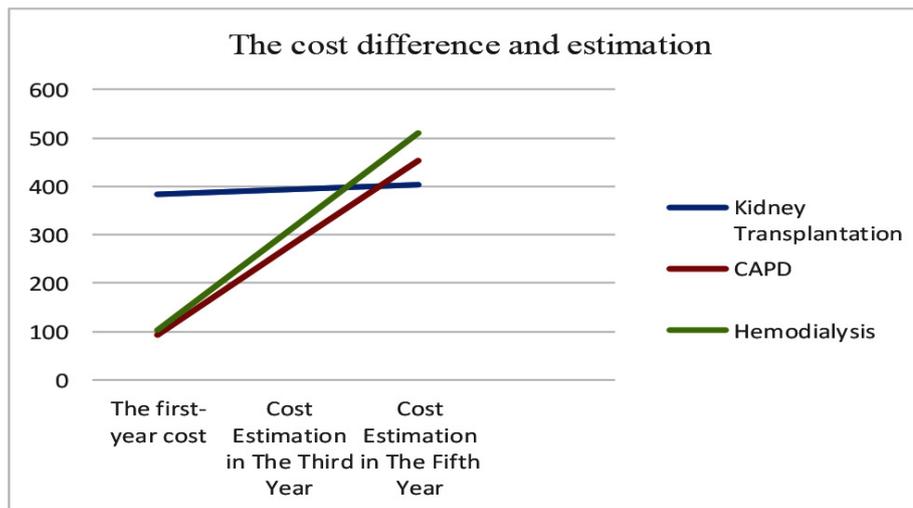
Type of treatment	Number	Average cost*	Minimum cost*	Maximum cost*	Monthly cost*
Kidney transplantation	30	380.1	296.7	415.4	0.38
Continuous ambulatory peritoneal dialysis (CAPD)	27	3.73	2.97	5.93	7.5
Hemodialysis	30	2.3	2.3	2.3	8.81

\*in million IDR

**Table 3. The first-year cost and the estimation for the third and fifth-year cost based on the type of treatment**

Type of treatment	First year cost*	Estimation cost in the third year*	Estimation cost in the fifth year*
Kidney transplantation	384.6	393.7	402.7
Continuous ambulatory peritoneal dialysis (CAPD)	93.7	273.7	453.7
Hemodialysis	104.1	307.8	511.5

\*in million IDR

**Figure 1.** The cost difference and estimation in the third and fifth year.

Data distribution and normality analysis using the Kolmogorov-Smirnov test showed that the data distribution was not normal, so we used nonparametric statistics with the Kruskal-Wallis test. Analysis using the Kruskal-Wallis Test found a significant difference between the cost of kidney transplantation, CAPD and hemodialysis ( $p=0.001$ ).

## DISCUSSION

Chronic kidney failure is still a health problem in developed and developing countries that burdens the health insurance system. The definition of CKD is damage to the kidneys for more than three months which causes the Glomerular filtration rate (GFR) to be less than 60 mL/min/1.73 m<sup>2</sup>. The most common causes of CKD are diabetes mellitus (44.4%), hypertension (26.8%), glomerulonephritis (7.2%), cystic kidney disease (2.4%), urological abnormalities (1.5%), and other factors (16.8%). In patients younger than 40 years,

the most common causes of CKD are focal segmental glomerulosclerosis (FSGS), systemic lupus erythematosus (SLE), and congenital urinary tract abnormalities.<sup>6</sup> Treatment for patients with CKD is renal function replacement therapy, which consists of hemodialysis, peritoneal dialysis, and kidney transplantation.<sup>7</sup>

Kidney transplantation is the best option in renal function replacement therapy because it can improve long-term survival and quality of life. Several studies have shown that kidney transplant recipients have a lower risk of death and cardiovascular disease than undergoing routine dialysis, both hemodialysis and peritoneal dialysis.<sup>8</sup>

As one of the national referral hospitals, dr. Sardjito General Hospital has started kidney transplant services since 1991. Until the end of 2020, dr. Sardjito General Hospital has performed kidney transplant services in more than 70 cases. Patients treated at dr. Sardjito General Hospital

comes from Yogyakarta and serves referrals from various regions throughout Indonesia.<sup>9</sup>

From 2018 to 2020, 30 patients underwent kidney transplantation at dr. Sardjito General Hospital, all donor's kidneys come from living individuals. All procedures for kidney donor nephrectomy were carried out laparoscopically by the urology consultant, while kidney implantation surgery was performed by open surgery.<sup>9</sup>

Postoperative care for the recipient is carried out in the intensive care unit (ICU) until the patient's condition is stable and suitable for transfer to the standard care room. Patient care is carried out comprehensively involving the urology department, the nephrology department of internal medicine, the anesthesiologist, the radiology department, the clinical pathology section and other departments as needed.<sup>9</sup>

