13TH REPORT OF

THE MALAYSIAN DIALYSIS & TRANSPLANT

REGISTRY

2005

Sponsors:
Malaysian Society of Nephrology
Association of Dialysis Medical Assistants and Nurses

The National Renal Registry is funded with grants from:
The Ministry of Health Malaysia
Ain Medicare
Baxter Healthcare
Coremed
Fresenius Medical Care
Minntech International
Roche

April 2006

ISSN 1675-8862

Published by:

The National Renal Registry
Malaysian Society of Nephrology
2nd Floor, MMA House
124, Jalan Pahang
50286 Kuala Lumpur
Malaysia

Telephone. : (603) 4045 8636
Direct Fax : (603) 4042 7694
e-mail : nrr@msn.org.my
Web site : http://www.msn.org.my/nrr

Important information:

This report is also published electronically on the website of the National Renal Registry at:

http://www.msn.org.my/nrr

ACKNOWLEDGEMENTS

The National Renal Registry would like to thank the following:

All the staff of the dialysis and transplant follow-up centres for their hard work and continued participation,

The Ministry of Health, Malaysia for support seen and unseen,

For their generous support:-

Ain Medicare

Baxter Healthcare

Coremed

Fresenius Medical Care

Minntech International

Roche

The staff of the Clinical Research Centre particularly Lim Jie Ying, Teh Poh Geok and Azizah Alimat

Members of the National Transplant Registry who have kindly contributed to this Report

&

All who have in one way or another supported the NRR

Abbreviations

CAPD	Continuous Ambulatory Peritoneal Dialysis
CCPD/APD	Continuous cycling peritoneal dialysis/automated peritoneal dialysis
CRA	Clinical Registry Assistant
CRC	Clinical Research Centre
CRM	Clinical Registry Manager
ADMAN	Association of Dialysis Medical Assistant and Nurses
ESRD	End Stage Renal Disease
HD	Haemodialysis
MOH	Ministry of Health
MSN	Malaysian Society of Nephrology
MOSS	Malaysian Organ Sharing System
NRR	National Renal Registry
NGO	Non-governmental organization
pmarp	per million age related population
RRT	Renal replacement therapy
SDP	Source data producer
TX	Transplant

NRR Advisory Committee Members
2004 to 2006

MSN Nominees

CHAIRMAN:	Dr. Zaki Morad B Mohd Zaher
MEMBERS:	Dr. Lim Teck Onn
	Dr. Lim Yam Ngo
	Dr. T. Thiruventhiran
	Dr. Tan Hee Wu
	Dr. Wong Hin Seng

ADMAN Nominees

MEMBERS:	Tam Chong Chiang
	Norlida Omar
SECRETARIAT	Lee Day Guat

NRR Office Staff

Clinical Registry Manager	Lee Day Guat
Clinical Research Assistant	Mardhiah Arifin
	Nor Azliana Ramli

CRC Technical Support Staff

Director	Dr. Zaki Morad B Mohd Zaher
Head	Dr. Lim Teck Onn
Epidemiologist	Dr. Jamaiyah Haniff
IT Manager	Celine Tsai Pao Chien
Database Administrator	Lim Jie Ying
	Sebastian Thoo
Network Administrator	Kevin Ng Hong Heng
	Adlan Ab Rahman
Statistician	Teh Poh Geok
	Leong Fei Shan
Webmaster	Patrick Lum See Kai
Desktop Publisher	Azizah Alimat

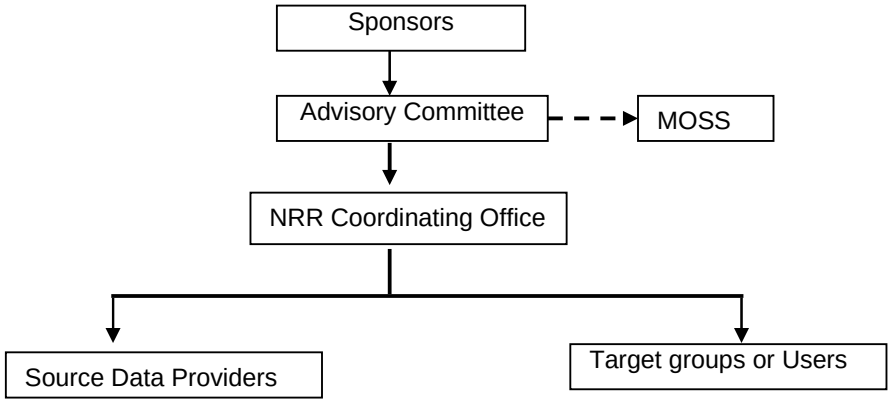
About the National Renal Registry

The National Renal Registry (NRR) has its origin in the Dialysis and Transplant Registry established by the Department of Nephrology in 1992. The sponsors of NRR are the Malaysian Society of Nephrology (MSN) and Association of Dialysis Medical Assistants and Nurses (ADMAN).

The objectives of NRR are to:

1. Determine the disease burden attributable to End Stage Renal Disease (ESRD), and its geographic and temporal trends in Malaysia.
2. Determine the outcomes, and factors influencing outcomes of Renal Replacement Therapy.
3. Evaluate the RRT program.
4. Stimulate and facilitate research on RRT and ESRD.
5. Maintain the national renal transplant waiting list.

The NRR organization is as follows:



Sponsors

The Malaysian Society of Nephrology is the sponsor of the National Renal Registry (NRR) and Malaysian Organ Sharing System (MOSS) and the co-sponsor is the Association of Dialysis Medical Assistants and Nurses.

Advisory Committee

This is the committee established by the sponsors to oversee the operations of the registry and MOSS. Interested parties including source data producers, Renal Registry Unit and target groups or users are represented on this committee.

National Renal Registry Office

The NRR office is the coordinating center that collects and analyses the data. It publishes the annual report of Malaysian Dialysis & Transplant Registry and the Directory of Dialysis Centres in Malaysia. The Clinical Registry Manager (CRM) oversees the daily operation of the NRR. The Clinical Research Centre of Hospital Kuala Lumpur provides the epidemiological, statistical and information technological support to NRR.

Source Data Producers

These are the dialysis centres that collect the required data. It is the most critical and yet difficult element of the system. It has to be systematic and uniform, and producers of source data need to be trained and motivated to ensure high data quality.

Users or Target groups

These are the individuals or institutions to whom the regular registry reports are addressed. It is their need for information to assist in the planning and implementing disease treatment, control and prevention activity that justify the investment in the registry. They include:

1. the renal community
2. the RRT provider
3. the public health practitioner
4. the decision maker in various government and non-government agencies who have responsibilities for any aspects of ESRD treatment, prevention and control
5. the researcher with an interest in ESRD and RRT.
6. the press and the public.

About MOSS

Cadaver organ transplantation activity has noticeably increased in the last decade in Malaysia. A recurring issue of concern was how and to whom cadaver organs are allocated. In 1999, the Malaysian Society of Nephrology (MSN) had established a committee, which was tasked to initiate the development of a national organ-sharing network. The network was referred as the Malaysian Organ Sharing System or MOSS in short, and the committee was thus named MOSS committee

The functions of the MOSS committee thus established then under MSN were to:

1. Make policy decisions concerning MOSS.
2. Secure funding from various sources to support MOSS operation.
3. Designate a place to be the coordinating centre for the operation of MOSS.
4. Canvass the view of nephrologists and other clinical staff involved concerning the policy and operation of MOSS.
5. Oversee the operation of the MOSS.
6. Employ a manager and other necessary support personnel to manage the day-to-day operation of the MOSS.
7. Appoint panel of nephrologists to examine eligibility of potential recipients

The objectives of MOSS in turn as established by the MOSS Committee were:

1. To maintain a list of patients who have voluntarily enrolled as potential recipients in the cadaveric kidney transplantation program
2. To prioritise the waiting list according to an agreed criteria and scoring system
3. To update the waiting lists at periodic intervals according to specified criteria
4. To provide a list of suitably matched potential recipients based on agreed criteria when a cadaver organ is available
5. To prepare an annual report of the status of the cadaveric kidney transplantation program including the waiting list, donor status and outcomes

The National Renal Registry (NRR), which was then sponsor by MSN, was directed to assist in the setting up of MOSS and to make available its database to support MOSS operations. From this database, a transplant waiting list was generated and indeed was in use.

However, the subsequent operations of MOSS such as in entering new patients into the list, maintaining and updating the list, updating patient's information and so on, turned out to be logistically more difficult than had been expected. Over the years, various manual systems and procedures had been tried to coordinate and support the activities of the various parties involved in the transplantation process. In particular:

1. The nephrologist caring for dialysis patients who are potential recipients need to be able to efficiently put their patients on the list, update their patients' data, and take them off the list temporarily or otherwise when necessary.

2. The Transplant Centre performing the transplant surgery obviously need timely access to the recipient wait list that is ranked according to pre-determined criteria, as well as to access their contact information in order to inform patients to come forward for transplant when an organ becomes available. At the same time, the transplant surgeon will want to review the selected patients' clinical information relevant to the transplant surgery.

3. The National Renal Registry is the channel through which nephrologists or dialysis centres notify patients in order to put patients on the wait list.

4. And finally, the MOSS Committee needs to be able to convey its policy and operational decisions to users, such as on assigning patients to nephrologists for the purpose of managing their wait list status, adjudication on patient eligibility for transplant and their ranking on the list, final decision on entry into the SOS list.

In early 2004, the MOSS Committee proposed to MSN council to support the development of a web based system, named eMOSS, to support the operations of MOSS. The nature of MOSS operations, involving multiple parties spread throughout the country was ideally suited for web-based automation. The proposal was accepted and funds allocated for the development. The NRR and the Clinical Research Centre (CRC) were tasked with undertaking this project, and also to help fund it in part.

eMOSS website is allocated in http://www.msn.org.my . You may down load a copy of the user manual from the website. This website is reinforced with high security. There are pre-set rules to the access right according to the approved guideline. Access to the patients information is however restricted to authorized and designated user only. To get your password please contact the MOSS coordinator at e-mail: moss@msn.org.my.

