

# The changing patterns of access overtime to the renal replacement therapy programme in Thailand

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## Abstract

Based on projected numbers, approximately only 50% of those requiring renal replacement therapy (RRT) receive it. Many patients who require RRT live in low- and middle-income countries. The objective of this study was to examine the changing pattern over time of entry into the RRT programme in Thailand following RRT's inclusion in the Universal Coverage Scheme. This study was an ecological study using the age-period-cohort analysis to look at dialysis registration and kidney transplant trends during RRT programme implementation. Data from 2008 to 2016 of patients diagnosed with end-stage renal disease (ESRD) were obtained from the National Health Security Office. The study found that the numbers of new patients with ESRD, aged 20–69, registered with the dialysis programme increased over time. For patients aged 20–40 years, the dialysis programme took up to 400 new patients for every 1000 new ESRD diagnoses. For kidney transplant, the rates increased slowly. The kidney transplant programme could at best treat only around 50 cases for every 1000 new ESRD diagnoses in patients aged 20–30 years. Findings of this study highlighted the importance of promoting strategies to reduce the increasing number of patients with kidney disease, to consider conservative therapy for older/frail patients, and to improve access to kidney transplantation and live-donation.

**Keywords:** Renal replacement therapy, dialysis, kidney transplant, universal health coverage, age-period-cohort analysis

## Introduction

Chronic kidney disease has been increasingly recognized as a global public health problem, not only because of the rising prevalence across the world but also because of widening inequities in accessing renal replacement therapy (RRT) when kidney function has failed completely (Grassmann *et al.*, 2005; White *et al.*, 2008; Coresh and Jafar, 2015; Liyanage *et al.*, 2015). It is estimated that, worldwide, only a half of those needing RRT receive it. Of those receiving RRT, only 9% reside in low- and middle-income countries; yet, these people make up at least 38% of those who need

the treatment (Liyanage *et al.*, 2015). In these countries, the low percentage of people accessing treatment is a consequence of the unaffordable cost of dialysis (Jah, 2013), arrangements of RRT service provision (Odubanjo *et al.*, 2011) and variation in universal public reimbursement for services (Sakhuja and Kohli, 2006; Pecoits-Filho *et al.*, 2009).

The Thai government launched the Universal Coverage Scheme (UCS) in 2001 to cover previously uninsured citizens outside the other two public schemes, namely, the Civil Servant Medical Benefit Scheme and the Social Security Scheme. To date, the UCS covers 48

### Key Messages

- Arrangements of a renal replacement therapy programme resulted in an increased access to high-cost care in Thailand.
- Dialysis registration was increasing in young patients.
- Dialysis and kidney transplantation in elderly were low and tended to decrease with age.

million beneficiaries or 76% of Thais (NHSO, 2017). RRT was initially excluded from the UCS benefit package due to fiscal constraints and lack of treatment facilities. The National Health Security Office (NHSO), which was responsible for the UCS, was increasingly pressured to expand benefits to include RRT, both dialysis and transplantation, by civil society organizations and patient groups (Tangcharoensathien *et al.*, 2005). Despite being known to have poor cost-effectiveness relative to many other interventions (Sennfalt *et al.*, 2002; Kontodimopoulos and Niakas, 2008; Haller *et al.*, 2011), in 2008, RRT was adopted into the benefit package of the UCS on the grounds that it would save lives and prevent indebtedness and health impoverishment among UCS members. The UCS introduced the RRT programme as a so-called ‘disease management programme’ which would provide RRT services for every UCS member in need.

