


ORIGINAL ARTICLE

Filtering for the best policy: An economic evaluation of policy options for kidney replacement coverage in the Philippines

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Abstract

Aim: Kidney failure patients in the Philippines have free choice on their kidney replacement therapy (KRT), with a majority choosing haemodialysis (HD) over peritoneal dialysis (PD) and transplantation despite the inadequate coverage of HD. Although national health insurance coverage is limited, KRT remains to be one of the top benefits payouts in the country. The study aims to identify the most cost-effective policy strategy for financing KRT in the Philippines, in the context of a universal healthcare policy.

Methods: A Markov model was developed to estimate and compare the costs and benefits of different policy options with the comparator being partial HD coverage. Direct medical, non-medical and indirect costs were measured, while outcomes were reported through quality-adjusted life years (QALYs). Parameters were derived from the kidney disease registry, hospital statistics from a tertiary hospital and a patient survey.

Results: The results of the cost-effectiveness analysis showed that shifting to a PD-First policy provides better value-for-money with an incremental cost-effectiveness ratio (ICER) of 570 029 Philippine Pesos (PHP) per QALY gained, compared with the ICER of the PD-First combined with pre-emptive transplant option of 577 989 PHP per QALY gained. Expanding existing HD coverage to 156 sessions was the least cost-effective policy (1 522 437 PHP per QALY gained).

Conclusion: Government should consider shifting to a PD-First strategy and support policies that promote kidney transplants among existing PD and HD patients. This study also highlights the need for proper evaluation of partial coverage policies to ensure that government investments represent good value-for-money and patients receive optimal care.

KEYWORDS

economic evaluation, end-stage kidney disease, haemodialysis, peritoneal dialysis, transplantation

The study was conducted while the primary author was in the Department of Health Philippines. She is now presently affiliated with the National University of Singapore.

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Kidney failure (KF) is a catastrophic illness that affects morbidity and mortality and brings about significant financial burden in both high- and low-income countries.¹ Several options for kidney replacement are available, such as transplantation, haemodialysis (HD) and peritoneal dialysis (PD); however, access remains limited due to a range of social, economic and health system factors.² It was estimated that 2.284 million premature deaths worldwide in 2010 are due to the lack of access to any kidney replacement therapy (KRT).³ A larger treatment gap was seen in low-income countries, particularly in Asia, where around 1.907 million patients need KRT but are unable to receive it. In the Philippines, KF is seen as one of the most burdensome conditions as it is the second largest expense of the national health insurance agency, the Philippine Health Insurance Corporation or PhilHealth⁴ and is often a source of out-of-pocket health expenditure among households. By the end of 2016, there were 36 247 patients on dialysis in the country,⁵ an increase of 15% from the previous year. The number of patients who have KF but are not receiving any form of dialysis remains unknown.

While a kidney transplant is considered the best option for KF patients, donor kidneys are not readily available, and the cost of post-surgery monitoring and immunosuppression therapy is limiting for most. Patients who are ineligible or are on the waiting list for transplant have to resort to dialysis, where the choice depends on both patient and system level factors such as age, comorbidities, availability, affordability and even personal preferences.⁶ Majority of patients in the Philippines are on centre-based HD (94%), while 4% are on continuous ambulatory peritoneal dialysis. Only 2% of KF patients are able to get kidney transplants. PhilHealth currently supports funding for all three modalities but at different levels of coverage (see Appendix S1). The inadequate coverage of 90 sessions of HD annually assumes that patients are able to bear the cost of the remaining sessions needed. However, current practice shows that more than half (52.76%) of the patients undergo dialysis twice weekly or less, to spread out the allocation of 90 sessions each year, resulting in sub-optimal outcomes. Most patients still choose HD despite the higher coverage for PD.