PARTICIPATING HAEMODIALYSIS CENTRES

1. 801 Rumah Sakit Angkatan Tentera (Kucing)
2. 819 Rumah Sakit Angkatan Tentera
3. 94 Hospital Angkatan Tentera (Terendak)
4. 96 Hospital Angkatan Tentera (Lumut)
5. Aiman Dialysis Centre
6. Alor Gajah Dialysis Centre
7. Alor Gajah Hospital
8. Alor Setar Hospital
9. AMD Rotary (Penang)
10. Amitabha Centre
11. Amitabha Haemodialysis Centre Johor Bahru
12. Ampang Puteri Specialist Hospital
13. Asia Renal Care (Penang)
14. Assunta Hospital
15. Bakti-NKF Dialysis Centre
16. Balik Pulau Hospital
17. Baling Hospital
18. Bangi Dialysis Centre
19. Banting Hospital
20. Batu Gajah Hospital
21. Batu Pahat Hospital
22. Batu Pahat Rotary
23. Bau Hospital
24. Beaufort Hospital
25. Beluran Hospital
26. Bentong Hospital
27. Berchaam Dialysis Centre
28. Berjaya NKF Dialysis Centre
29. Besut Hospital
30. Betong Hospital
31. Bintulu Hospital
32. BP Renal Care (Batu Pahat)
33. BP Renalcare (Segamat)
34. BP Renalcare (Yong Peng)
35. Buddhist Tzu Chi Dialysis Centre (Butterworth)
36. Buddhist Tzu-Chi Dialysis Centre (Jitra)
37. Buddhist Tzu-Chi Dialysis Centre (Penang)
38. Bukit Mertajam Hospital
39. Bukit Mertajam Specialist Hospital
40. C.S. Loo Kidney & Medical Specialist
41. Changkat Melintang Hospital
42. Charis-NKF Dialysis Centre
43. Che Eng Khor Centre
44. Cheras Dialysis Centre
45. CHKMUS-MAA Medicare Charity
46. Damai Medical & Heart Clinic
47. Damansara Specialist Hospital
48. Duchess of Kent Hospital
49. Dungun Hospital
50. Fatimah Hospital
51. Fo Yi NKF Dialysis Centre
52. Gerik Hospital
53. Gleneagles Medical Centre
54. Gua Musang Hospital
55. Haemo Care
56. Haemodialysis Association Klang
57. Haemodialysis Edina
58. Healthcare Dialysis Centre
59. Hope Haemodialysis Society Ipoh
60. Hospital Pakar Sultanah Fatimah Muar
61. Hospital Raja Perempuan Zainab II
62. Hulu Terengganu Hospital
63. Ipoh Hospital
64. Ipoh Hospital Home Unit
65. Island Hospital
66. JB Lions MAA-Medicare Charity Dialysis Centre (1)
67. JB Lions MAA-Medicare Charity Dialysis Centre (2)
68. Jelebu Hospital
69. Jerantut Hospital
70. Johor Specialist Hospital
71. K K Tan Specialist Specialist (Bukit Mertajam)
72. Kajang Hospital
73. Kampar Hospital
74. Kapit Hospital
75. KAS-Rotary-NKF
76. KB Rotary-MAA Charity Dialysis
77. Kelana Jaya Medical Centre
78. Kemaman Hospital
79. Keningau Hospital
80. Kepala Batas Hospital
81. Kg Baru Medical Centre
82. Kluang Hospital
83. Kota Belud Hospital
84. Kota Kinabatangan Hospital
85. Kota Marudu Hospital
86. Kota Tinggi Hospital
87. Kuala Kangsar Hospital
88. Kuala Krai Hospital
89. Kuala Kubu Bharu Hospital
90. Kuala Lipis Hospital
91. Kuala Lumpur Dialysis Centre
92. Kuala Lumpur Hospital (Home)
93. Kuala Lumpur Hospital (Paed)
94. Kuala Lumpur Hospital (Unit 1)
95. Kuala Lumpur Hospital (Unit 2B)
96. Kuala Lumpur Hospital (Unit 3)
97. Kuala Lumpur Lions Renal Centre
98. Kuala Nerang Hospital
99. Kuala Pilah Hospital
100. Kuala Terengganu Hospital
101. Kuantan Clinical Diagnostic Centre
102. Kudat Hospital
103. Kulim Hospital
104. Labuan Hospital

PARTICIPATING HAEMODIALYSIS CENTRES (continued)

105. Lahad Datu Hospital
106. Lam Wah Ee Hospital
107. Langkawi Hospital
108. Lawas Hospital
109. Lifeline Dialysis Clinic
110. Likas Hospital
111. Limbang Hospital
112. Loh Guan Lye Specialist Centre
113. MAA-Medicare Charity (Butterworth)
114. MAA-Medicare Charity (Cheras)
115. MAA-Medicare Charity (Kajang)
116. MAA-Medicare Charity (Kota Kinabalu)
117. MAA-Medicare Charity (Kuala Lumpur)
118. MAA-Medicare Charity (Mentakab)
119. MAA-Medicare Charity (Teluk Intan)
120. Machang Hospital
121. Mahkota Medical Centre
122. Marudi Hospital
123. Melaka Hospital
124. Mentakab Hospital
125. Mersing Hospital
126. Metro Specialist Hospital
127. Miri Hospital
128. Miri Red Crescent Dialysis Centre
129. Moral Uplifting-NKF Dialysis (Ipoh)
130. Muadzam Shah Hospital
131. Muar Dialysis
132. Muar Lions Renal Centre
133. Mukah Hospital
134. National Kidney Foundation Dialysis Centre (KL)
135. Nephrolife Haemodialysis Centre
136. Nobel Dialysis Centre
137. Normah Medical Specialist Centre
138. Pahang Buddhist Association
139. Pakar Perdana Hospital
140. Pantai Air Keroh Hospital
141. Pantai Indah Hospital
142. Pantai Medical Centre (1)
143. Pantai Medical Centre (2)
144. Pantai Mutiara Hospital
145. Papar Hospital
146. Parit Buntar Hospital
147. Pasir Mas Hospital
148. Pathlab Charity Dialysis Centre
149. Pekan Hospital
150. Penang Adventist Hospital
151. Penang Caring Dialysis Society
152. Penang Hospital
153. Penang Hospital (Home)
154. Persatuan Amal Chin Malaysia Barat
155. Persatuan Buah Pinggang Sabah
156. Persatuan Dialisis Kurnia PJ
157. Persatuan Membaiki Akhlak-Che Luan Khor_NKF
158. Pertubuhan Bakti Fo En Bandar Kulim
159. Pertubuhan Dialisis Rotary-Satu Hati
160. Pertubuhan Hemodialisis Muhibbah Segamat
161. Pertubuhan Hemodialisis Muhibbah Segamat (Labis)
162. Pertubuhan Hemodialisis SPS
163. Pertubuhan Pekhidmatan Haemodialisis AIXIN Kerian
164. PingRong-NKF
165. Poliklinik Komuniti Tanglin
166. Pontian Hospital
167. Pontian Rotary Haemodialysis Centre
168. Port Dickson Hospital
169. Premier Renal Care
170. Province Wellesley Renal Medifund
171. Pusat Darul Iltizam
172. Pusat Dialisis Dr. K K Tan (Kulim)
173. Pusat Dialisis Dr. K K Tan (Sg Petani)
174. Pusat Dialisis Ehsan Perak
175. Pusat Dialisis Emnur Teguh
176. Pusat Dialisis Epic
177. Pusat Dialisis Falah
178. Pusat Dialisis Intan
179. Pusat Dialisis Kuala Kangsar
180. Pusat Dialisis Mesra
181. Pusat Dialisis Nefro Utama (Kota Tinggi)
182. Pusat Dialisis Nefro Utama (Kuala Terengganu)
183. Pusat Dialisis Nefro Utama (Pontian)
184. Pusat Dialisis Nefro Utama (Setapak)
185. Pusat Dialisis Penawar
186. Pusat Dialisis Penawar Permai
187. Pusat Dialisis Perbadanan Islam (Kota Tinggi)
188. Pusat Dialisis Pusat Pungutan Zakat
189. Pusat Dialisis Sijangkang
190. Pusat Dialisis Taiping
191. Pusat Dialisis Taiping (Cawangan Kamunting)
192. Pusat Dialisis Taiping (Cawangan Kuala Kangsar)
193. Pusat Dialisis Trengganu/NKF
194. Pusat Dialisis Tuanku Syed Putra-NKF
195. Pusat Dialisis Waqaf An-nur (Batu Pahat)
196. Pusat Dialisis Waqaf An-nur (Kota Raya)
197. Pusat Dialisis Waqaf An-nur (Pasir Gudang)
198. Pusat Dialysis Mesra (Kapar)
199. Pusat Dialysis Mesra KKB
200. Pusat Dialysis Setia
201. Pusat Haemodialysis St Anne BM
202. Pusat Haemodialysis Suria
203. Pusat HD SJAM Bacang Melaka
204. Pusat Hemodialisis Beng Siew
205. Pusat Hemodialisis Damai
206. Pusat Hemodialisis Darul Iltizam
207. Pusat Hemodialisis Darul Iltizam Tapah
208. Pusat Hemodialisis Darul Takzim
209. Pusat Hemodialisis Dato' Lee Kok Chee
210. Pusat Hemodialisis Fasa
211. Pusat Hemodialisis Harmoni
212. Pusat Hemodialisis Hidayah

PARTICIPATING HAEMODIALYSIS CENTRES (continued)