The UCS-funded RRT adopted a ‘PD first’ policy, meaning that all new end-stage renal disease (ESRD) patients without contraindications must use continuous ambulatory peritoneal dialysis (CAPD) as first-line therapy, or shoulder the costs of haemodialysis (HD) themselves. HD patients who were on HD before the ‘PD first’ policy, and patients with contraindications to CAPD, were eligible for full reimbursement of the cost of HD. Under the PD-first policy, renal transplant and all essential high-cost medications are also included in the benefits (Chungsaman and Kasemsap, 2017). When patients’ eGFR level reaches 15 ml/min per 1.73 m<sup>2</sup>, they are diagnosed as ESRD. However, according to the Thai Nephrology Society guidelines, UCS patients without signs or symptoms of kidney failure will be asked to enter the RRT programme once the eGFR level drops to 6 ml/min per 1.73 m<sup>2</sup>.

Thailand, as a developing country, faces problems of inadequacy of healthcare infrastructure. To date, there has been limited study of the performance of the RRT programme. This study aimed to assess the changing patterns of entry into the RRT programme of adult UCS patients diagnosed with ESRD using an age-period-cohort analysis to establish whether launching the RRT programme promoted entry into the programme over time.

## Methods

### Data sources

We undertook the age-period-cohort analysis using the administrative health databases of the UCS. These databases contain detailed demographic, diagnostic, procedures, medications, laboratory and other clinical data at the individual level, and can be linked together and also linked to mortality data from the Ministry of Interior’s civil registration system by using the 13-digit citizen identification number. The NHSO has audit procedures to ensure quality as well as prevent duplicates of the claims data at both central and regional NHSO, and also has encoding processes for all citizen identification numbers before handing the data to any third party.

### Study population

A cohort of patients who were diagnosed with ESRD was first constructed. It included adult UCS members aged 20–69 who had an index

hospitalization or outpatient visit with an ESRD diagnosis (ICD-10 code N180 or N185) as either primary diagnosis or secondary diagnosis between 1 January 2008 (the date RRT was adopted into the UCS benefit package) and 31 December 2016. After that, any cohort member who received an RRT modality: dialysis (either peritoneal dialysis or HD) and kidney transplant, were identified. The study also included anyone who had modality changes, mostly from peritoneal dialysis to HD, during the study period. It excluded self-paying HD patients (approximately 1700 new UCS patients per year) and patients who had a history of temporary dialysis treatment in a period shorter than 30 days. This included patients who started dialysis then were lost to follow-up or died within 30 days; also those who were registered into the RRT programme <30 days before the census date (31 December 2016). As the RRT programme was designed to cover patients with established renal failure, those who were diagnosed with acute/reversible renal failure were not included in the database.

### Data analysis

Age of entry into the RRT programme was determined by the time (year) between the date of birth and the date of dialysis registration or receiving a kidney transplant. ‘Cohort’ was the individuals’ years of birth. The ‘period’ denoted calendar years of the period studied. Individuals were grouped into 10 five-year age at registration (or at transplantation) groups (aged 20–69) and 11 five-year cohort groups (from 1942 to 1996). Period was used as a single year interval (from 2008 to 2016). The age-standardized registration rates were estimated for each year of the period studied using the World Health Organization’s world population in the year 2000 as the standard.

In the age-period-cohort model, a set of nested models (likelihood-ratio test) was used to compare the goodness of fit within a set of models. This was done by first comparing the deviance of any model that deviated from linear effects (the null model which contained only the age parameter). The deviance was then compared in this manner until the deviance of the last pair of models was obtained. The preferred model was selected by the lowest deviance. Finally, the effects of the key variables (age, period and cohort) were estimated by using a log-linear Poisson regression. For parameterization, drift was extracted by the weight average method. Knots (parameters) were equally spaced. Equal numbers of knots were allocated to age, period and cohort. The study used five knots in all models. Data analyses and graphical presentations were conducted by Stata version 12. Modelling was carried out using the `apcfit` command (Rutherford *et al.*, 2012). All confidence intervals are 95% confidence intervals.

## Results

Overall, numbers of new patients with ESRD, aged 20–69, registered with the dialysis programme, increased over time and the total number of new registrations in the period was 56 238 (Table 1).

