

# Dialysis Provision in Malaysia

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## Summary

We determined the provision for dialysis treatment in Malaysia. There were 181 dialysis centres as at 1st June 1999 (161 Haemodialysis (HD) and 20 Continuous Ambulatory Peritoneal Dialysis (CAPD) centres), providing treatment for 5614 patients. This is equivalent to an estimated prevalence rate of 253 patients per million population (pmp) and new dialysis acceptance rate of 49 patients pmp. Dialysis facilities were widely distributed throughout the country though rather unevenly among states. Penang, Selangor/KL, Malacca led with number of dialysis patients pmp ranging from 417 to 480. Kelantan and Sabah had the lowest provision with 51 and 64 patients pmp respectively. There were more centres and HD capacity in the private sector while the Non-Government Organisation and public sectors had about the same capacity. However the public sector had more patients on account of availability of CAPD and home HD services, as well as low HD capacity to patient ratio. The number of centres, HD capacity and patients have increased rapidly especially since 1991; the estimated growth rates were 16.5 centres/year, 658 capacity/year, and 392 patients/year respectively. There was also a trend toward increasing over-capacity in the private and NGO sectors.

In conclusion, the level of dialysis provision is increasing, indicating increasing accessibility of dialysis treatment in Malaysia. Over-capacity is a concern in the private and NGO sectors. Thus funding agencies should be encouraged to source provision from those sectors. The public sector still has the crucial role of providing for under-served areas in the country.

**Key Words:** Dialysis, Haemodialysis, CAPD, Provision, Health services research

## Introduction

Dialysis refers to any medical treatment that aims at replacing normal kidney function by artificial means. The treatment is indicated for patients with end-stage renal disease (ESRD). The leading causes of ESRD in this country are diabetes mellitus and glomerulonephritis<sup>1</sup>. Most patients however presented late with kidney failure so that the cause of their kidney failure can no longer be established<sup>1</sup>. Dialysis is an effective life saving treatment. Without dialysis, life expectancy for a patient with ESRD is less than a year.

Life expectancy on treatment may be as long as 16 years, depending on age and health status of the patients<sup>2</sup>. However, dialysis treatment has its drawbacks. Apart from the expense, it is time consuming and has adverse impact on the patient's quality of life. In this regard, there is no doubt that kidney transplantation is a superior treatment for ESRD. Transplantation is however limited by the severe shortage of organ donors in Malaysia. Hence, dialysis will remain, in the foreseeable future, the mainstay of treatment for ESRD in Malaysia.

There are in general two types of dialysis treatment:

1. **Haemodialysis (HD):** in this treatment, dialysis (removal of uraemic solutes in the blood) is carried out across an artificial membrane housed in a dialyser connected to the patient's arterio-venous fistula via an extra-corporeal circuit. A machine is required for the purpose. Typically most patients undergo 3 sessions of treatment per week, each session of 4 to 5 hours in duration. The machine may be located in a centre or at home/place of work. These are referred to as centre HD and "home" HD respectively.
2. **Continuous Ambulatory Peritoneal Dialysis (CAPD):** in this treatment, dialysis is performed across the natural semi-permeable peritoneal membrane of the abdomen. To obtain access to the membrane, a permanent catheter is required and dialysate is infused via the catheter to dwell in the abdomen. After several hours of dwelling during which dialysis occurs, the dialysate is drained out via the same catheter and fresh dialysate infused for another round of dialysis. Each round of infusing and draining dialysate is called an exchange. Typically most patients undergo 4 exchanges per day.

The level of dialysis provision for patients with ESRD in Malaysia remains largely undocumented. Information on provision in the public sector are available from the National Renal Registry<sup>1</sup> but information on provision in the Non-governmental organisations (NGO) and private sectors are incomplete. An organisation called the Malaysian Organ Sharing System (MOSS) was recently set up to operationalise organ sharing. The objective was to enable any patient on dialysis in the country, whether in the public, NGO or private sector to receive a best match donated cadaveric kidney for the purpose of transplantation. To participate in MOSS, all dialysis centres in the country are required to register their patients and to provide some basic information about their centre. The data so obtained formed the basis of this study. The objectives are to describe the level and distribution of dialysis provision in Malaysia. Dialysis provisions are expressed in terms of number of centres, machines, treatment capacity and patients.