213. Pusat Hemodialisis Islam Makmur
214. Pusat Hemodialisis Kampar_Yayasan Nayang
215. Pusat Hemodialisis Kau Ong Yah Ampang
216. Pusat Hemodialisis Kota Tinggi
217. Pusat Hemodialisis Majlis Perbandaran Kelang
218. Pusat Hemodialisis Manjung
219. Pusat Hemodialisis Mawar N. Sembilan (Bahau)
220. Pusat Hemodialisis Mawar N. Sembilan (Lukut)
221. Pusat Hemodialisis Mawar N. Sembilan (Rantau)
222. Pusat Hemodialisis Mawar N. Sembilan (Seremban)
223. Pusat Hemodialisis Mawar N. Sembilan (Seremban)
224. Pusat Hemodialisis Mawar N. Sembilan (Seri Kembangan)
225. Pusat Hemodialisis Mergong
226. Pusat Hemodialisis Nabilah
227. Pusat Hemodialisis Rotary Kulai
228. Pusat Hemodialisis Waz Lian
229. Pusat Hemodialisis Yayasan Felda
230. Pusat Hemodialisis Zakat (Balik Pulau)
231. Pusat Hemodialisis Zakat (Bukit Mertajam)
232. Pusat Hemodialisis Zakat (Butterworth)
233. Pusat Hemodialysis Seroja
234. Pusat Kesihatan Jitra
235. Pusat Pakar Tawakal
236. Pusat Perubatan Primier HUKM
237. Pusat Perubatan Tentera (Kota Bharu)
238. Pusat Rawatan Dialisis Nefro Utama (Batu Caves)
239. Pusat Rawatan Dialisis Nefro Utama (Kota Bharu)
240. Pusat Rawatan Dialisis Wan Nong Batu Gajah
241. Pusat Rawatan Islam (Kuala Lumpur)
242. Pusat Rawatan Islam Ar-Ridzuan
243. Pusat Waqaf An -nur (Senawang)
244. Putra Medical Centre
245. Putrajaya Hospital
246. Queen Elizabeth Hospital
247. Ranau Hospital
248. Raub Hospital
249. Rawatan Dialisis Amal Lions-NKF
250. Rawatan Dialysis Bukit Tinggi
251. Rawatan Haemodialysis Koswip
252. Reddy Clinic
253. Rejang Medical Centre
254. Renal Associates
255. Renal Care (Ipoh Specialist)
256. Renal Care (Kedah)
257. Renal Dialysis Centre
258. Renal Healthcare
259. Renal Link (Penang)
260. Renal Medicare
261. Renal-Link (Kelantan)
262. Renal-Link Sentosa
263. Rotary Damansara-NKF Dialysis
264. Rotary HD Centre (Johor Bahru)
265. Rotary Tawau Tanjung
266. S.P. Menon Dialysis Center (Kuala Lumpur)
267. S.P. Menon Dialysis Center (Petaling Jaya)
268. S.P. Menon Dialysis Centre (Klang)
269. Sabah Medical Centre
270. Sandakan Kidney Society
271. Saratok Hospital
272. Sarawak General Hospital
273. Sarikei Hospital
274. Seberang Jaya Hospital
275. Segamat Hospital
276. Selama Hospital
277. Selangor Medical Centre
278. Selayang Hospital
279. Semporna Hospital
280. Serdang Hospital
281. Seremban Hospital
282. Seri Manjung Hospital
283. Serian Hospital
284. Sg Siput Hospital
285. Sibu Hospital
286. Sibu Kidney Foundation
287. Sik Hospital
288. Sipitang Hospital
289. SJAM-KPS Haemodialysis Centre 1 (Kelang)
290. SJAM-KPS Haemodialysis Centre 2 (Kelang)
291. SJAM-KPS Haemodialysis Centre 3 (Banting)
292. SJAM-KPS Haemodialysis Centre 5 (Rawang)
293. SJAM-KPS Haemodialysis Centre 6 (Kuala Selangor)
294. Smartcare Dialysis Centre (Subang Jaya)
295. Smartcare Dialysis Clinic (Cheras)
296. Sri Aman Hospital
297. Sri Kota Medical Centre
298. Strand Specialist Hospital
299. Subang Jaya Medical Centre
300. Sultan Ismail Pandan Hospital
301. Sultanah Aminah Hospital
302. Sultanah Aminah Hospital (Paed)
303. Sungai Bakap
304. Sungai Petani Hospital
305. Sunway Medical Centre
306. Superkids Trinity-NKF Dialysis Centre
307. Systemic Dialysis Centre
308. Systemic Dialysis Centre (2)
309. Syukur Elit Sdn Bhd
310. Taiping Hospital
311. Tambunan Hospital
312. Tampin Hospital
313. Tanah Merah Hospital
314. Tangkak Hospital
315. Tanjung Karang Hospital
316. Tanjung Malim Hospital
317. Tapah Hospital
318. Tawau Hospital
319. Teluk Intan Hospital
320. Temenggong Seri Maharaja Tun Ibrahim Hospital

PARTICIPATING HAEMODIALYSIS CENTRES (continued)

321. Temerloh Hospital
322. Tenang Haemodialysis Centre
323. Tenang Haemodialysis Jasin
324. Tengku Anis Hospital
325. Tenom Hospital
326. Tengku Ampuan Afzan Hospital
327. Tengku Ampuan Jemaah Hospital
328. Tengku Ampuan Rahimah Hospital
329. The Kidney Dialysis Centre 1
330. The Kidney Dialysis Centre 2
331. The Nayang-NKF Dialysis Centre
332. The Penang Community HD Society
333. Timberland Medical Centre
334. Tuanku Fauziah Hospital
335. Tumpat Hospital
336. Tung Shin Hospital
337. Tung Shin Hospital & Yayasan Nanyang Press
338. Universiti Kebangsaan Malaysia Bangi
339. Universiti Kebangsaan Malaysia Hospital
340. Universiti Sains Malaysia Hospital
341. University Malaya Medical Centre
342. Victorious Life Centre
343. Woh Peng Cheang Seah
344. Yakin Jaya
345. Yan Hospital
346. Yayasan Akhlak-NKF Taiping
347. Yayasan Kebajikan SSL
348. Yayasan Kebajikan SSL Puchong
349. Yayasan Kebajikan The Southern Melaka
350. Yayasan Pembangunan Keluarga Johor-NKF
351. Yayasan Rotary Kluang

PARTICIPATING PERITONEAL DIALYSIS CENTRES

1. 96 Hospital Angkatan Tentera (Lumut)
2. BP Renal Care
3. Damai Medical & Heart Clinic
4. Hospital Pakar Sultanah Fatimah Muar
5. Hospital Raja Perempuan Zainab II
6. Ipoh Hospital
7. Kuala Lumpur Hospital (Adult)
8. Kuala Lumpur Hospital (Paed)
9. Kuala Terengganu Hospital
10. Melaka Hospital
11. Penang Hospital
12. Queen Elizabeth Hospital , Kota Kinabalu
13. Sarawak General Hospital
14. Selayang Hospital
15. Seremban Hospital
16. Sultanah Aminah Hospital (Adult)
17. Sultanah Aminah Hospital (Paed)
18. Tengku Ampuan Afzan Hospital
19. Tengku Ampuan Rahimah Hospital
20. Universiti Kebangsaan Malaysia Hospital
21. Universiti Sains Malaysia Hospital
22. University Malaya Medical Centre

PARTICIPATING TRANSPLANT FOLLOW-UP CENTRES

1. Alor Setar Hospital
2. Ampang Puteri Specialist Hospital
3. Batu Pahat Hospital
4. Bintulu Hospital
5. Damai Medical & Heart Clinic
6. Duchess of Kent Hospital
7. Hospital Pakar Sultanah Fatimah Muar
8. Hospital Raja Perempuan Zainab II
9. Ipoh Hospital
10. Kemaman Hospital
11. Kluang Hospital
12. Kuala Lumpur Hospital (Paed)
13. Kuala Lumpur Hospital (Adult)
14. Kuala Terengganu Hospital
15. Mahkota Medical Centre
16. Melaka Hospital
17. Mentakab Hospital
18. Miri Hospital
19. Penang Hospital
20. Pontian Hospital
21. Queen Elizabeth Hospital
22. Renal Dialysis Centre Sdn. Bhd, Gleneagles Intan Medical Centre
23. Sabah Medical Centre
24. Sarawak General Hospital
25. Segamat Hospital
26. Selangor Medical Centre
27. Selayang Hospital
28. Seremban Hospital
29. Sibu Hospital
30. Sri Kota Medical Centre
31. Subang Jaya Medical Centre
32. Sultan Ismail Pandan Hospital
33. Sultanah Aminah Hospital (Paed)
34. Sultanah Aminah Hospital (Adult)
35. Sunway Medical Centre
36. Taiping Hospital
37. Tan Medical Renal Clinic
38. Tawau Hospital
39. Tengku Ampuan Afzan Hospital
40. Tengku Ampuan Rahimah Hospital
41. Timberland Medical Centre
42. Universiti Kebangsaan Malaysia Hospital
43. Universiti Sains Malaysia Hospital
44. University Malaya Medical Centre

