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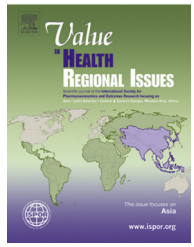

Budget Impact Analysis of Peritoneal Dialysis versus Conventional In-Center Hemodialysis in Malaysia

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ABSTRACT

Objectives: To investigate the 5-year health care budget impact of variable distribution of adult patients treated with peritoneal dialysis (PD) and in-center hemodialysis (ICHD) on government funding in Malaysia. **Methods:** An Excel-based budget impact model was constructed to assess dialysis-associated costs when changing dialysis modalities between PD and ICHD. The model incorporates the current modality distribution and accounts for Malaysian government dialysis payments and erythropoiesis-stimulating agent costs. Epidemiological data including dialysis prevalence, incidence, mortality, and transplant rates from the Malaysian renal registry reports were used to estimate the dialysis patient population for the next 5 years. The baseline scenario assumed a stable distribution of PD (8%) and ICHD (92%) over 5 years. Alternative scenarios included the prevalence of PD increasing by 2.5%, 5.0%, and 7.5% or decreasing 1% yearly over 5 years. All four scenarios were accompanied with commensurate changes in ICHD. **Results:** Under the current best available cost information, an increase in the prevalent PD population from 8% in 2014 to 18%, 28%, or 38% in 2018 is predicted to result in 5-year cumulative savings of Ringgit Malaysia (RM) 7.98 million, RM15.96 million, and RM23.93 million, respectively, for the Malaysian government. If the prevalent PD population were to decrease from 8% in 2014 to 4.0% by 2018, the total expenditure for dialysis treatments would increase by RM3.19 million over the next 5 years. **Conclusions:** Under the current cost information associated with PD and HD paid by the Malaysian government, increasing the proportion of patients on PD could potentially reduce dialysis-associated costs in Malaysia.

Keywords: budget impact, in-center hemodialysis, peritoneal dialysis.

Introduction

The global epidemic of chronic kidney disease poses a major public health problem not only in high-income countries but also in Asia. This problem is driven by the aging population, the global diabetes epidemic in which Asia has emerged as an epicenter [1], as well as the high prevalence of hypertension among Asians [2]. Similar trends are seen in Malaysia where National Health and Morbidity surveys have shown that the prevalence of diabetes among adults 18 years and older increased from 11.6% in 2006 to 14.2% in 2011 and the prevalence of hypertension rose from 32.2% to 32.7% [3].

Patients with chronic kidney disease who reach the final stage of kidney failure known as end-stage renal disease (ESRD) will require renal replacement therapy (RRT) by either hemodialysis (HD) or peritoneal dialysis (PD) or renal transplantation to sustain life. However, the provision of RRT is costly and has become a serious, escalating burden on the finances and human resources of health care systems worldwide.

Malaysia is an upper-middle income developing country in Southeast Asia with a population of 29.3 million and an annual gross domestic product of US $9983 per capita in 2012 [4]. Provision of RRT consumes a disproportionate amount of the health care budget—for example, in 2005, 0.06% of the Malaysian population with ESRD accounted for 1.72% of its total health care spending [5]. In 2013, a total of 33,519 prevalent patients with ESRD received RRT [6], but this figure is projected to double to 50,000 by 2020. Renal transplantation, that is, the surgical procedure to place a healthy donated kidney in the patient with ESRD, is the best RRT option. However, the new transplant rate in Malaysia is very low at 3 per million population (pmp) in 2013. Hence, most of the patients require dialysis therapy. In 2012, 94% of the patients on RRT were on dialysis therapy, with 92% on HD and 8% on PD [6].

In HD, blood obtained from the patient via a surgically created connection, for example, an arteriovenous fistula, is dialyzed across an artificial membrane in a dialyzer that is connected to a circuit outside the patient's body. In PD, the peritoneal membrane lining the patient's peritoneal cavity acts as a natural filter for wastes and excess fluids. PD dialysis solutions are instilled and removed via a permanent catheter placed through the abdominal wall into the peritoneal cavity. The PD solution

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exchanges are done manually with minimal equipment three to five times daily in continuous ambulatory PD (CAPD) or overnight with the assistance of an automated cycler (automated PD [APD]).

In Malaysia, the provision of dialysis is via a public-private mix in health care. Although the Ministry of Health (MOH) remains to date as the largest single institutional provider for dialysis, the ministries of defense and higher education also provide dialysis to their employees and associated dependents. Historically, long-term HD in the MOH began in 1969 with very limited facilities at the main tertiary referral hospital in the country. Out of necessity, home HD was introduced in which patients bought their own machines but the government provided disposables, saline, and heparin. Office HD programs were also initiated in government departments such as the Ministry of Education and Treasury to enable department employees or their family members to obtain dialysis services, as well as minimize the risk of employees losing their jobs because of frequent leave for dialysis elsewhere. This also occurred in the armed forces and police where dialysis units were opened to cater to the needs of their personnel and dependents. This is how the provision of HD services by various government agencies such as the MOH, the Ministry of Education, and the armed forces evolved. In addition, several large corporations such as Malaysian Banking, Bank Bumiputera now Commerce International Merchant Bankers (CIMB), and Malaysian Airlines also provided office HD. However, as access to in-center HD services expanded, home HD and office HD have largely been replaced by HD performed in hospitals or freestanding hemodialysis centers. Although public, private, and nongovernmental organizations provided 30%, 45%, and 25% of overall dialysis treatment in 2012, respectively, the overall government funding constituted at least 58% of the total expenditure for dialysis in the country [6]. Growth of dialysis provision by the private sector has been the most rapid, and this has been mainly sustained by government funding through various agencies, predominantly the Public Service Department and the Social Security Organization, the latter being a government-run social insurance organization that receives mandatory contributions for employees in the private sector.