Of the 30 patients who underwent kidney transplantation at dr Sardjito General Hospital from 2018 to 2020, four patients used general financing and 26 patients who used JKN BPJS financing with details of 17 patients with class I, three patients with class II and six patients in class 3. The financing that must be paid by the patient or JKN BPJS for both donors and recipients of kidney transplantation for general, class I, class II, and class III financing, respectively, was 369.1 million IDR, 415.4 million IDR, 369.1 million IDR, and 296.7 million IDR. Furthermore, renal recipient patients will have regular check-ups at the renal polyclinic once a month with an average monthly cost of 377 thousand IDR. The average cost paid in the first year for kidney transplant patients is 384.6 million IDR. The estimated average cost paid in the first three years is 393.7 million IDR. The estimated average cost paid in the first five years is 402.7 million IDR. Transplant costs at dr. Sardjito General Hospital is cheaper than the research results by Roselli et al. in Colombia in 2012, where the cost of kidney transplantation in the first five years reached more than one billion IDR for each patient.<sup>10</sup>

Marbun et al. in 2018 investigated the patient survival rate and graft survival rate in post-kidney transplant patients at dr.

Cipto Mangunkusumo General Hospital Jakarta found that the 1-year survival rates for grafts and patients were 92% and 87%, while the 3-year survival rates for grafts and patients were 90.6% and 79.7%, respectively.<sup>11</sup> Data on graft and patient survival rates at dr. Sardjito General Hospital has not yet had in this research.

The process of peritoneal dialysis requires the installation of a peritoneal catheter. The most commonly used peritoneal catheter for peritoneal dialysis is the Tenckhoff catheter. Tenckhoff catheter placement can be done by open surgery, laparoscopically, and percutaneously.<sup>12</sup> dr Sardjito General Hospital has carried out CAPD measures since 1995. From 2018 to 2020, there were 27 new cases of CKD patients whom CAPD carried out at dr. Sardjito General Hospital. Installation of the Tenckhoff Catheter with the laparoscopic technique has been carried out since 2015. There have not been many studies on the effectiveness of the laparoscopic technique and open surgery on installing a Tenckhoff catheter for peritoneal dialysis.<sup>13</sup>

After installing the CAPD, the patient will be checked once a month to the renal polyclinic to evaluate the Tenckhoff catheter and take 120 dialysate fluids for one month. The cost to be paid by JKN BPJS for the installation of CAPD is 2.97 million IDR and a maximum of 5.93 million IDR. If there is a revision or repair of the Tenckhoff Catheter, the monthly routine costs of control patients at the renal polyclinic (including dialysate fluid) was an average of 7.5 million IDR.

The average funding for patients undergoing CAPD at dr. Sardjito General Hospital that JKN BPJS must pay in one year is 93.7 million IDR, so the estimated average cost to be paid in the third and fifth years was 273.7 million IDR and 453.7 million IDR. This estimation was slightly different from the research conducted by Novelia et al. in 2019, where the annual fee to be paid by JKN BPJS for CAPD patients is 81.7 million IDR.<sup>14</sup> This condition was caused by the different types of hospitals between dr. Sardjito General Hospital with several hospitals studied in the study.

Kohar researched the survival rate of CKD patients undergoing CAPD at dr. Sardjito General Hospital in the

period 2007 to 2011. That study showed the average survival rate of patients undergoing CAPD was 40.26 months, with survival rates in the third and fifth years of 65% and 42%, respectively.<sup>13</sup>

Hemodialysis is the most common type of CKD treatment compared to other types of therapy, such as peritoneal dialysis and kidney transplantation. Financing expenditures for routine hemodialysis are a significant burden on the national health system (JKN BPJS).<sup>15</sup>

Hemodialysis is routinely carried out using an HD catheter at dr. Sardjito General Hospital. The average cost of installing an HD catheter is 2.3 million IDR. Patients with CKD undergo routine hemodialysis twice a week, with a hemodialysis cost of 982 thousand IDR for JKN BPJS patients and 885 thousand IDR for general patients. So that the financing to be paid in one year is 104.1 million IDR, the estimated average cost to be paid in the third year and fifth year is 307.8 million IDR and 511.5 million IDR. This estimation was not much different from the research conducted by Novelia et al. where the annual fee to be paid by JKN BPJS for hemodialysis patients at various hospitals in Bogor and Jakarta is 102 million IDR.<sup>14</sup>

The analysis showed a significant difference in the total costs in the first year between kidney transplantation, CAPD and hemodialysis. A kidney transplant is much more expensive than the cost of CAPD and hemodialysis, but the cost per month is much cheaper than the other two procedures. In the third year estimation, the costs incurred for CAPD and hemodialysis will be close to the costs incurred for kidney transplantation. In the fifth year, the costs for kidney transplantation will be smaller than the costs for CAPD and hemodialysis.