CONTRIBUTING EDITORS

Chapter	Title	Editors	Institutions
1	Renal Replacement Therapy in Malaysia	Lim Teck Onn	Clinical Research Centre
		Lim Yam Ngo	Kuala Lumpur Hospital
2	Dialysis in Malaysia	Lim Teck Onn	Clinical Research Centre
		Lim Yam Ngo	Kuala Lumpur Hospital
		Lee Day Guat	National Renal Registry
3	Death & Survival On Dialysis	Wong Hin Seng	Kuala Lumpur Hospital
		Ong Loke Meng	Penang Hospital
		Wan Shaariah Md Yusuf	Seremban Hospital
4	QoL and Work Rehabilitation on Dialysis	Liu Wen Jiun	Sultanah Aminah Hospital
		Zaki Morad B Mohd Zaher	Kuala Lumpur Hospital
5	Paediatric Renal Replacement Therapy	Lee Ming Lee	Seremban Hospital
		Lynster Liaw	Penang Hospital
		Susan Pee	Sultanah Aminah Hospital
		Wan Jazilah Wan Ismail	Selayang Hospital
		Lim Yam Ngo	Kuala Lumpur Hospital
6	Treatment of Anaemia in Dialysis Patients	Philip N. Jeremiah	Ampang Puteri Specialist Hospital
		Bee Boon Cheak	Kuala Lumpur Hospital
7	Nutrition Status on Dialysis	Tilakavati Karupaiah	Faculty of Allied Health Sciences Universiti Kebangsaan Malaysia
		Ahmad Fauzi Abdul Rahman	Puteri Specialist Hospital
8	Blood Pressure Control and Dyslipidemia	Prasad Menon	Subang Jaya Medical Centre
		Lee Wan Tin	Subang Jaya Medical Centre
9	Renal Bone Disease	Rozina Bt Ghazalli	Penang Hospital
		Fan Kin Sing	Gleneagle Intan Medical Centre
		Shahnaz Shah Firdaus Khan	Tengku Ampuan Rahimah Hospital
10	Hepatitis on Dialysis	Teo Sue Mei	Ipoh Hospital
		Claire Tan Hui Hong	Sarawak Hospital
		Foo Sui Mei	Ipoh Hospital
		Indralingam Vaithiligam	Taiping Hospital
11	Haemodialysis Practices	Tan Chwee Choon	Tengku Ampuan Rahimah Hospital
		Shahnaz Shah Firdaus Khan	Tengku Ampuan Rahimah Hospital
12	Chronic Peritoneal Dialysis Practices	Sunita Bavanandan	Kuala Lumpur Hospital
		Anita Bhajan Manocha	Kuala Lumpur Hospital
13	Renal Transplant	Goh Bak Leong	Serdang Hospital
		Fan Kin Sing	Gleneagle Intan Medical Centre

FOREWORD

In this and the previous report the treatment rate for dialysis had exceeded the 100 per million-population mark. The continued and consistent growth of the dialysis population over the last two decades let this achievement passed by unnoticed. This figure is significant in a number of ways. For many years the nephrologists in the country have quoted the incidence of end stage renal disease (ESRD) in the country as 100 new cases per million population. Secondly they used this figure as a target of the treatment rate to be achieved and lobbied the government for more treatment facilities. We were of course wrong on the first score. The incidence of ESRD is higher than 100 per million population. A local study had indicated this and figures from neighbouring countries with similar populations showed similar higher incidence. In parts of our country the treatment rate has reached 140 per million. However the "magical" figure of 100 has been useful for nephrologists and the public alike to lobby for more facilities. We were able to garner support from governmental agencies and non-governmental organisations alike to meet this target. This is reflected not just from the varied background of the dialysis providers but also from the funding sources. The combined efforts of all parties led to this achievement. A new target will have to be set. The total number of dialysis patients is expected to increase to about 20,000 by the year 2008 if the current growth rate is maintained. The centre survey done at the end of 2005 indicated that there are almost 13,000 patients on dialysis. The treatment rate for those less than 65 years of age has plateaued while that of those older than sixty-five years continues to rise. This changing demographic is not unexpected and has been noticed for many years. However there is some concern about how prepared and capable some centres are in managing older patients especially those with co-morbidities.

The recurrent theme in this report is the variation in outcomes of dialysis treatment. This includes mortality as well as other intermediate measures such as blood pressure and dialysis adequacy. This should be studied further. There are differences in case mix but of more concern are differences in structure, processes and expertise. More detailed studies should be done and efforts made to redress this problem. The registry welcomes individuals who are interested in studying this further

The projected increase in the number of dialysis patients has led many to seriously review the strategy in the management of chronic kidney disease (CKD). Although there is awareness on the need to manage CKD effectively, the implementation of prevention of renal failure treatment is far from satisfactory. This is probably because there are many more players in this effort and to implement a cohesive national program can be a major challenge. The role of primary care physicians is crucial and nephrologists in tertiary centres have little contact with them and hence less opportunity to influence their treatment of CKD. Nonetheless a major initiative has to be taken if any success is to be expected. A start would be to look at the prevalence and course of CKD

The National Renal Registry (NRR) has decided that it will assist in this effort by providing data on CKD. The NRR has decided to set up a Glomerulonephritis (GN) Registry that will tract the course of biopsy proven GN. Data from such a registry will hopefully help formulate guidelines on the prevention of renal failure in patients with GN. The registry fully appreciates that the major cause of ESRD is Diabetic Nephropathy and any effort on prevention of renal failure will have to deal with this major scourge.

The NRR feels that to develop a Diabetic nephropathy registry will be a major task presently. It hopes that the experience gained with the GN registry will prepare it for the development of a diabetic nephropathy registry

.

In 2006 the Private Healthcare Facilities and Services Act 1998 will be enforced. A regulation attached to the Act concerns Hemodialysis treatment. Some aspects of the regulation on Hemodialysis have been developed based on prevailing practices as documented in the registry reports. Any regulation on Hemodialysis should take into account evidence based practice. The registry is a repository of much data that can provide evidence to guide practice that can ensure a favourable outcome. It is important that all participants continue to provide timely and accurate data. This will place the registry in a strong position to assist the nephrologists in developing guidelines that are relevant to this country.

Dr. Zaki Morad
Chairman,
National Renal Registry

CONTENTS

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF FIGURES

LIST OF FIGURES (continue)

LIST OF FIGURES (continue)

LIST OF FIGURES (continue)

LIST OF FIGURES (continue)

REPORT SUMMARY

- Intake of new dialysis patients showed a linear increase over the years -from 952 in 1996 to 2774 in 2004 with corresponding treatment rates of 45 and 108 per million population respectively.

- Prevalent dialysis patients increased from 2922 (138 per million) in 1996 to 11767 (460 per million) at year end 2004.

- The number of new transplant patients increased from just above 151 in 1996 to 185 in 2004 but transplant rates remain about 5-7 per million. Patients with functioning renal transplants increased from 1024 (48 per million) to 1582 (62 per million) over the same period.

- Dialysis treatment rates varied from about 48-80 per million state population in the economically underdeveloped states to >140 per million in the more economically advantaged states in 2004.

- From the centre survey carried out at the end of 2005, there were a total of 12974 dialysis patients, 34% in the Ministry of Health hospitals, 32% in non-governmental organization (NGO) centres and about 31% in the private sector. The gap between HD capacity and patient intake was widening for all 3 sectors but was widest for the NGO sector.

- The treatment gap between men and women has remained consistent over the years.

- Dialysis treatment rates for those < 65 years of age had plateaued while those >65 years continue to register rapid increase. 52% of new dialysis patients were at least 55 years old

- At least 88% of new patients were accepted into centre haemodialysis

- The government continued to fund about 50% of dialysis treatment, NGO funding decreased to 12% in 2004, and self funding had decreased to 23%.

- Diabetes mellitus continued to be the commonest cause of ESRD accounting for 52% in 2005, followed by hypertension at 7%.

- The annual death rate for those on CAPD remained relatively unchanged while there was an upward trend in the annual death rate for those on haemodialysis.

- Cardiovascular disease and death at home remained the commonest cause of death in 2005; sepsis was next at 12%.

- The unadjusted 5 and 10 year patient survival on dialysis were 59% and 37% respectively. HD patient survival was superior to that on CAPD. HD patient survival varied widely between centres. Adjusted patient survival varied widely between CAPD centres at 5-years but not at 1-year.

- Older and diabetic patients had poorer survival on dialysis.

- Median QoL index scores were satisfactory. Patients on HD, diabetics and older patients reported lower QoL scores.

- Employment among HD and CAPD patients increased with increasing years on dialysis.

- In 2005, 80% of HD and 72% of CAPD patients were on erythropoietin (EPO). Blood transfusion rate in dialysis patients remained at 10 -15%. There was decreasing use of oral iron supplements; use of IV Iron has increased. Variations were seen in the use of EPO, blood transfusion rates and measures of iron stores in HD and CAPD centres

- Serum albumin levels remained at mean and median of 40g/L for HD but showed a decreasing trend in CAPD patients. There were wide variations in the proportion of patients with serum albumin >40g/L in both HD and CAPD centres.

- BMI for both HD and CAPD patients improved. There was some variation in proportion of patients with BMI $\geq$ 18.5 in both HD and PD centres.

- In 2005, the mean and median predialysis systolic BP was 149 mm Hg in HD and 140 mmHg in CAPD patients, while the diastolic BP was about 80 mmHg for both HD and CAPD patients. The variation noted among the various HD and PD centres in median systolic or diastolic BP was not wide but there was wide variation in the proportion of patients achieving BP of <140/90 mmHg.

- Improving cholesterol levels were seen in both HD and CAPD patients with lower levels seen in HD patients. Serum triglyceride levels did not show much change over the years and was lower in HD patients. There was not much variation in lipid control between dialysis centres.

- In 2005 calcium carbonate remained the major phosphate binder in both HD and CAPD patients. Phosphate control was better in CAPD patients. The target of calcium phosphate product of less than 4.5 $mmol^2/L^2$ was achieved more by CAPD patients than HD. There was variation in serum calcium, phosphate and calcium phosphate product among both hemodialysis and CAPD centres.

- The prevalence of Hepatitis B infection has remained unchanged over the years, and was quite similar between HD and CAPD patients. HCV prevalence showed a declining trend of about 9% since 2001. The proportion of HCV infected patients varied widely between HD centers.

- Haemodialysis practices have changed since 1997 to 2005. There was increased use of brachiocephalic fistulae, higher blood flow rates, increased usage of synthetic membranes, increased number of reuse and almost universal use of bicarbonate buffer. Median prescribed KT/V plateaued over the last few years at 1.6. There was wide variation in the proportion of patients with blood flow rates of >250 ml/min, and KT/V of $\geq$1.3 among HD centres. Technique survival was better in HD compared to PD, in the younger age groups and the non-diabetics but was not related to the year of starting dialysis.