Over time, there were a larger number of cases, yet fairly constant rates in the young age groups. Overall rates of people with dialysis registration started at 100 per million population (pmp) in 2008 (equivalent to current UK dialysis take on rates) and increased

**Table 1** Numbers of dialysis registrations (*n*) and age-standardized rates of dialysis registration for patients aged 20–69 years, 2008–16

Year	20–39 years		40–59 years		60–69 years		Overall		
	<i>n</i>	Rate <sup>a</sup>	<i>n</i>	Rate <sup>a</sup>	<i>n</i>	Rate <sup>a</sup>	<i>n</i>	Crude rate <sup>a</sup>	Adjusted rate <sup>a</sup>
2008	604	49	2139	170	417	131	3160	113	103
2009	467	38	1718	133	407	122	2592	91	83
2010	601	49	2503	191	812	232	3916	136	123
2011	735	62	3036	227	1238	330	5009	173	154
2012	824	67	3496	258	1732	454	6052	204	182
2013	1039	86	4371	321	2556	638	7966	268	235
2014	1029	51	4714	242	3087	595	8830	198	183
2015	1063	54	4867	248	3458	637	9388	209	191
2016	1069	54	4771	240	3485	611	9325	206	186

<sup>a</sup>Rate per million UCS population years within each age group.

**Table 2** Numbers of new kidney transplants (*n*) and age-standardized rates of kidney transplants for patients aged 20–69 years, 2008–16

Year	20–39 years		40–59 years		60–69 years		Overall		
	<i>n</i>	Rate <sup>a</sup>	<i>n</i>	Rate <sup>a</sup>	<i>n</i>	Rate <sup>a</sup>	<i>n</i>	Crude rate <sup>a</sup>	Adjusted rate <sup>a</sup>
2008	7	1	3	0	0	0	10	0	0
2009	17	1	10	1	1	0	28	1	1
2010	27	2	17	2	1	0	55	2	2
2011	40	3	24	2	2	1	66	2	2
2012	29	2	25	2	4	1	58	2	2
2013	61	5	76	6	9	2	146	5	5
2014	40	2	69	4	10	2	119	3	3
2015	54	3	62	3	6	1	122	3	3
2016	65	3	78	4	8	1	151	3	3

<sup>a</sup>Rate per million UCS population years within each age group.

continuously over time to ~200 pmp around 2014, then plateauing at that level. Despite a constant increase in dialysis take on over time, kidney transplant rates were low across all age groups, in particular for those over 60 years. The total numbers of ESRD patients who had a kidney transplant were at its highest point in 2013, at around 150 cases, then fell to just above 100 cases in 2014–15 and climbed back to 150 cases again in 2016 (Table 2).

Although the registration rate in 2008 was low at the start of the programme, and the rates of all age groups were very close at first (20–30% of ESRD diagnoses), by 2012, the rates had risen to a peak across most age groups and then dialysis take on gradually decreased in successive years for the age groups of 55 or more years, and particularly for the older age groups. Over the 9-year period, it is clear that the approach to dialysing older people changed, and fewer older people started dialysis after the peak in 2012. Consequently, a wide gap in registration rates developed with the rates ranging from 10% to 50% of ESRD diagnoses (Figure 1a). For kidney transplantation, the rates showed high peaks in some specific years and very young age groups (Figure 1b). These numbers need to be seen not just in the context of rates pmp, but also in terms of available facilities to deliver these interventions. Total numbers of available dialysis take on slots have remained constant since 2015, and also the capacity for kidney transplantation. The total numbers of transplants, particularly in patients aged 40 years and above, have

not changed much since 2014. In 2016, the transplant rates ranged from 0% to 5% of ESRD diagnoses (Figure 1b).

In the reference year 2014, the effects of age on dialysis were strongest for patients aged 20–40 years. The dialysis programme could take up to 400 new patients of this age group for every 1000 new ESRD diagnoses (Figure 2a). The dialysis programme saw many more new registrations than the transplant programme, which could treat at best only around 50 cases for every 1000 new ESRD diagnoses in patients aged 20 (Figure 2c). From 2009, the dialysis programme showed an upward trend in registrations and the trend started to decline after 2012 (Figure 2b). For kidney transplantation, after a sharp increase between 2008 and 2010, rates increased slowly over time until 2016 (Figure 2d).