## Materials and Methods

There were 181 dialysis centres in Malaysia as at 1st June 1999, of which 161 provide HD services and 20 CAPD services. MOH HD centres also support home HD service. All centres were included in this survey; no sample was taken. Each centre completed a questionnaire. Information requested included address, persons in charge, year commenced operation, number and type of dialysis personnel, number of patients, treatment facility and policy (number and type of machine, water treatment system, isolation policy for HbsAg and anti-HCV positive patients, dialyser reuse policy, CAPD connectology system). Data obtained from the questionnaire survey were cross-checked with data held on dialysis patients and centres by the National Renal Registry<sup>1</sup>. No major discrepancy (defined as difference greater than 10%) was found between the 2 sources of information. Of course the National Renal Registry does not have information on all patients and all centres in the country. This is therefore at best a partial validation of the questionnaire data but it does provide some evidence for its validity. Data on home HD patients in MOH centres are obtained directly from the National Renal Registry. The proportion of HD patients on home HD has been declining steadily; 35% in 1994, 31% in 1995, 27% in 1996 and 22% in 1997<sup>1</sup>. It is projected to reach 14% by 1999.

## Statistical methods

Standard error estimates are not reported because no sample was taken. Results on distribution by state are also expressed in per million-population since states obviously vary in their population sizes. State population data are based on 1998 census population projection. It is very difficult to estimate the amount of cross boundary patient flow; this source of error is therefore not accounted for in computing state estimates. All results are prevalence estimates for the stated year since we only have cross-sectional data. We attempted to estimate the new dialysis acceptance rate from 1st June 1998 to 1st June 1999. Required assumptions are constant dialysis growth rate of about 400 patients per year based on the data, death rate of

10% per year and 150 new transplantation per year. The latter 2 assumptions are based on data from the National Renal Registry<sup>1</sup>, which has reported consistent dialysis death rates of 9 - 12% per year and 100 to 200 new renal transplants per year. HD treatment capacity is derived by assuming on average patients underwent 3 HD sessions per week and a centre can maximally operate 2.5 shifts per day. A single HD machine can therefore support 5 patients' treatment. Obviously HD treatment capacity is calculated only for centre HD. The ratio of the number of centre HD capacity to the number of centre HD patients is a useful measure of utilisation of available capacity.

Only 4 (2%) centres did not respond. Another 2 (1%) and 10 (5%) responding centres had missing data on the number of HD machines and the number of HD patients respectively. As the objective of this analysis was to estimate the total amount of dialysis provision in the country, we could not therefore ignore the missing data and confine the analysis to available data. Hence, we imputed the missing data based on a regression imputation model guided by the imputation principles described by Little<sup>3</sup>. The imputation model included sector (public, NGO or private), state, year of operation, number of dialysis personnel. These are well known correlates of level of dialysis provision in a centre. The imputations were then drawn by predictive mean matching<sup>3</sup>. Each centre with missing data was matched with each respondent on its predicted values. We then used the data of the centre with the closest match to impute the missing data. In effect, imputed values were drawn from the distribution of respondents. The advantages of this method over others are that it preserves the distribution of the data and provides some protection against model misspecification<sup>3</sup>. The analysis was performed by program written in STATA<sup>4</sup>.

## Results

There were 181 dialysis centres in Malaysia as at 1st June 1999, of which 161 provide HD services and only 20 centres provide CAPD services. There were 1552 HD machines providing 7760 HD treatment capacity in the country, and supporting the haemodialysis treatment of 4727 patients. Including CAPD and home HD patients,

there were 5614 dialysis patients or 253 patients per million population (pmp) in Malaysia as at 1st June 1999. The estimated new dialysis acceptance rate from 1st June 1998 to 1st June 1999 was 49 new patients pmp.

### Dialysis provision by state

Table I shows the distribution of dialysis provision by state. Malacca, Penang, Selangor and Wilayah Persekutuan led in both treatment capacity and number of dialysis patients. At the bottom of the table were Kelantan and Sabah. These states, as well as Pahang, and Trengganu suffered from severe under-provision. However, there was no obvious relation between treatment capacity and capacity to patient ratio. Kelantan had the lowest provision and yet the highest capacity to patient ratio, clearly suggesting non-utilisation of available capacity.