- Chronic PD - In 2005, CAPD remained the commonest mode of PD at 93% but APD use increased to 4%. The Baxter disconnect system was the commonest connectology used. Ninety-four percent of patients performed 4 exchanges a day, 90% used a fill volume of 2 L. The median delivered weekly Kt/V was 2.1, 61% achieved target of 2.0 with a 8-fold variation between the highest- and the lowest-performing centres. 78% of prevalent patients had low-average or high-average PET status. High PET status was more common among prevalent patients. Technique survival was better for younger patients and non-diabetics but was not related to the year of starting dialysis or gender.

- In 2005, median peritonitis rate was 35 patient-months but varied between 23 and 65 patient-months/episode among centres. Gram positive and Gram negative organisms each accounted for 35% and 32% of peritonitis episodes.

Chapter 13 Renal Transplantation

- There were 151 new renal transplant recipients in 2004 and 1657 with functioning transplants.
- Mean age of new transplant patients in 2005 was 39 years; 71% were male, 21% diabetic, 4% HbsAg positive and 3% anti-HCV positive at the time of transplantation.
- Commonest known primary renal disease was chronic glomerulonephritis followed by hypertension.
- In 2005, commercial transplants from China constituted 69% of all new renal transplantation, live donor transplantation 26% and local cadaveric transplants contributed only 3%.
- 78% of renal transplant recipients were on cyclosporine, 97% on prednisolone, and 14% were on tacrolimus. 41% were on MMF and 40% on azathioprine
- 13% of the prevalent renal transplant recipients had diabetes mellitus before transplantation, another 8% developed diabetes mellitus post transplantation
- In 2004, 37 (2%) of transplant recipients died and 44 (3%) lost their grafts. Infection, cardiovascular disease and cancer were the commonest causes of death for the last decade accounting for 25%, 10% and 18% in 2004. Renal allograft rejection accounted for 50-60% of graft loss.
- The overall transplant patient survival rate from 1993 to 2005 was 95%, 92%, 88% and 81% at 1 year, 3 years, 5 years and 10 years respectively, while the overall graft survival rate was 92%, 85%, 79% and 63% respectively.

Chapter 5: Paediatric Renal replacement therapy

- Intake of new paediatric dialysis patients increased from 12 in 1990 to 75 in 2005 giving a dialysis acceptance rate of 1 per million age related population (pmarp) to 7 pmarp respectively.
- New renal transplant rate at only 1 pmarp over the last 15 years.
- At the end of 2005 there were a total of 429 patients under 20 on dialysis giving a dialysis prevalence rate 39 pmarp.
- The number of patients with functioning transplants in 2004 was 120 giving a prevalence rate of 11 pmarp.
- Dialysis treatment rates were higher in the economically advantaged states of Malaysia.
- The number of 0-4 year olds provided RRT remained very low**.**
- Chronic PD was the preferred mode of initial dialysis modality; 20% of which was APD.
- More than 90% received dialysis in government centres.
- Glomerulonephritis accounted for 28% of ESRD, focal segmental glomerulosclerosis 11%, and SLE 7%. 34% of patients had unknown primary renal disease.
- Patient survival on HD was 94% for 1 year, 85% for 5 years and 78% for 10 years. CAPD patient survival was 95% at 1 year, 81% at 5 years
- CAPD had worse technique survival compared to HD 2 years after the start of dialysis.
- Patient survival for renal transplantation was 97% for 1 year, 94% at 5 years and 94% at 10 years post transplant; graft survival was 90% at 1 year, 79% at 5 years and 67% at 10 years.

CHAPTER 1

ALL RENAL REPLACEMENT THERAPY IN MALAYSIA

Lim Teck Onn
Lim Yam Ngo

1.1 Stock and Flow

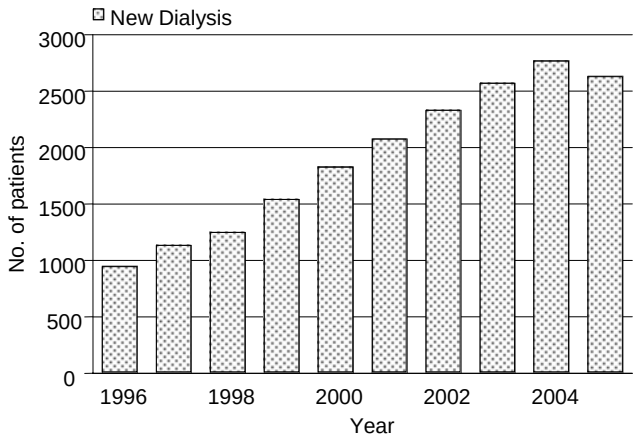
The intake of new dialysis patients continued to grow linearly over the years - from 952 in 1996 to 2774 in 2004. The number of prevalent dialysis patients also increased linearly but more sharply from 2922 in 1996 to 11767 in 2004 and almost 13000 by the end of year 2005. The number of new transplant patients increased from 151 in 1996 to 185 in 2004 and patients with functioning renal transplants increased from 1024 to 1582 over the same period. (table and figure 1.01)

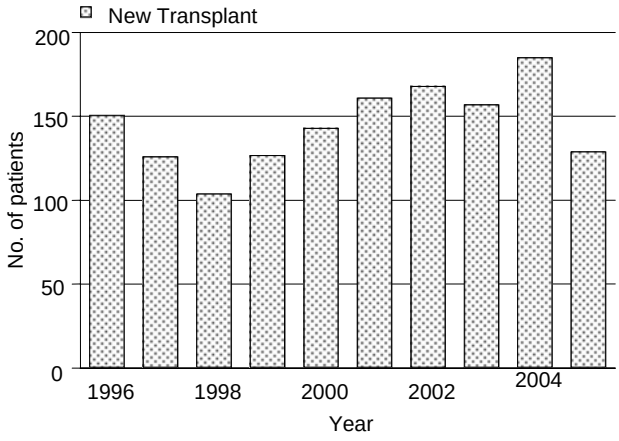
Table 1.01: Stock and Flow of RRT, Malaysia 1996 – 2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New Dialysis patients	952	1135	1250	1543	1835	2078	2333	2573	2774	2636
New Transplants	151	126	104	127	143	161	168	158	185	133
Dialysis deaths	222	315	373	487	586	810	920	1142	1188	1203
Transplant deaths	31	29	23	25	27	35	31	36	37	37
Dialysing at 31st December	2922	3699	4540	5540	6693	7832	9093	10384	11767	12974
Functioning transplant at 31st December	1024	1083	1114	1176	1250	1334	1426	1498	1582	1659

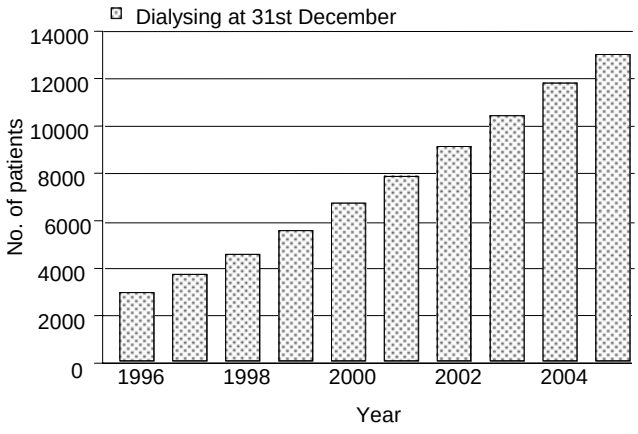
Figure 1.01: Stock and Flow of RRT, Malaysia 1996 – 2005

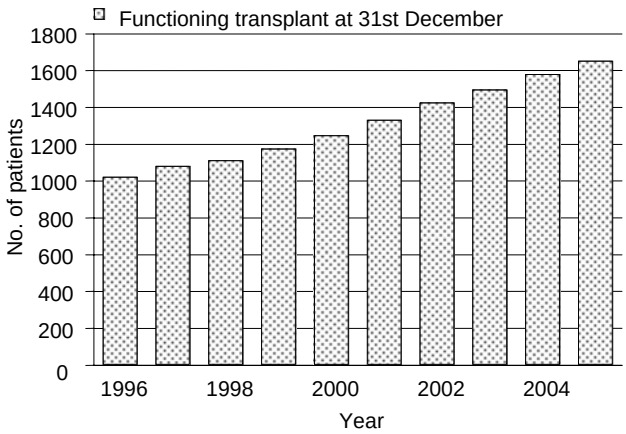
(a) New Dialysis and Transplant patients





(b) Patients Dialysing and with Functioning Transplant at 31st December 1996 – 2005





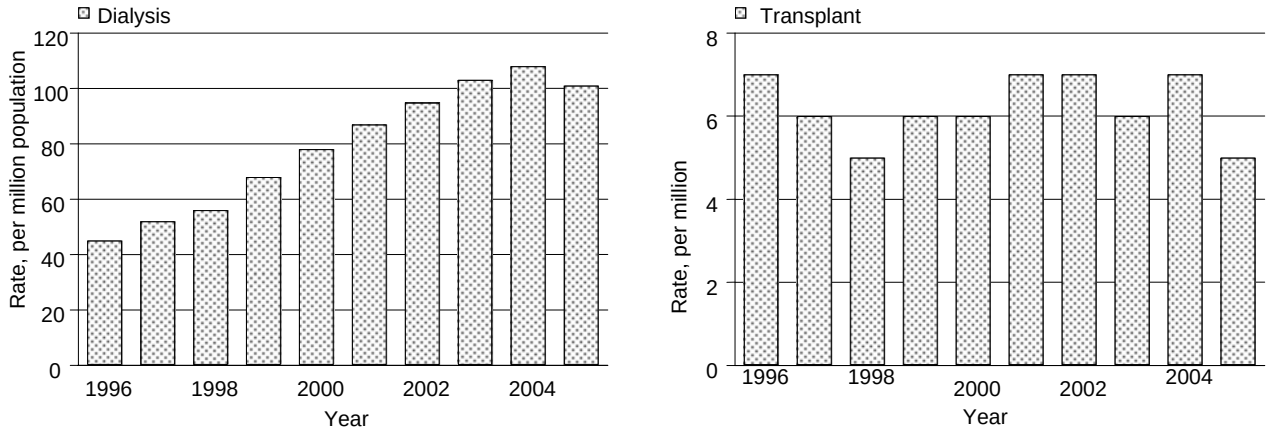
1.2 Treatment Provision Rate

Dialysis acceptance rates continued to increase albeit at a slower rate in the last few years. The dialysis acceptance rate for 2004 was the highest yet at 108 per million population. (Data for 2005 are preliminary since at the time preparation of this report there were still many new cases yet to be notified to registry). New transplant rates remained low over the years fluctuating between 5-7 per million population per year. (table and figure 1.02)