## Discussion

The RRT programme intended to provide access to essential healthcare and prevent UCS beneficiaries incurring financially catastrophic payments due to expensive treatment. It has achieved these aims by enrolling ESRD patients into the programme regardless of age or socio-economic status and it is the NHSO that pays for service costs, not patients.

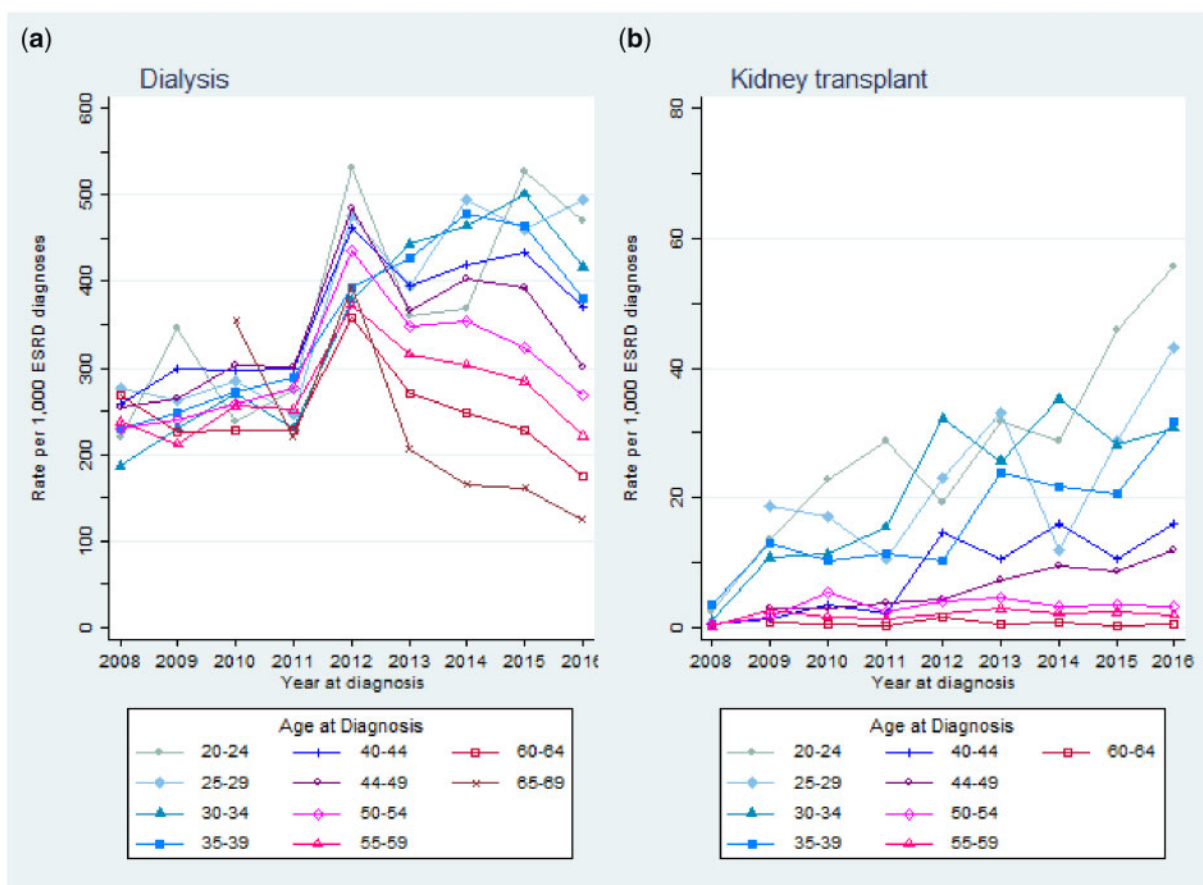
The study assessed rates of registration into the RRT programme by the age-period-cohort method. The dialysis registration rate is likely to have responded to the new policy since registration trends increased after each change in reimbursement policy. Dialysis centres and professionals started to be available nationwide from 2009 onwards (NHSO, 2017). With availability of services, previously unrecognized cases with ESRD were identified and registered. Hence, registration rates began to increase sharply in the 24 months following the introduction of the programme in 2008. An increase was also evident when the NHSO started to reimburse treatment for UCS patients who had previously refused the PD-first policy, and allowed them to register for free HD. This additional benefit is likely to have boosted the dialysis registration rate after 2014.