Several countries have implemented “PD-First” or “PD-favoured” policies wherein use of PD as first modality of choice for KF patients is encouraged or incentivized. This is due to the growing body of evidence that PD is more cost-saving compared with centre-based HD.⁷ Reflections from Hong Kong and Thailand's experience suggest that collecting necessary economic evidence is critical when developing a national dialysis coverage policy.⁸ As of June 2020, there are over 20 pending bills in the 18th Congress of the Philippines seeking to expand the coverage of HD from 90 to 156 sessions (assuming three sessions per week, per year) and establish a dialysis centre in each government hospital. Given PhilHealth's limited budget, it is unclear whether expanding the coverage of HD to 156 sessions would be affordable and sustainable. As such, it is the objective of this study to determine the cost effectiveness, from a government purchaser and societal perspective, of different kidney replacement coverage policies to inform future coverage expansion decisions of PhilHealth and ongoing pieces of legislation related to KRT. This is in line with the

SUMMARY AT A GLANCE

This article aims to identify a cost-effective policy strategy for access to kidney replacement therapy in the Philippines, and calls on the government to consider shifting to a Peritoneal Dialysis (PD)-First strategy and support policies that promote kidney transplants among existing PD and haemodialysis patients.

Universal Health Care Law enacted in February 2019⁹ that requires a review of the health benefits package using health economic evaluation and health technology assessment (HTA).

1 | METHODS

This study utilized economic evaluation methods, specifically, a cost-utility analysis, which is defined as a comparative analysis of alternatives, in terms of both their costs and outcomes (presented in quality-adjusted life years [QALY]).¹⁰ The alternatives being compared are the options for covering KRT vs the current scenario where a vast majority are on twice-weekly HD or less, which is deemed inadequate. These are shown in Table 1. The choice of the policy options evaluated was based on a series of consultations with relevant stakeholders. Costs of each strategy are estimated, relative to their benefits, which are identified as patient survival and quality of life.

A Markov model in Microsoft Excel was developed to simulate a hypothetical cohort of adult KF patients going through different states reflecting treatment options, considering the probability of switching from one modality to the other, complications from PD and HD, survival from each modality and possible graft loss after transplantation. The model was adapted from Teerawattananon et al,¹¹ which was developed to compare an HD-first with a PD-first policy in the Thai context. Although this model has a similar structure, the main difference is the addition of a pre-emptive transplant state, an option highly recommended^{12,13} but rarely evaluated together with dialysis options. A schematic of the model is seen in Figure 1. Only adult chronic KF patients needing KRT are considered in the model; hence, paediatric patients and those with acute kidney injury are excluded. The base-case population is 52 years, which is the mean age of adult patients with KF in the Philippines.⁵ All patients are also assumed to undertake either of the three modalities, as palliative care alone is rarely preferred since KRT is covered by PhilHealth. Patients can switch between each dialysis modality and can undergo a transplant pre-emptively or after being on dialysis. For simplicity, we assume that patients can only undergo a transplant once in their lifetime, and then progress to the post-transplant state where they take immunosuppressants for a lifetime or until they require dialysis as a result of chronic graft loss.

The study took two perspectives: the government purchaser (PhilHealth), which takes into account only the direct medical costs, and societal perspective which includes non-medical costs such as travel, meals and caregiver expenditure. Productivity losses were excluded due to the wide variation in income estimates. Relevant costs and outcomes per health state are estimated and modelled for a

lifetime (99 years) considering the treatment duration of dialysis and immunosuppression post-transplant. Both costs and health outcomes were discounted at an annual rate of 3%, as recommended by draft HTA guidelines at the time the study was conducted.

Effectiveness of the policy strategies were measured in terms of treatment-specific survival and quality of life, factoring the distribution of patients per option. Treatment survival data per modality was obtained from the Philippine Renal Disease Registry and the National Kidney and Transplant Institute (NKTi). NKTi is the national referral tertiary facility for kidney disease and has the largest volume of KF patients in the country. Key distribution parameters and rates of complications were obtained from the same hospital. We assumed similar efficacy in terms of survival for PD and adequate HD for the model and used the survival data for twice-weekly HD patients for the status quo option. This assumption is consistent with other evaluations of the same interventions.^{11,14,15} The 2-year aggregate survival data from the hospital were modelled using exponential distribution to estimate annual cumulative survival and death risk for twice- and thrice-weekly HD, PD and transplant patients. In addition to the registry and hospital data, a cross-sectional survey using the EuroQol 5D-5L tool¹⁶ was conducted from March to April 2019 among 262 KF patients. The survey was administered to eligible adult patients in NKTi who have been on their current modality (post-transplant, HD or PD) for at least 3 months, to get an estimate of health utility per modality. Utility scores were calculated using the Philippines' EQ-5D-5L value set.¹⁷