Table 1.02: New Dialysis Acceptance Rate and New Transplant Rate per million population 1996 – 2005

Acceptance rate	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New Dialysis	45	52	56	68	78	87	95	103	108	101
New Transplant	7	6	5	6	6	7	7	6	7	5

Figure 1.02: New Dialysis Acceptance and New Transplant Rate 1996 - 2005

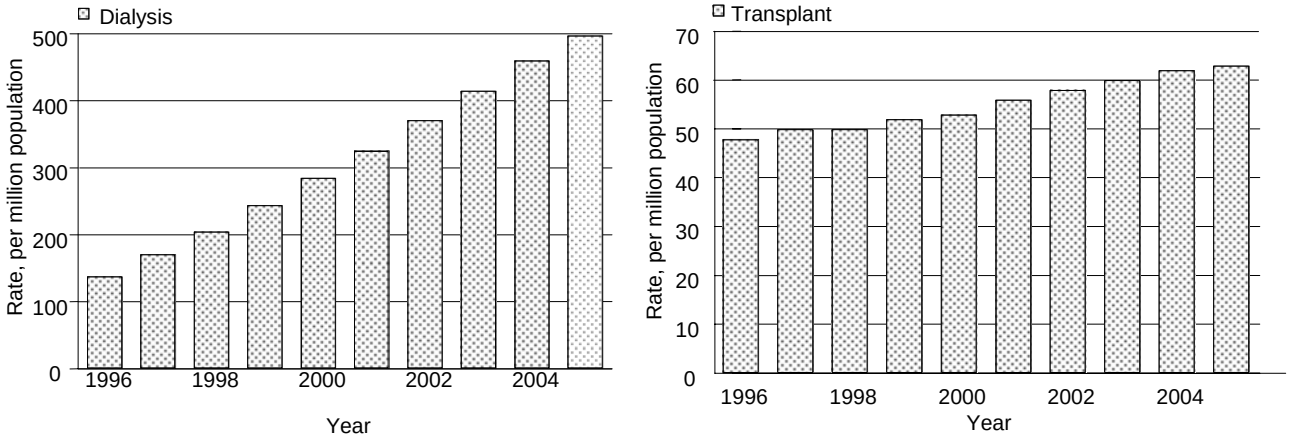


Dialysis prevalence rate also increased linearly over the last 10 years, from 138 per million population in 1995 to 460 in 2004 and almost 500 in 2005. The transplant prevalence rate however only showed a slight increase to 63 per million in 2005. (table and figure 1.03)

Table 1.03: RRT Prevalence Rate per million population 1996 – 2005

Prevalence rate	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Dialysis	138	171	205	244	285	326	371	415	460	497
Transplant	48	50	50	52	53	56	58	60	62	63

Figure 1.03: Dialysis and Transplant Prevalence Rate per million population 1996 - 2005



CHAPTER 2

DIALYSIS IN MALAYSIA

Lim Teck Onn
Lim Yam Ngo
Lee Day Guat

2.1: PROVISION OF DIALYSIS IN MALAYSIA (Registry report)

2.1.1 Dialysis treatment provision

In 2004, 2774 patients commenced dialysis, giving a treatment rate of 108 per million population. The increase in dialysis provision rate from 2003 to 2004 was only 5 per million compared to 8 to 12 in the previous years. At year end 2004, a total of 11767 patients were on dialysis treatment giving a prevalence rate of 460 per million per year.

Table 2.1.1: Stock and flow – Dialysis Patients 1996 – 2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New Dialysis patients	952	1135	1250	1543	1835	2078	2333	2573	2774	2636
Died	222	315	373	487	586	810	920	1142	1188	1203
Transplanted	56	59	61	69	106	133	143	122	149	93
Lost to Follow-up	5	5	8	10	10	14	21	37	69	120
Dialysing at 31st Dec	2922	3699	4540	5540	6693	7832	9093	10384	11767	12974

Table 2.1.2: Dialysis Treatment Rate per million population 1996 – 2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Acceptance rate	45	52	56	68	78	87	95	103	108	101
Prevalence rate	138	171	205	244	285	326	371	415	460	497

2.1.2.Geographic distribution

The economically advantaged states on the west coast of Peninsular Malaysia – Melaka, Pulau Pinang, Negri Sembilan, Johor, Selangor and W. Persekutuan of Kuala Lumpur, and Perak - have dialysis treatment rates exceeding 100 per million state population since year 2000. Dialysis provision rate in the northern Peninsular Malaysia states, Kedah and Perlis exceeded 100 per million for the first time in 2003. The East Coast states of Peninsular Malaysia and Sarawak and Sabah still have very much lower treatment rates. Melaka continued to have the highest treatment rate exceeding 200 for the first time and Sabah the lowest at 48 per million in 2004.

Table 2.1.3: Dialysis Treatment Rate by State, per million state population 1996-2005

State	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Pulau Pinang	72	84	112	124	105	122	150	142	197	185
Negeri Sembilan	74	74	92	96	118	112	131	148	157	147
Negeri Melaka	82	95	109	88	150	156	171	180	209	137
Johor Darul Takzim	57	80	71	104	131	138	148	146	150	133
Perak Darul Redzuan	58	62	64	76	106	103	116	129	140	131
Selangor & W. Persekutuan	81	76	91	102	121	119	126	134	140	128
Kedah & Perlis	26	54	47	59	69	68	90	105	96	97
Terengganu Darul Iman	27	36	34	36	37	75	88	68	80	90
Pahang Darul Makmur	16	45	36	46	49	51	53	66	70	73
Kelantan Darul Naim	6	12	15	27	31	59	62	73	64	69
Sarawak	36	46	33	44	51	67	58	62	68	61
Sabah	18	16	24	32	26	36	36	44	48	43

2.2: DIALYSIS PROVISION IN MALAYSIA (Centre survey report)

2.2.1 Dialysis provision

Data submission of individual dialysis and transplant patients to the National Renal Registry is entirely voluntary and completeness cannot be ascertained. Dialysis centre surveys have been conducted in December of each year since 1999. This annual cross-sectional survey was carried out to describe the most current level and distribution of dialysis provision at the end of each year. This section reports the results of the centre survey carried out in December 2005. Dialysis provision is expressed in terms of number of centres, machines, treatment capacity (one HD machine to 5 patients) and patients.

At the end of 2005, there were a total of 12974 dialysis patients. The Ministry of Health (MOH) provided dialysis to 34% of patients, non-governmental organizations (NGO) 32% and the private sector at 31%. Almost all private dialysis patients received centre haemodialysis treatment compared to the MOH sector where patients on chronic peritoneal dialysis (PD) and home haemodialysis comprised about a quarter of all dialysis patients. (table 2.2.1)

Of the 3 main sectors, the private sector had the largest number of dialysis centres but the NGO centres had the largest HD capacity. (fig 2.2.1 a & b) The Ministry of Health had the lowest HD treatment capacity to patient ratio at 1.52 and the NGO sector the highest at 1.7. (fig 2.2.1d)

Table 2.2.1: Number of dialysis centres, HD machines and treatment capacity by sector, December 2005

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	137	1042	5210	3428	1.52	4471
NGO	99	1427	7135	4207	1.7	4169
Private (PRV))	144	1317	6585	4112	1.6	3998
University (UNI)	8	54	270	138	1.96	240
Armed Forces (AF)	8	46	230	102	2.25	96