It was evident that not all patients started RRT once they were newly diagnosed with ESRD. More than half of all ESRD patients were not registered into the dialysis programme. In addition, after dialysis registrations reached a peak in 2012, the RRT programme was able to enrol a higher percentage of young patients needing RRT; however, the registration rates tended to decrease with age, despite the high and growing proportion of older patients with ESRD diagnoses.

There are two likely explanations of these findings. Firstly, the guideline of taking up patients into the RRT programme developed by the Thai Nephrology Society recommended that patients with ESRD diagnoses without signs or symptoms of kidney failure should be asked to register into the RRT programme when their eGFR levels dropped to 6 ml/min per 1.73 m<sup>2</sup>. The principle of waiting until the eGFR was low was based on the IDEAL trial (Cooper *et al.*, 2010).

Secondly, for the low registration rates in elderly patients, the finding corresponds to that of some prior studies (Morton *et al.*, 2010; Rayner *et al.*, 2014; Tonkin-Crine *et al.*, 2015; Thammatacharee, 2016) that the elderly with ESRD, who have multiple illnesses and lack family support, are likely to be unable to use or may refuse to start dialysis. This is less likely to be a supply-side issue, since in the UCS, the guideline of RRT registration does not indicate an age limit and the payment to the RRT programme is based on the number of registrations. So, the more patients are registered, the greater the amount of reimbursement to dialysis centres.

When comparing RRT with other healthcare interventions, RRT modalities are usually ranked as providing inferior value for money expressed in terms of incremental cost-effectiveness ratios



**Figure 1** Dialysis registration (a) and kidney transplant (b) rates per 1000 ESRD diagnoses\* by year and age at diagnosis, 2008–16.

(Chaikledklew, 2014). Thailand took the decision to include RRT in the UCS benefit package due to concern about inequalities with the health benefit packages of other social insurance schemes, and evidence of the impoverishing effects of payment for treatment for affected people and their families. Results from other literature have indicated that HD is the least cost-effective treatment option, while CAPD and kidney transplant represent more cost-effective approaches (Sennfalt *et al.*, 2002; Kontodimopoulos and Niakas 2008; Haller *et al.*, 2011). While renal dialysis is less cost-effective in comparison to transplantation (Muirhead, 1996) but it is essential to prolong a patient's life and since organ donors tend to be in short supply, transplantation is not available to every patient.