Despite a remarkable growth in dialysis provision rates by more than 10-fold between 1993 and 2012, Malaysia is still unable to provide universal access to RRT [6]. With the expected rise in the prevalence of ESRD, the sustainability of dialysis therapy in the future is uncertain. In addition, there is an imbalance in dialysis treatment rates between geographical regions. Although the overall prevalence rate of patients on dialysis was 1019 pmp in 2013, states on the economically developed west coast of Peninsular Malaysia have a very high treatment rate ranging from 962 to 1585 ppm, whereas Sabah, Sarawak, and the east coast states of Peninsular Malaysia have far lower treatment rates ranging from 438 to 907 pmp [6].

PD is as effective as HD in the treatment of patients [7,8], and an economic evaluation conducted in government hospitals in Malaysia in 2003 has shown that the cost per life-year saved is slightly less for PD than for in-center HD (ICHD) (Ringgit Malaysia [RM] 31,635 vs. RM33,642) [9]. Studies using modeling methods for other countries have shown that where PD costs are less than HD costs, increased PD utilization would result in substantial health care savings [10,11]. In Malaysia, increasing PD utilization would also address inequality in dialysis access by allowing patients in rural areas and small towns, where HD is scarce or nonexistent, to obtain dialysis treatment. In addition, PD offers a number of medical advantages over HD. These include better preservation of residual renal function, less risk of bacteremia and sepsis, better quality of life, better hemodynamic stability, less requirements for erythropoetin-stimulating agents (ESAs), improved survival advantage in the first 2 years of RRT, and improved transplant outcomes [12–14].

In 2012, a small working group of nephrologists was formed in the MOH to prepare a proposal for the Malaysian government to encourage increased use of PD. As a part of this initiative, this study was conducted to explore the 5-year health care budget impact of a variable mix of dialysis modalities of PD and HD to treat adult patients with ESRD in Malaysia. The information obtained may facilitate financial planning and health policy decisions regarding health care allocations for a more sustainable dialysis treatment program in the future.

Methods

An Excel-based budget impact model was developed to estimate the dialysis-associated costs from the perspective of the Malaysian federal government, assuming various dialysis modality mixes between PD and ICHD over 5 years. The period of 5 years was chosen because this is the same duration as the Malaysian government's economic development plans—the nation is presently in the Tenth Malaysian Plan, which spans from 2011 to 2015. The dialysis population that is covered by the Malaysian government changes year by year. Taking account of patients with ESRD both entering and leaving dialysis, the baseline dialysis population in each year was estimated using linear regression on the prevalence (pmp) of dialysis patients obtained from the Malaysian Dialysis and Transplant Registry for the past 10 years from 2003 to 2012 [6]. The entry rate in each year was estimated by projecting the incidence (pmp) of dialysis patients from 2003 to 2012, whereas the leaving rates accounted for both mortality (per 1000 patient-years) and kidney transplantation for the same period [6]. Over the last decade, the number of new transplant patients has been decreasing consistently. Using the past 10-year trend generates negative transplants in the near future, which is not logical. As a result, we assumed that the transplant number will remain constant between 2014 and 2018 by using the 2012 number. In addition, we assumed that all transplants are performed in government centers because over the last 20 years, 94% of local transplants have been performed in government hospitals [6]. Partial-year patients, including both the entering and leaving patients with ESRD, were assumed to be distributed uniformly throughout the year. Therefore, the costs and resource use of these patients were counted as half of those of full-year patients.

In the baseline model, among the 58% of the total dialysis patients funded by the government agencies, 8% of them were assumed to receive PD and 92% ICHD over 5 years in alignment with 2013 Malaysian Dialysis and Transplant Registry data [6]. Three hypothetical scenarios were compared with this reference scenario. The first scenario was an increase in the use of PD by 2.5% per year over 5 years. The second was an increase in the use of PD by 5.0% per year, and the third was an increase in the use of PD by 7.5% per year over 5 years. For comparison, a scenario of decreasing the use of PD by 1.0% each year for 5 years was also analyzed. In each of the four hypothetical scenarios, ICHD percentages were adjusted so that the total percentage of PD and ICHD remained constant at 100% (Table 1).

The dialysis-associated costs accounted in the model included dialysis access, dialysis services, and ESA use. Four types of HD vascular access exist in Malaysia: noncuffed catheter, cuffed catheter, arteriovenous fistula, and arteriovenous graft. Therefore, different access costs were weighted to impute one HD access cost as the final model input. In addition, there are several government agencies paying for dialysis in Malaysia, including the MOH, the Public Service Department, the Social Security Organization, and other government agencies (e.g., the Department of Defense). Each agency pays for the same service, for example, supply of ESA, with a different price. Therefore, our