Figure 2.2.1(a): Distribution of dialysis centres by Sector, December 2005

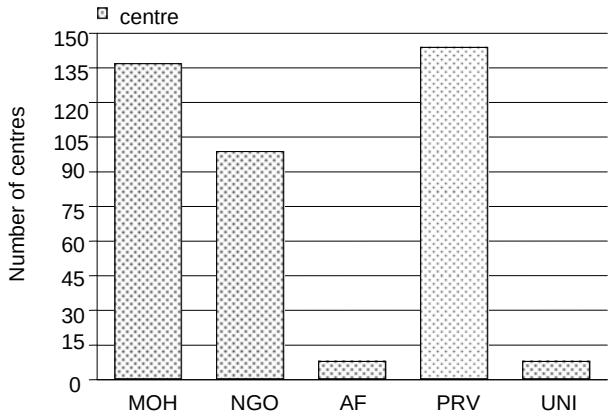


Figure 2.2.1(b): Distribution of HD capacity by Sector, December 2005

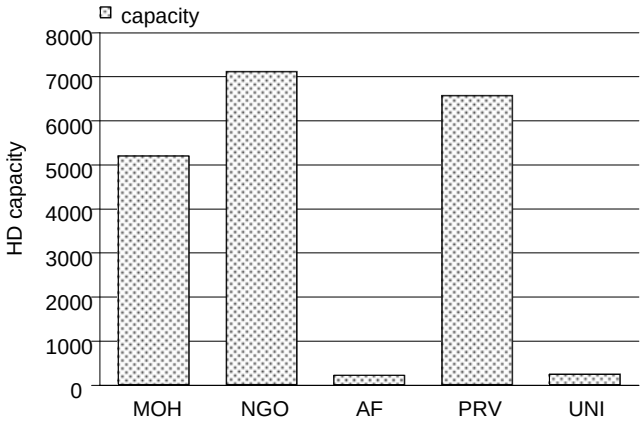


Figure 2.2.1(c): Distribution of dialysis patients by Sector, December 2005

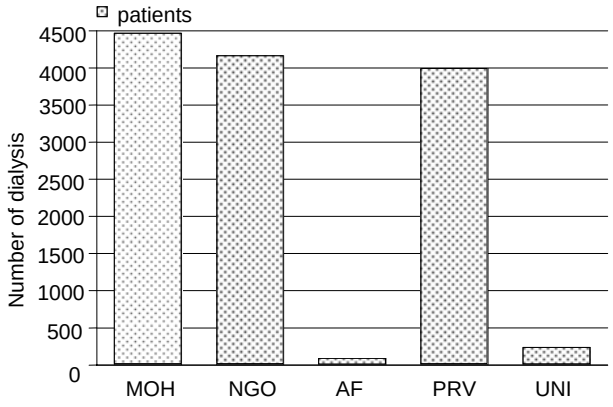
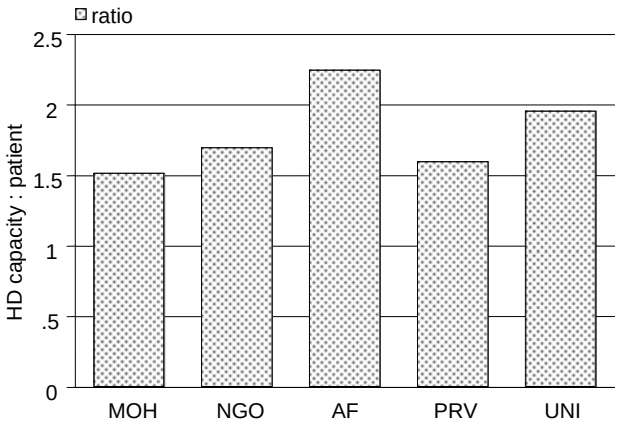


Figure 2.2.1(d): HD capacity: patient ratio by Sector,



2.2.2.Geographic distribution

The economically advantaged states have the highest number of dialysis centres, treatment capacity, patients and treatment rate. However, other than Pahang, which had the highest HD capacity to patient ratio at 1.99, the HD capacity to patient ratio did not vary too widely between the various states. (table and fig 2.2.2.). This is unlike previous years when HD capacity to patient ratio was higher in the economically disadvantaged states compared to the advanced states. Although the number of HD machines has increased, the intake of patients was more than the increase in number of new machines. This increased intake may be partly the result of the availability of more nephrologists serving in the underserved areas.

Table 2.2.2: Number of dialysis centres, number of HD machines and treatment capacity, HD capacity to patients ratio and number of dialysis patients by state in December 2005.

State	Centre (No.)	Centre HD machines	Centre HD machines pmp	Centre HD capacity (No.)	Centre HD capacity pmp	Centre HD patients (No.)	Centre HD patients pmp	HD capacity: patient ratio	All dialysis patients (No.)	Dialysis treatment rate pmp
Penang (Pe)	36	373	254	1865	1270	1128	768	1.65	1156	787
Melaka (Me)	15	188	264	940	1318	547	767	1.72	530	743
Johor (Jo)	54	570	184	2850	919	1900	613	1.5	2060	664
Selangor & Federal Territory (SF)	111	1174	187	5870	933	3546	564	1.66	3864	614
Perak (Pe)	47	431	191	2155	955	1292	573	1.67	1364	605
Negeri Sembilan (Ne)	12	136	144	680	719	577	610	1.18	559	591
Kedah & Perlis (KP)	28	279	135	1395	673	796	384	1.75	935	451
Sarawak (Sw)	25	218	94	1090	471	729	315	1.5	821	355
Trengganu (Tr)	10	79	78	395	389	271	267	1.46	325	320
Pahang (Pa)	15	141	99	705	494	354	248	1.99	436	306
Kelantan (Ke)	16	117	78	585	389	364	242	1.61	411	273
Sabah (Sb)	27	180	60	900	298	483	160	1.86	513	170
Malaysia	396	3886	149	19430	744	11987	459	1.62	12974	497

Figure 2.2.2(a): Distribution of dialysis centres by State, December 2005

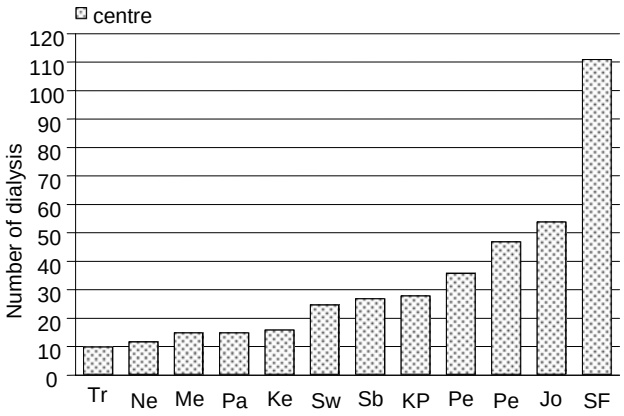


Figure 2.2.2(b): Distribution of dialysis patients by State, December 2005

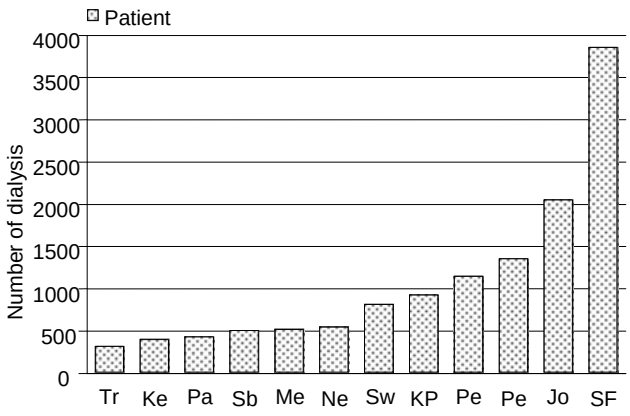


Figure 2.2.2(c): Distribution of dialysis treatment by State, December 2005

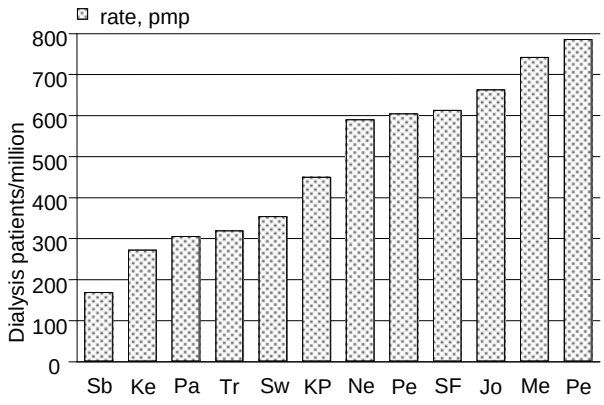
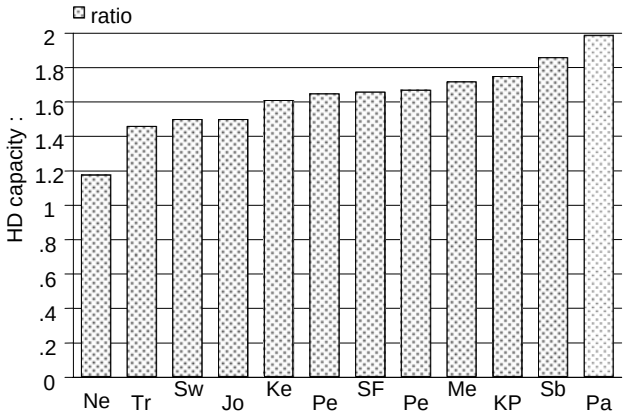


Figure 2.2.2(d): HD capacity to patient ratio by State,



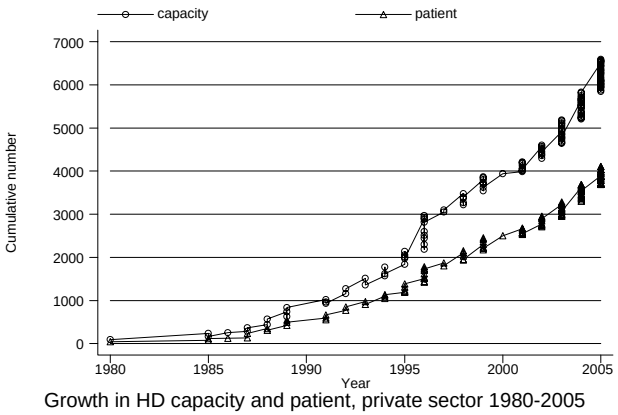
2.2.3 Growth in dialysis provision by sector

There has been a very rapid increase in the number of HD patients from 198 in 1980 to 11987 in 2005. (table 2.2.3). However as shown in figures 2.2.3, there is a divergence between HD capacity and number of dialysis patients over the years indicating that gap between HD capacity and patient intake is widening. This divergence was widest in the NGO sector.