### Dialysis provision by sector

Dialysis service providers were classified as MOH, University, Armed Forces, Non-governmental organisation (NGO) and private. Levels of dialysis provision by sector are summarised in Table II below. There were more centres and treatment capacity in the private sector. MOH had the lowest centre HD capacity to patient ratio. While the private sector had more HD patients, MOH had the most dialysis patients on account of the availability of CAPD and home HD services.

### Growth in dialysis provision

The first hospital to provide regular dialysis treatment in the country was the Kuala Lumpur Hospital. It commenced its dialysis operation in 1969. In the 1970s and up to mid 1980s, the rate of increase in dialysis centres was sluggish. It was not until the early 1990s that dialysis treatment provision in the country really took off (Figs. 1 and 2). The average rate of increase in number of dialysis centres from 1991 onwards was 16.5 centres per year, while the estimated growth in treatment capacity and number of dialysis patients was 658 HD treatment capacity/year and 392 patients/year respectively. Clearly, there was a divergence between growth in HD capacity and dialysis patients, indicating increasing under-utilisation of available capacity over time as shown in Fig. 2.

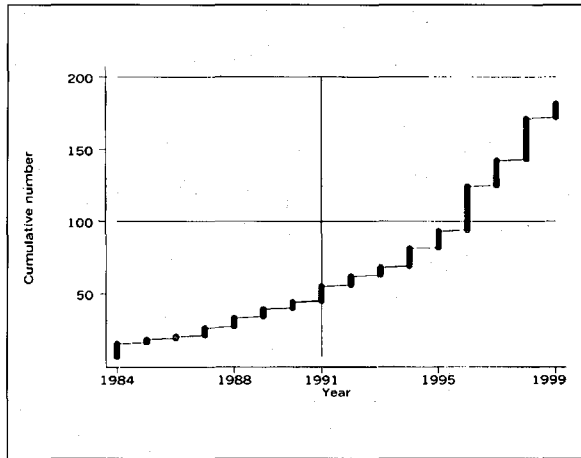
**Table I**  
**Number of Dialysis Centres, Number of HD Machines and Treatment Capacity, HD Capacity to Patient Ratio, and Number of Dialysis Patients by State in 1999**

State	Centre No.	Centre HD Machines No.	Centre HD Machines/ million Population	Centre HD Capacity* No.	Centre HD Capacity/ Million Population	Centre HD Patients No.	Centre HD Patients/ Million Population	Centre HD Capacity: Patient Ratio	All Dialysis Patients No.	All Dialysis Patients/ Million Population
Pulau Pinang	25	192	156	960	778	485	393	1.98	593	480
Selangor & W.Persekutuan	51	516	115	2580	575	1704	380	1.51	2134	476
Negeri Melaka	9	81	138	405	689	239	407	1.69	245	417
Johor Darul Takzim	22	191	73	955	366	686	263	1.39	786	301
Perak Darul Ridzuan	18	175	83	875	415	540	256	1.62	614	291
N. Sembilan Darul Khusus	7	58	70	290	352	165	200	1.76	211	256
Sarawak	12	98	49	490	246	237	119	2.07	305	153
Kedah & Perlis	15	92	52	460	259	249	140	1.85	254	143
Trengganu Darul Iman	5	33	33	165	164	80	80	2.06	108	108
Pahang Darul Makmur	5	34	27	170	134	104	82	1.63	109	86
Sabah	6	38	14	190	68	165	59	1.15	180	64
Kelantan Darul Naim	6	44	30	220	148	73	49	3.01	75	51
Malaysia	181	1552	70	7760	350	4727	213	1.64	5614	253