In terms of estimating costs and resources used, annual costs per health state were taken from three main sources. First, current coverage rates were obtained from PhilHealth's published case rates as of 2015. This reflects the actual amount paid for by the national health insurance agency, which was used to model the costs of the status quo option. Second, costs used for adequate HD, PD-First and pre-emptive transplant policies were taken from the prevailing unit costs used in NKTi, which were estimated through a micro-costing exercise. Rates of peritonitis and vascular access-related conditions were factored in the costing. Because the differences in initiation costs for HD (eg, vascular access surgery) and PD (catheter insertion procedure) were minimal and were incurred only in the first year of treatment,

TABLE 1 Policy options compared

Policy option	Description
Status quo (main comparator)	This scenario assumed that 94% of patients are on haemodialysis (HD) but only 90 sessions are covered. 4% will utilize peritoneal dialysis (PD) that is fully covered by PhilHealth for an entire year, while only 2% undergo a transplant. Those who survive the transplant surgery receive immunosuppressive therapy but is not covered by PhilHealth.
Adequate HD	The adequate option assumed a similar distribution of patients in the status quo, but with an increase in the number of HD sessions provided. This assumed that PhilHealth expands coverage to 156 sessions per year to provide treatment thrice a week and covers the full cost of immunosuppressive therapy.
Peritoneal dialysis-first	The PD-First policy assumed that a 11% of the population are medically contraindicated for PD (eg, obese, history of abdominal surgery, cognitive disabilities, etc.) and are given HD. All eligible patients (87%) are given PD as initial mode. Similarly, 2% undergo a transplant based on similar assumptions from the status quo and adequate HD policy.
PD-First + Pre-emptive transplant	This scenario assumed that 10% are given a kidney transplant upon diagnosis of KF without having undertaken any form of dialysis, while remaining patients are provided with PD, except those with contraindications.