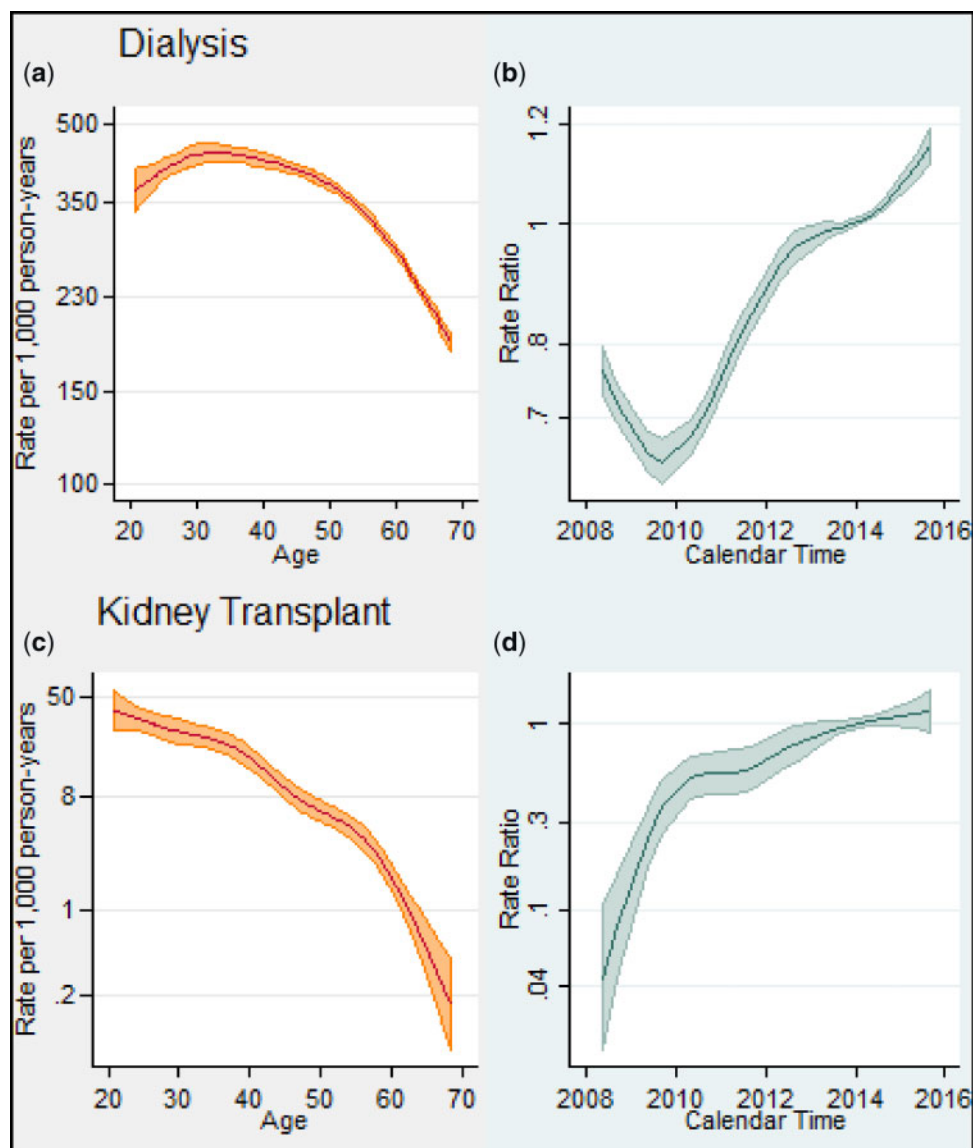
Thailand has introduced many strategies to promote organ donation, e.g. patients are asked on admission whether they wish to donate their organs; an online organ registration system has been set up, and a number of organ donation campaigns have been launched. These strategies have encouraged growth in the number of donations, in particular from deceased donors (Thai Transplantation Society, 2017). Nonetheless, the kidney transplant rate in Thailand was ~8 pmp (Chuasuwana and Praditpornsilpa, 2015) which was low in comparison to other countries worldwide (GODT, 2017). This study found that the kidney transplant rate of UCS patients was 3 pmp. At this rate, it accounted for just one-third of all kidney transplants in Thailand, despite the fact that the UCS is the largest public health scheme and covers 76% of all Thais.

This study found that the incidence of RRT registrations among UCS patients was very high (200 pmp). Assuming that this number accounted for 50% of all ESRD patients, the incidence of ESRD in

Thailand may be one of the highest in the world, comparable to countries with the highest ESRD incidence like Taiwan (476 pmp), the Jalisco region of Mexico (411 pmp) and the USA (376 pmp) (United States Renal Data System, 2017). This highlights that chronic kidney disease is very important for Thailand, and that prevention of people requiring dialysis is needed. Especially for diabetes, there is good evidence that the need to dialysis can be prevented by blood pressure and diabetes treatment.