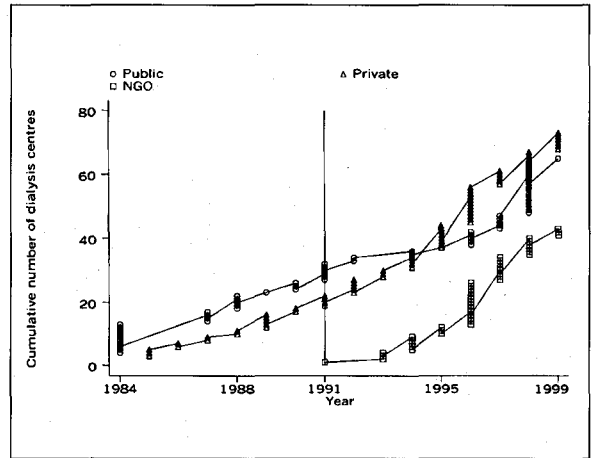
\* HD treatment capacity is derived by assuming on average patients underwent 3 HD sessions per week and a centre can maximally operate 2.5 shifts per day. A single HD machine therefore can support 5 patients' treatment.

**Table II**  
**Number of Dialysis Centres, HD Machines and Treatment Capacity, HD and Dialysis Patients by Sector in 1999**

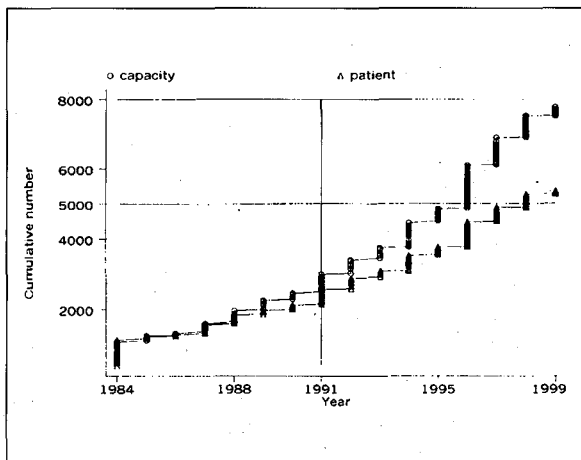
Sector	Centre No.	Centre HD Machines No.	Centre HD Capacity No.	Centre HD Patients No.	Centre HD Capacity : Patient Ratio	All Dialysis Patients No.
MOH	52	404	2020	1503	1.34	2236
Private	73	584	2920	1624	1.8	1656
NGO	43	484	2420	1393	1.74	1393
University	5	39	195	87	2.24	207
Armed Forces	8	41	205	120	1.71	120



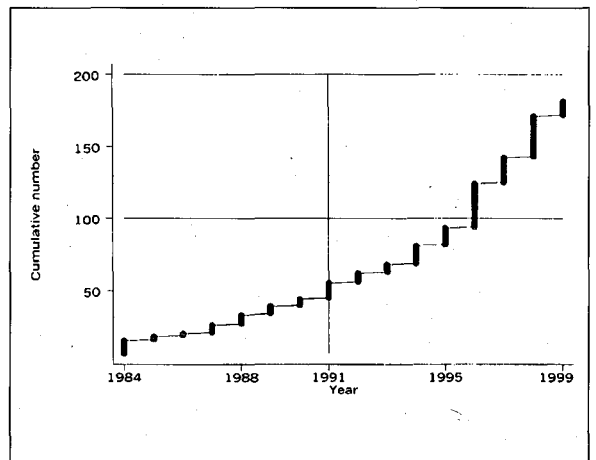
**Fig. 1: Growth in number of dialysis centres, 1984 - 1999.**



**Fig. 3: Growth in dialysis centres by sector 1984 - 1999.**



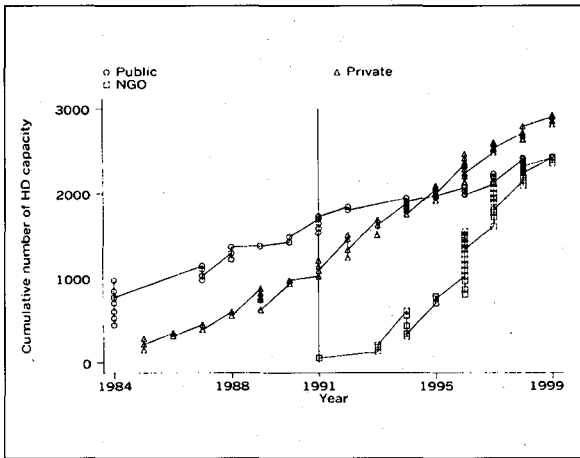
**Fig. 2: Growth in HD capacity and dialysis patients, 1984 - 1999.**