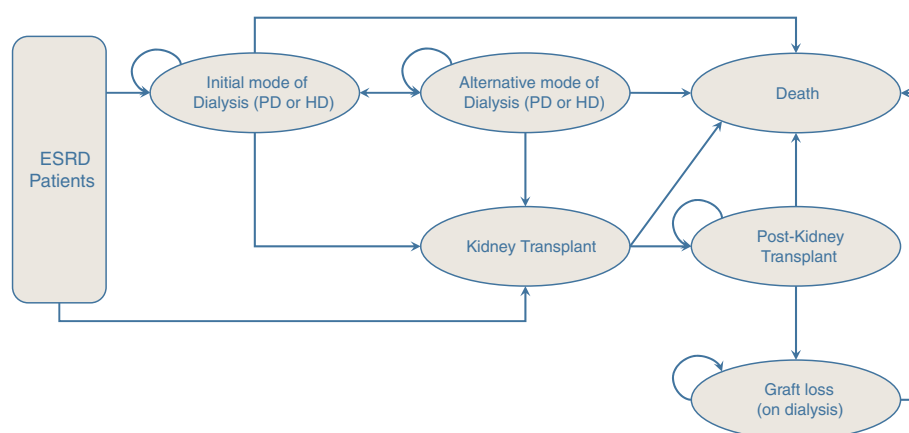


FIGURE 1 Markov model schematic

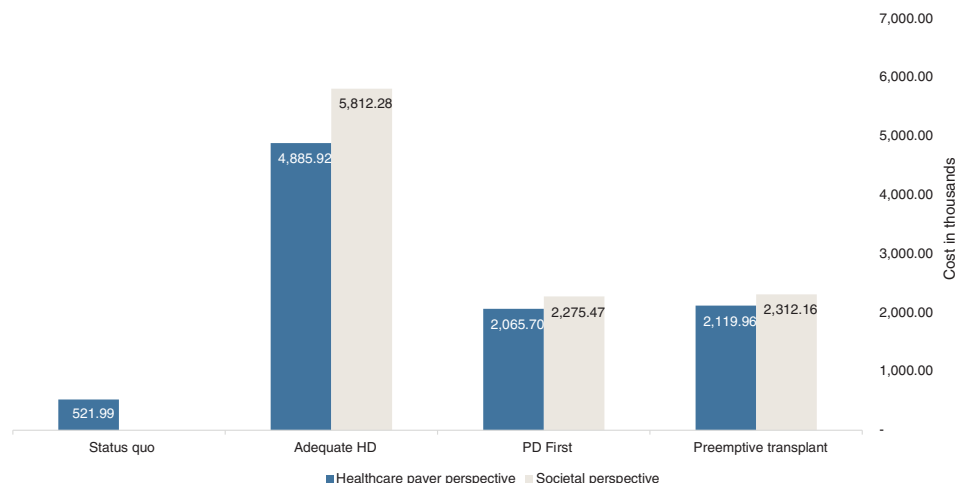
TABLE 2 Input parameters in the economic evaluation

Parameter	Mean	SE	Distribution	Source
Transition probabilities				
Probability of switching from haemodialysis (HD) to peritoneal dialysis (PD)	0.004	0.004	Beta	National Kidney and Transplant Institute (NKTi) ¹⁸
Probability of switching from PD to HD	0.053	0.013	Beta	NKTi ¹⁸
Probability of having a transplant among dialysis patients	0.025	0.010	Beta	NKTi ¹⁸
Probability of dying from transplant surgery	0.012	0.010	Beta	NKTi ¹⁸
Probability of graft loss	0.005	0.004	Beta	Renal Disease Registry ⁵
Survival				
HD survival rate (twice weekly, year 1)	0.536			NKTi ¹⁹
HD survival rate (twice weekly, year 2)	0.460			NKTi ¹⁹
PD survival rate (year 1)	0.820			NKTi ¹⁹
PD survival rate (year 2)	0.810			NKTi ¹⁹
KT survival rate (year 1)	0.987			NKTi ¹⁹
KT survival rate (year 2)	0.935			NKTi ¹⁹
Costs (in Philippine Pesos)				
Annual direct medical cost of HD	562 307.64	562 307.64	Gamma	NKTi ²⁰
Annual direct medical cost of PD	235 614.00	235 614.00	Gamma	NKTi ²⁰
Direct medical cost of kidney transplant surgery	1 235 653.95	1 235 653.95	Gamma	NKTi ²⁰
Annual societal cost of HD	655 907.64	655 907.64	Gamma	Patient Survey
Annual societal cost of PD	250 014.00	250 014.00	Gamma	Patient Survey
Annual post-transplant maintenance cost	462 845.83	462 845.83	Gamma	NKTi ²⁰
Societal cost of post-transplant maintenance	465 245.83	465 245.83	Gamma	Patient Survey
PhilHealth reimbursement rate for HD for 1 year	234 000.00	234 000.00	Gamma	PhilHealth case rates ²¹
PhilHealth reimbursement rate for PD for 1 year	270 000.00	270 000.00	Gamma	PhilHealth case rates ²²
PhilHealth reimbursement rate for transplant surgery	600 000.00	600 000.00	Gamma	PhilHealth case rates ²³
Utilities				
Post-kidney transplant	0.911	0.016	Beta	Patient Survey
Twice weekly haemodialysis	0.667	0.041	Beta	Patient Survey
Thrice weekly haemodialysis	0.697	0.035	Beta	Patient Survey
Peritoneal dialysis	0.779	0.025	Beta	Patient Survey
Others				
Discount rate for costs	0.030			Department of Health ²⁴
Discount rate for outcomes	0.030			Department of Health ²⁴