A systematic review estimated that around the world in 2010, there were 9.7 million patients needing RRT, but only 2.6 million patients were able to use it. The proportion of those in need but not receiving RRT ranged from just 5% in North America to 91% in Africa (Liyanage *et al.*, 2015). Variations among different regions were found to be more associated with supply-side factors (such as macroeconomic issues, health systems and renal service provision) rather than health status or demographics of the general population (Caskey *et al.*, 2011).

Evidence of inequalities due to the insurance system and RRT provision also exists in other lower middle-income countries. For example, in Mexico, chronic kidney disease was a serious health problem, but only Social Security System beneficiaries (48% of the overall population) had access to RRT benefits. The public insurance programme that covered the rest of population did not include RRT services (Pecoits-Filho *et al.*, 2009; Garcia-Garcia and Chavez-Iñiguez, 2018). In Malaysia, the government is the main source of funding for dialysis (63%). These funds are channelled as subsidies to non-profit HD centres and as payment for dialysis treatment for pensioners, civil servants and their dependents in private HD



**Figure 2** Effects of age (a and c) and period (b and d) on dialysis registrations and transplant (rates per 1000 ESRD diagnoses).

centres. Patients without these subsidies pay themselves or receive charitable support (Ahmad *et al.*, 2016). Thailand introduced the current service on the grounds that it would save lives and prevent indebtedness and health impoverishment among UCS members and their families.

In Thailand, chronic kidney disease was not ranked as a topmost health problem in terms of deaths and disability. It was reported to be an underlying condition in patients with hypertension, diabetes, high uric acid, and using traditional medicines (Ingsathit *et al.*, 2010). It is not surprising, after all chronic kidney disease is frequently asymptomatic until patients reach ESRD, and in the absence of diagnostic services may be misdiagnosed as another condition. Apart from hypertension and diabetes, chronic glomerulonephritis was one of the main primary diagnoses among those who had ESRD and who later underwent kidney transplant (Thai Transplantation Society, 2017). The government has been launching many health promotion and prevention programmes to control non-communicable diseases, but it is too early to look for positive results in relation to ESRD from these programmes, as ESRD develops over decades in frequently asymptomatic individuals.

This study was a facility-based study which enhanced validity by capturing most individuals of interest and results were representative of the studied population. In addition, the age-period-cohort analysis is regarded as a powerful tool in modelling and analysing routinely collected information from administrative records or disease registries (Carstensen, 2007). This study has some limitations. The age-period-cohort analysis does not establish a cause-effect relationship to prove whether the RRT programme really caused an effect on the outcome of interest (registration). In addition, the secondary data used in this analysis were mainly intended for administrative purposes, and thus had limitations. For example, data for many fields which were not used for budget claims, such as laboratory results, were not routinely recorded.

To date, there is still a lack of reliable epidemiological information on the various stages of chronic kidney disease in the general population. This is because it is a silent disease: a patient may be living asymptotically until the condition reaches an advanced stage. Patients who receive RRT can be used to identify the number of patients with last-stage chronic kidney disease; however, numbers of patients in this sense reflect only the portion of patients who receive treatment and

cannot be used to represent the entire affected population, or even the number of patients with ESRD (Eustace and Coresh, 2005).

## Conclusions

Thailand is unusual as a middle-income country in having opened access to RRT for its whole population. It did this by including RRT in the benefit package of the UCS and expanding treatment resources. This paper provides evidence that rates of registration increased, especially for younger groups, whereas older people may have been less willing to enter treatment and may benefit from conservative management programmes. Transplantation rates remain too low, and it is hoped that kidney live-donation programmes can be established. Policy-makers should find strategies to reduce the increasing number of patients with kidney disease who later develop ESRD.

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*Conflict of interest statement.* D.N. is involved in GSK-funded research of CKD in Sub Saharan Africa.

*Ethical approval.* No ethical approval was required for this study.

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