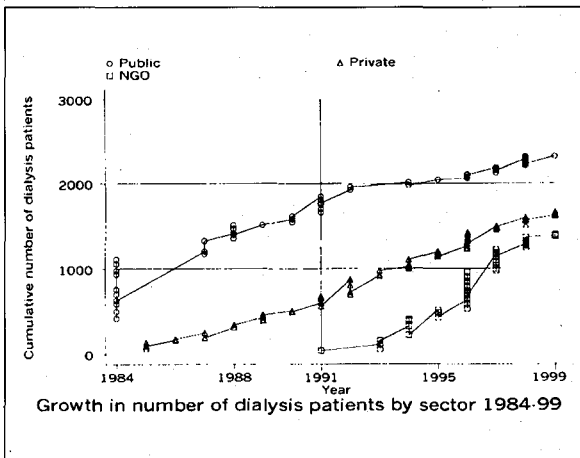
**Fig. 4: Growth in HD machines by sector 1984 - 1999.**

Growth rate however varied by sector (Figs. 3 - 6). The public sector (MOH, Armed Forces and University combined) began its steady investment in dialysis facilities on a planned basis year on year from 1984. By 1999, there were 65 public dialysis centres providing 2420 HD treatment capacity and dialysing 2563 patients. The NGO sector, since its inception in 1991, has witnessed a phenomenal growth both in the number of centres and treatment capacity. By 1999, its treatment capacity had equaled that of the public sector.

The private sector has similarly experienced rapid growth in the number of centres and treatment capacity year on year from 1991 onwards. By 1995, the number of private centres in the country had exceeded the public sector, and by 1996, the treatment capacity in the private sector had exceeded that in the public sector too. In spite of the huge increase in treatment capacity in the NGO and private sectors to equal or exceed that in the public sector, the public-sector still led in terms of the number of patients under treatment (Fig. 6). This is

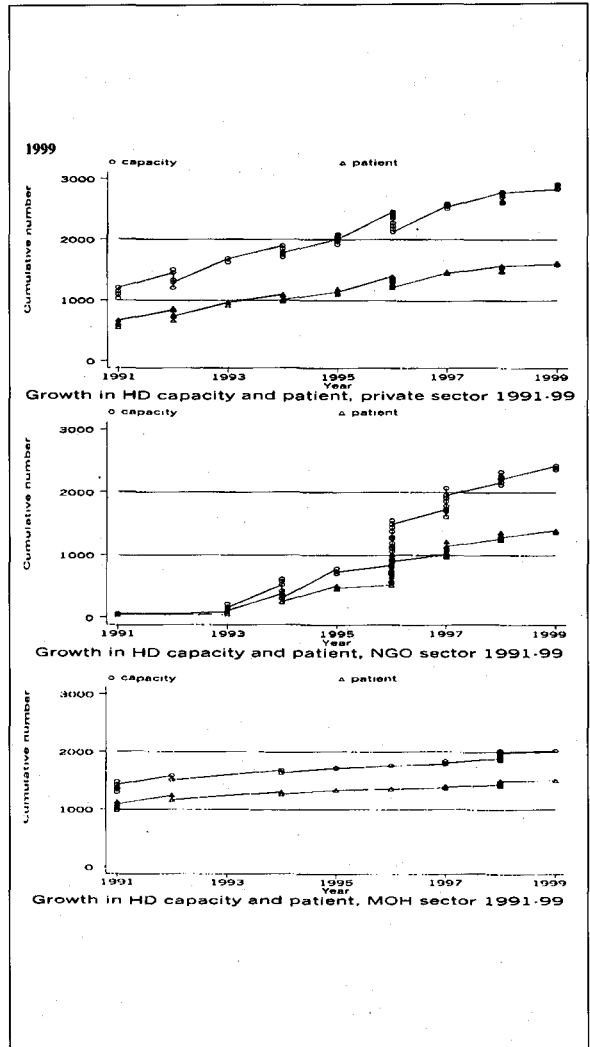


**Fig. 5: Growth in HD capacity by sector 1984 - 1999.**



**Fig. 6: Growth in number of dialysis patients by sector 1984 - 1999.**

partly because of the availability of CAPD and home HD services in the public sector. However, clearly too, in the private and NGO sectors, treatment capacities were relatively under-utilised. In 1999, the ratios of HD capacity to HD patients under treatment were 1.34, 1.74 and 1.80 in the MOH, NGO and private sector respectively. As shown in Fig. 7, there was clearly a trend toward increasing over-capacity in the private and NGO sectors.