these were excluded from the estimates of direct medical costs. A panel of experts was convened prior to the conduct of the study to validate all model assumptions and input parameters. The experts agreed to use NKTi's resource utilization as a reference as it is seen as a standard for efficiency and quality for renal care in the country. Lastly, non-medical and indirect costs were obtained through an additional questionnaire from the same respondents of the EQ-5D-5L survey. All costs were estimated in 2019 Philippine Pesos (PHP). PhilHealth Case Rates are from 2015; however, these were not adjusted for inflation since these still reflect the current coverage rates at present. All input parameters used in the study are presented in Table 2.

The cost effectiveness of each policy option is presented as an incremental cost-effectiveness ratio (ICER), which is the ratio of the difference between costs and outcomes of a policy strategy (eg, PD-First) and the status quo. Deterministic and probabilistic sensitivity analysis were conducted to account for structural and parameter uncertainty. A Monte Carlo simulation was conducted where transition probability, cost and utility parameters were assigned a probability distribution and a random estimate was selected for 10 000 iterations.²⁵ The ICER for each simulation was compared against a ceiling threshold value and presented in a cost-effectiveness acceptability curve. Although there is no explicit threshold in the Philippines, it was recommended by the HTA Council of the Department of

FIGURE 2 Total lifetime cost per patient for each policy option



Health to use 150 000 PHP per QALY as a guide for considering value for money of health interventions.

Given that the main user of this study was the national social health insurance agency, PhilHealth, a budget impact analysis was conducted to estimate the projected impact of choosing the most cost-effective policy option. The budget impact was calculated for a cohort of patients for a 10-year period.

2 | RESULTS

From 262 participants, 45 were transplant patients, 105 were on PD and 112 were on HD. HD patients were further disaggregated between those who undergo twice- and thrice-weekly sessions. Patients on twice-weekly HD had a shorter life-expectancy compared with patients on PD and kidney transplant. In terms of quality of life, post-transplant patients reported a significantly higher health utility (0.91, 95% confidence interval [CI]: 0.88-0.94) compared with HD (0.68, 95% CI: 0.63-0.74) and PD (0.78, 95% CI: 0.73-0.83) patients. A Tobit regression analysis showed that the number of comorbidities is an independent and significant predictor of health utility.

The estimated total annual medical cost per patient for the first year is highest for kidney transplant due to the cost of the surgery. However, when survival is considered, providing adequate HD is most expensive among all the options (see Figure 2). Cost estimates from a societal perspective showed that the direct non-medical costs are highest for HD since patients visit the dialysis centre or hospital more frequently, thus spending higher on transportation and meals. On the other hand, PD and transplant patients had similar mean non-medical expenses. The survey also showed that almost all patients seek dialysis treatment with a caregiver, usually a family member or friend who is unpaid. Although the study did not account for productivity losses, it is expected that this will drive the societal cost for HD upward due to the time lost during treatment (at least 12 hours per week) for both patients and their caregivers.

In terms of cost effectiveness, all the policy options are well above the threshold of 150 000 PHP. However, when compared

across the three policies vs the status quo, shifting to a PD-First policy provides the best value for money to PhilHealth with an ICER of 570 029 PHP per QALY gained, compared with the PD-First option with pre-emptive transplants with an ICER of 577 989 PHP per QALY gained, and to the adequate HD policy of expanding to cover 156 sessions, as it has an ICER of 1 522 437 PHP per QALY gained, making it the least cost effective strategy. This expanded HD policy can be described as a dominated intervention, as it has worse outcomes compared with the other options and comes at a significantly higher cost.

The budget impact analysis where a cohort of patients was followed for 10 years showed that expanding to thrice weekly HD would cost PhilHealth more than twice the total cost of the current policy, whereas shifting to PD-First and PD-First with more transplants would entail an increase of 11% and 43% of the total cost, respectively (see Figure 3). The figure also shows that while maintaining the status quo is the cheapest option, it provides the worst outcomes as most patients would remain on twice-weekly HD and have poor survival.