This study did not consider the costs incurred as a result of CKD patients undergoing routine hemodialysis requiring hospital treatment or other examinations or actions and did not consider the costs incurred by patients to come routinely twice a week to the hospital so that the cost of a kidney transplant will be far more profitable than undergoing hemodialysis.

## CONCLUSIONS

The results showed that there was a difference in costs between kidney transplantation, CAPD and hemodialysis. The cost of a kidney transplant is much more expensive than the cost of CAPD and hemodialysis, but the cost per month is much cheaper than the other two procedures. In the third year estimation, the costs incurred for CAPD and hemodialysis will be close to the costs incurred for kidney transplantation. In the fifth year, the costs for kidney transplantation will be smaller than the costs for CAPD and hemodialysis.

## DISCLOSURE

### Author Contribution

FHP contributed in making concept and design, searching the literature, conducting the research, and preparing the manuscript. TG and UT contributed in defining the intellectual content and reviewing the manuscript. TG conducted as guarantor.

### Conflict of Interest

All authors stated no conflict of interest regarding conducting the research and publishing the manuscript.

### Funding

All authors stated no external funding or grants funded this research.

## REFERENCES

1. Bikbov B, Purcell CA, Levey AS, Smith M, Abdoli A, Abebe M, et al. Global, regional, and national burden of chronic kidney disease, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2020;395(10225):709–33.
2. Liyanage T, Ninomiya T, Jha V. Worldwide Access to Treatment for End-Stage Kidney Disease: A Systematic Review. *J Vasc Surg*. 2015;62(4):1089. Available from: <http://dx.doi.org/10.1016/j.jvs.2015.08.003>
3. Indonesian Nephrologist Association. 8th Report Indonesia Renal Registry [Internet]. Jakarta; 2015. Available from: [http://www.indonesiarenalregistry.org/renal\\_tabel.php](http://www.indonesiarenalregistry.org/renal_tabel.php)
4. YaghoubiFard S, Goudarzi R, Etminan A, Baneshi M, Barouni M, Sirizi MJ. Cost-effectiveness analysis of dialysis and kidney transplant in patients with renal impairment using disability adjusted life years in Iran. *Med J Islam Repub Iran*. 2016;30:390.
5. Kementerian Kesehatan. Permenkes No. 52 Thn. 2016 tentang Standar Tarif Pelayanan

- Kesehatan dalam Penyelenggaraan Program Jaminan Kesehatan. Indonesia; 2016.
6. Rahn KH, Heidenreich S, Brückner D. How to assess glomerular function and damage in humans. *J Hypertens*. 1999;17(3):309–17. Available from: <http://dx.doi.org/10.1097/00004872-199917030-00002>
  7. Marbun MBH, Umami V, Susalit E. A 3-year survival rate of kidney transplant recipient in Cipto Mangunkusumo General Hospital in Indonesia. *J Ren Med*. 2017;1(2):1–5.
  8. Adekoya AO, Halawa A. Kidneys from deceased elderly donors: Factors associated with adverse outcomes. *Exp Clin Transpl*. 2016;14(1):32–7.
  9. Fatihah AZ, Andayani TM, Yasin NM. The Short Form-6 Dimension (SF-6D) Validity and Reliability in Hemodialysis Patients. *J Farm DAN ILMU KEFARMASIAN Indones*. 2021;8(2):150–5.
  10. Rosselli D, Rueda J-D, Diaz C. Cost-effectiveness of kidney transplantation compared with chronic dialysis in end-stage renal disease. *Saudi J Kidney Dis Transplant*. 2015;26(4):733. Available from: <http://dx.doi.org/10.4103/1319-2442.160175>
  11. Marbun MBH, Susalit E, Umami V. 7 years experience of living donor kidney transplantation in Indonesia: a retrospective cohort study. *Acta Med Indones*. 2018;50(2):119–24.
  12. Bircan HY, Kulah E. Effects of a Novel Peritoneal Dialysis: The Open Versus Laparoscopic Preperitoneal Tunneling Technique. *Ther Apher Dial*. 2015;20(1):66–72. Available from: <http://dx.doi.org/10.1111/1744-9987.12377>
  13. Kohar MA, Danarto HR. Survival analysis of continuous ambulatory peritoneal dialysis on patients with end stage renal disease in Sardjito Hospital period 2007-2011. *Indones J Urol*. 2018;25(2). Available from: <http://dx.doi.org/10.32421/juri.v25i2.399>
  14. Novelia E, Nugraha RR, Thabrany H. Cost Effectiveness Analysis Between Hemodialysis and Peritoneal Dialysis. *J Ekon Kesehat Indones*. 2017;1(3). Available from: <http://dx.doi.org/10.7454/eki.v1i3.1776>
  15. Kristinia S, Santoso K. An Estimated Mortality and Disability Adjusted Life Years (DALYs) of Non-communicable Diseases in Indonesia. *Int J Pharm Res*. 2020;12(sp2):3040–5. Available from: <http://dx.doi.org/10.31838/ijpr/2020.sp2.370>



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