**Fig. 7: Growth in HD capacity and HD patients in the private, NGO and MOH sectors, 1991 - 1999.**

**Discussion**

The results of this study should be interpreted cautiously. Firstly, it is based on self-reporting by dialysis centres rather than actual count of number of patients and facilities as in a census. We have no reason to suspect systematic under or over reporting by centres, and this is confirmed by cross-checking against available data from the National Renal Registry<sup>1</sup>. Of course some

centres were reluctant to divulge information on the number of patients, as indicated by its higher proportion of missing data. Therefore, the estimates, in particular for the number of HD and dialysis patients, must be regarded as "best guess". More reliable estimates must await completion of the ongoing exercise by MOSS to register all dialysis patients in the country for the purpose of establishing a renal transplant waiting list. Interpretation of results in Table I on state distribution of dialysis provision must bear in mind the fact that we did not and could not account for cross boundary flow of patients. For example, patients from western Pahang are likely to dialyse in W. Persekutuan/Selangor where dialysis facilities are concentrated. Similarly, patients from Kedah may go to Penang for treatment; and those from northern Johore and Negri Sembilan to Malacca. Thus, dialysis provision for Malacca, Penang and WP/Selangor were likely to be overestimated. These were the 3 states with the highest level of dialysis provision.

Nevertheless, this is the first description of the provision of dialysis treatment in Malaysia; and probably for the provision of any medical treatment in the country. The results are encouraging. The continuing growth in the number of centres and treatment capacity is testimony to the country's commitment to making dialysis treatment increasingly accessible. Dialysis service was initially only available in the public sector, as is often the case for any costly treatment. Over the years and especially since 1991, the private sector has registered impressive growth in both treatment capacity and patients treated. NGO provision is of course a more recent phenomenon; nevertheless it has caught up very quickly. In the near future, dialysis services in the country will undoubtedly be increasingly dominated by the private and NGO sectors.

While the growth in the number of centres has been impressive, the distribution of services is of course no less important. This is especially important for centre based treatment like HD, the mode of treatment that has increased most rapidly, as distance from a centre is an important determinant of access to dialysis. HD centres and treatment capacities have tended to concentrate in well-developed states. This is of course

not surprising for a service that has become increasingly private sector dominated. Investment decision on treatment capacity build-up would favour better-developed states that enjoy a higher standard of living. Not surprising too, that the least developed states like Kelantan, Trengganu, Pahang and Sabah suffered from severe under-provision. This is obviously an area where the public sector still has a crucial role to play. Future public sector investment decision on location for dialysis treatment capacity ought to favour these states.

The trend towards increasing under-utilisation of available capacity in the private and NGO sector is cause for concern. As dialysis is a scarce treatment resource (relative to needs), its deployment should certainly be improved. However, so long that ability and willingness to pay remain the main determinant of access to treatment in the NGO and private sectors (even in the NGO sector, the subsidised charges still exceed the ability of most Malaysians to pay), the tendency towards over-capacity may be difficult to correct. In recent years, funding sources for dialysis treatment has changed. New sources of funding like Baitumal, Jabatan Perkhidmatan Awam (JPA) for retired government servants or parents of government servants and SOCSO for workers has enabled more Malaysians with ESRD to access treatment. The treatment of these patients can be provided for in the private and NGO sectors where the excess capacity can be utilised. This would also allow a better match between capacity planning and dialysis needs.

In conclusion, this study has shown that the level of dialysis provision in the country is rapidly increasing. Even the economic slow down in the past two years has failed to dampen the growth. The trend towards increasing over-capacity in the private and NGO sector should encourage funding agencies to source provision in those sectors. The public sector still has a crucial role to provide for under-served areas in the country.

### Acknowledgments

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