The cost-effectiveness acceptability curve (Figure 4) represents the probability of each policy strategy being good value-for-money based on different threshold values. At the current threshold of 150 000 PHP, PD-First policy is the most favoured option. However, if the government had a higher willingness to pay, incentivizing more transplants together with PD-First has a higher probability of being cost effective.

3 | DISCUSSION

This study is the first comprehensive evaluation of costs and outcomes associated with kidney replacement provision and financing in Philippine setting. The results of the survival analysis extrapolated to a lifetime horizon proved that patients on twice-weekly HD had poorer outcomes compared with those on PD, and even among HD patients who receive three sessions weekly. When compared regionally, Indonesian and Thai HD patients lived longer than Philippine patients by 5.22 years and 12.9 years, respectively.^{11,14} However, in terms of

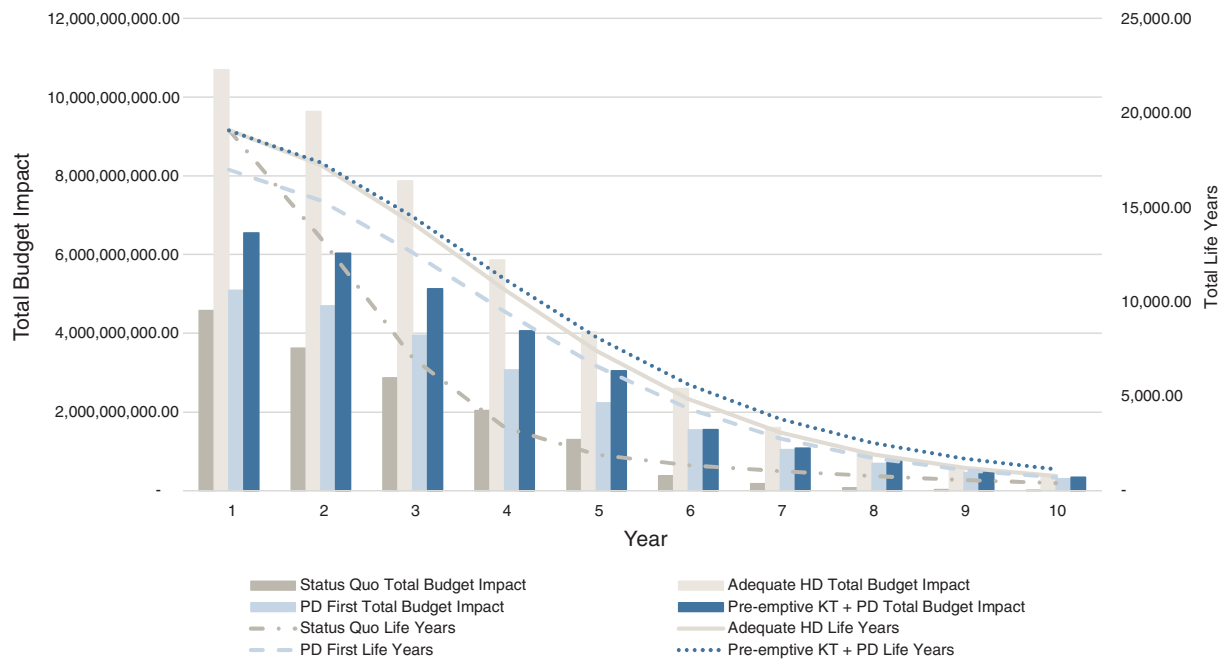


FIGURE 3 Ten-year budget impact for a single cohort of patients

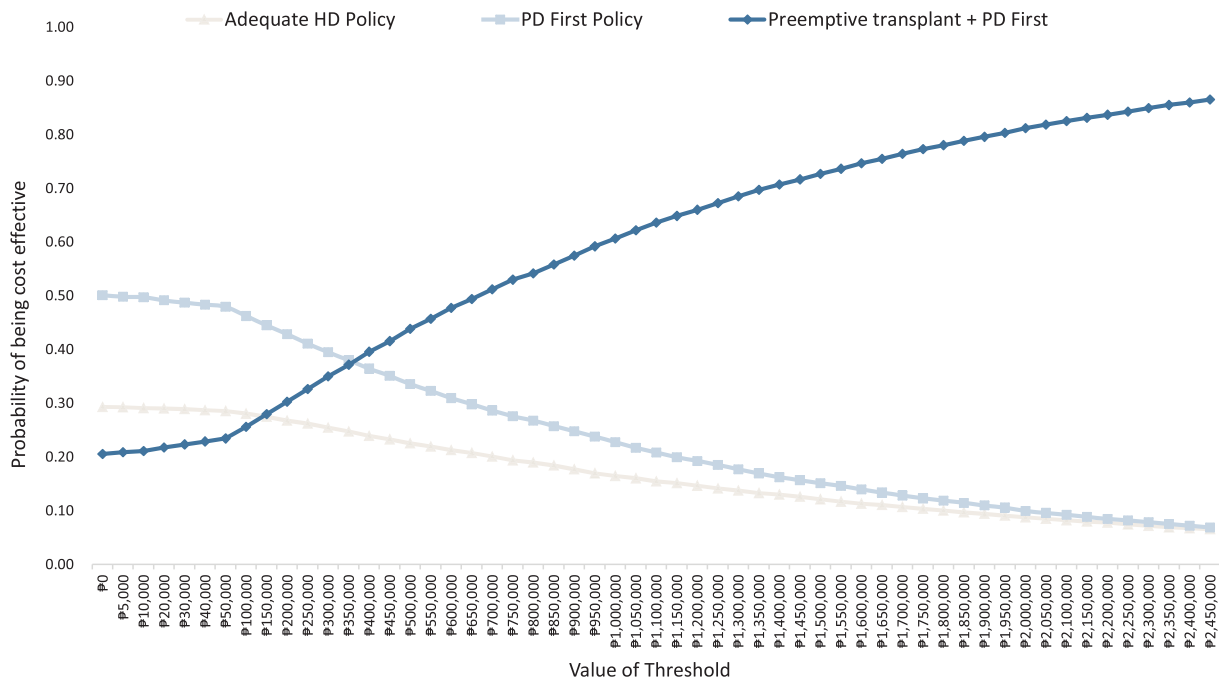


FIGURE 4 Cost-effectiveness acceptability curve

quality of life, there was no significant difference between PD, twice-weekly and thrice-weekly HD patients. Utility values for all modalities were highly dependent on the number of comorbidities each patient had. When looking at costs, it is unsuitable to look only at the annual cost of each option without considering long-term survival. Kidney transplantation would have the highest total cost in the first year but

would eventually decline in succeeding years. In contrast, dialysis costs are consistently high and would decline only depending on modality-specific survival. When all variables are considered, ICER results showed that none of the options were cost-effective when compared against the country threshold, but with the PD-First policy option having the lowest ICER among all coverage options.

Findings from this study showed similar results to evaluations done in Thai and Indonesian contexts, albeit with slightly different comparators. When looking at cost effectiveness alone, all showed that covering kidney replacement is not cost effective when compared against a country-specific threshold value. This is mainly due to the high cost and long duration of treatment, with most patients needing dialysis for the rest of their life, or until they undergo transplantation. This highlights the need to promote better primary health-care services, especially in the context of universal coverage, to prevent patients from reaching the end stage and utilizing more public resources. However, even with a well-functioning primary care system, some patients will inevitably do so, thus, making it necessary for governments and national health insurance agencies such as PhilHealth to be strategic with how kidney replacement modalities are funded. Further, given that PhilHealth already covers dialysis for over 36 000 patients at present, it may be impossible to disinvest from it. This shifts the question to determining which strategy is optimal, considering the existing coverage and the current distribution of patients who are already on dialysis. With this framing, this study showed that expanding HD alone is not only very expensive to the health system, but also poses significant financial burden on the patients and their families. The existing coverage of 90 sessions per year implies that patients are able to pay out-of-pocket for the remaining 66 sessions, but the data show that more than half are unable to afford it, hence, resorting to a twice weekly treatment schedule or less, which may be deemed inadequate. This inadequate coverage policy also worsens the inequity of service provision as mostly formal sector members of the national health insurance program have the ability to pay for the remaining sessions and are thus able to achieve better health outcomes.

Shifting to PD-First is seen as a challenging political process as there are many other barriers and facilitators that influence the patient's choice of KRT, many of which were not explored in this economic evaluation. From a health service planner perspective, PD may seem to pose less burden on the system as it requires less visits to the clinic and it can be done at home, making it a preferred option especially for an archipelagic country like the Philippines where geographic access to health care remains to be a problem. Setting up more freestanding HD centres require large capital investment on machines and the needed infrastructure. This is particularly difficult for far-flung areas and poorer provinces, and is evident by the current distribution of HD centres which are mostly located in highly urbanized cities. However, it must be emphasized that incentivizing PD does not mean eliminating HD completely, as we recognize that these modalities, including transplant, are complementary. The policy needs to be crafted with the proper incentives and a safety net for patients who are unable to shift to PD. The experience of Thailand showed that the need for HD did not decline even after implementing a PD-First policy since the access to PD increased, and many of these patients were required to shift when they developed complications. We recommend a gradual shift to PD, starting with newly diagnosed patients who are unable to get a transplant immediately. Existing HD patients are encouraged to shift when possible, otherwise, those with

medical contraindications to PD should be given full HD coverage of 156 sessions per year. The government should also consider negotiating for lower prices of PD solutions and immunosuppressive medications to lower the overall cost of PD and kidney transplants as they contribute to 89% and 82% of PD and transplantation cost, respectively. Lastly, updating existing policies and programs to promote better organ donation is suggested, to increase the supply of kidney donors and make kidney transplantation the primary choice of new patients.

This study is the first model-based economic evaluation in the country that used all local data for its input parameters, including a newly developed EQ-5D-5L value set for the Philippines. It also utilized a wide range of real-world data sources, from a national registry and hospital records, to claims database, and patient reported outcomes through the quality of life survey. Another strength is the inclusivity and transparency that was upheld during the evaluation process, where multiple stakeholders such as decision makers, nephrologists, epidemiologists, health economists, patient groups and even industry representatives participated and provided input to the study goals and overall methodological framework throughout the conduct of the research. Stakeholder buy-in was crucial to foster acceptability and better implementation of the findings.

Given these, the study is not without limitations. Some of the survival data, cost and quality of life inputs were taken from a single facility, the NKTl. Although patient characteristics of the NKTl cohort is consistent with the national KF profile based on the national registry data, the cost data may not necessarily be generalizable to the entire Philippines. NKTl is a large tertiary hospital with a high volume of patients, thus they are able to procure supplies and machines at a much cheaper price due to economies of scale. Smaller clinics in the provinces outside the National Capital Region may not be able to get similar prices that were used in the study. However, if PhilHealth does the strategic purchasing and contracting for these facilities, then they may be able to drive prices down and make KRT provision more sustainable and affordable.

Covering kidney replacement therapies in context of universal health coverage remains to be a challenge for most countries. Lessons from the Philippines show that a good understanding of current context in terms of existing coverage and distribution of patients per modality is essential in making a relevant evaluation. There was a need to scrutinize whether partial dialysis coverage result to sub-optimal outcomes and possibly widening the inequity gap which goes against the key principles of a universal health coverage policy. From this assessment, shifting to a PD-First policy instead of expanding current HD coverage is the best strategy to make KRT affordable and sustainable for the health system, complemented by increased kidney transplant uptake. Implementation and policy-making considerations are provided to ensure better use of this piece of economic evidence.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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