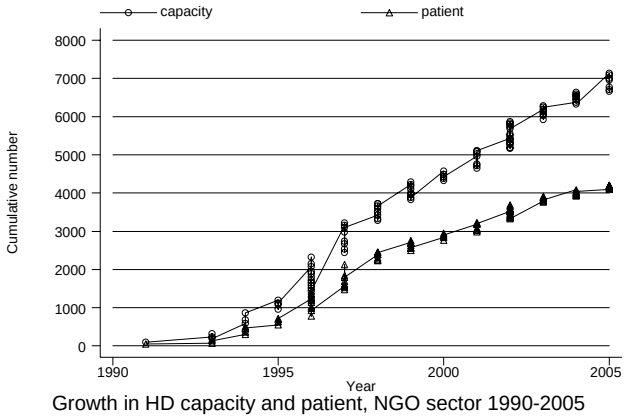
Table 2.2.3: Growth in HD capacity and HD patients in Private, NGO and MOH sectors, 1980-2005

Sector	Private		NGO		MOH	
	Cumulative HD capacity	Cumulative HD patients	Cumulative HD capacity	Cumulative HD patients	Cumulative HD capacity	Cumulative HD patients
1980	95	43	-	-	145	155
1985	235	119	-	-	975	724
1990	1020	666	95	50	1500	1118
1995	2140	1383	1200	716	2345	1758
2000	3940	2497	4575	2953	3525	2505
2005	6585	4112	7135	4207	5710	3668

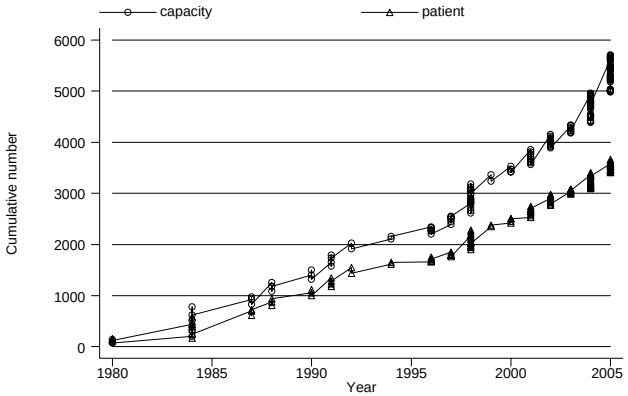
Figure 2.2.3: Growth in HD capacity and HD patients in Private, NGO and MOH sectors, 1980-2005



Growth in HD capacity and patient, private sector 1980-2005



Growth in HD capacity and patient, NGO sector 1990-2005



Growth in HD capacity and patient, MOH sector 1980-2005

2.3: DISTRIBUTION OF DIALYSIS TREATMENT

2.3.1 Gender distribution

The treatment gap between men and women accepted for dialysis has remained consistent over the years, suggesting this is a true reflection of the difference in ESRD incidence between the 2 sexes rather than any conscious or unconscious bias in treatment allocation. However, figure 2.3.1(b) shows a convergence in the proportion of prevalent male and female patients. This is probably because of the survival advantage in female patients.

Table 2.3.1(a): Dialysis Treatment Rate by Gender, per million male or female population 1996– 2005

Gender	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Male	51	63	62	81	92	97	110	122	125	118
Female	45	50	57	61	73	88	94	95	106	95

Figure 2.3.1 (a): Dialysis Treatment by Gender 1996 – 2005

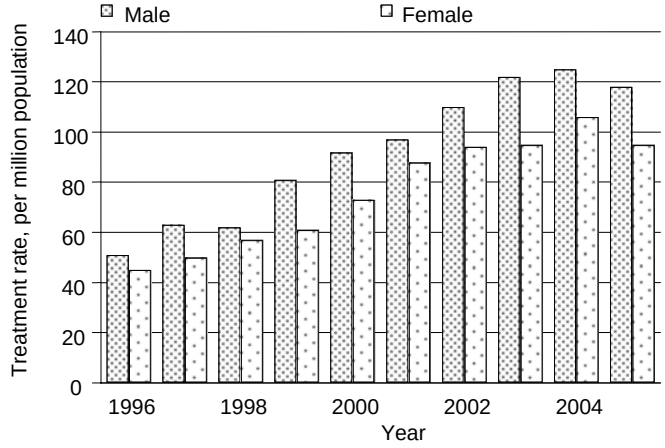
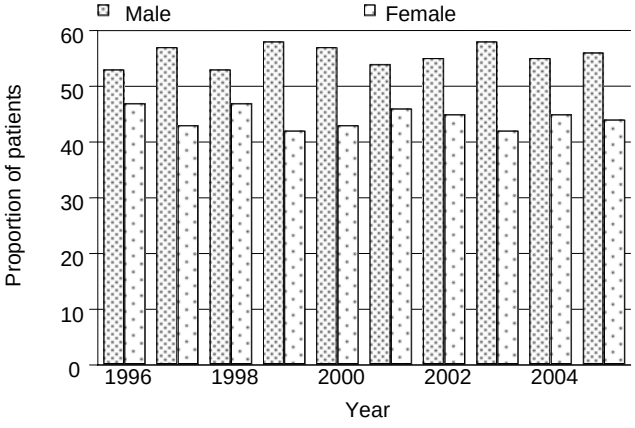


Table 2.3.1(b): Gender distribution of Dialysis Patients 1996-2005

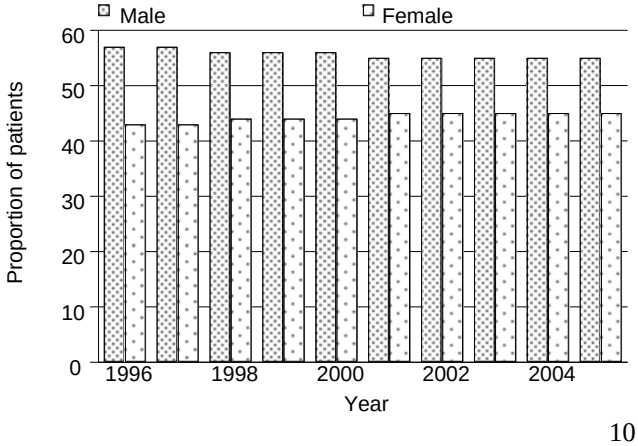
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New Dialysis patients	952	1135	1250	1543	1835	2078	2333	2573	2774	2636
% Male	53	57	53	58	57	54	55	58	55	56
% Female	47	43	47	42	43	46	45	42	45	44
Dialysing at 31st December	2922	3699	4540	5540	6693	7832	9093	10384	11767	12974
% Male	57	57	56	56	56	55	55	55	55	55
% Female	43	43	44	44	44	45	45	45	45	45

Figure 2.3.1(b): Gender Distribution of Dialysis patients 1996 – 2005

(i) New Dialysis patients



(ii) Dialysing patients at 31st December



2.3.2 Age distribution

Except for the age group 65 years and older which continued to register increase in treatment rates, dialysis treatment rates in the other age groups have plateaued in the last few years, suggesting that almost all patients with ESRD in those age groups who were in need of dialysis were able to access treatment. The treatment rate for patients 65 years and older had exceeded 600 per million in 2004. 52% of new dialysis patients were at least 55 years old

Table 2.3.2(a): Dialysis Treatment Rate by Age Group, per million age group population 1996 – 2005

Age groups (years)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1-14	3	3	3	3	4	4	5	4	5	5
15-24	13	15	15	16	18	22	28	25	27	27
25-34	38	39	40	42	46	47	55	51	50	48
35-44	68	80	81	85	98	102	101	101	111	93
45-54	154	166	174	225	248	250	272	276	297	257
55-64	227	290	311	370	430	508	532	583	575	544
>=65	172	213	228	300	347	434	495	575	628	565

Figure 2.3.2(a): Dialysis Treatment Rate by Age Group 1996 - 2005

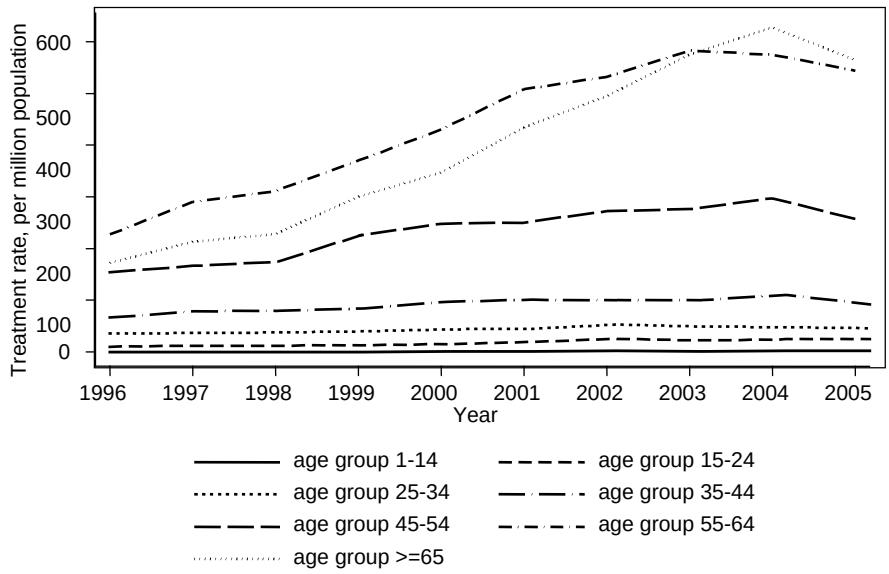
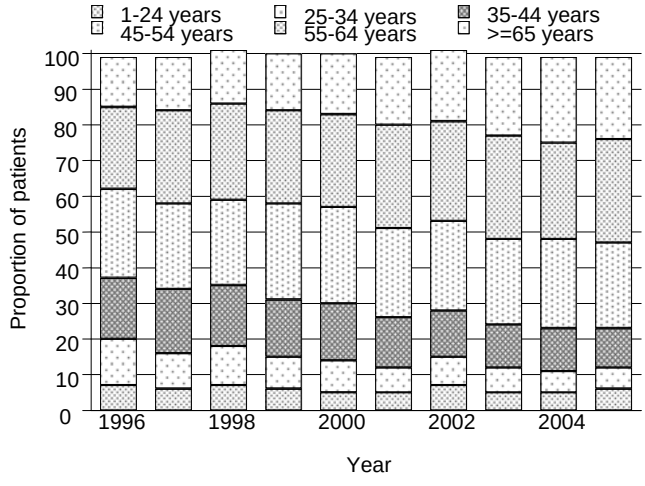


Table 2.3.2(b): Percentage Age Distribution of Dialysis Patients 1996 – 2005

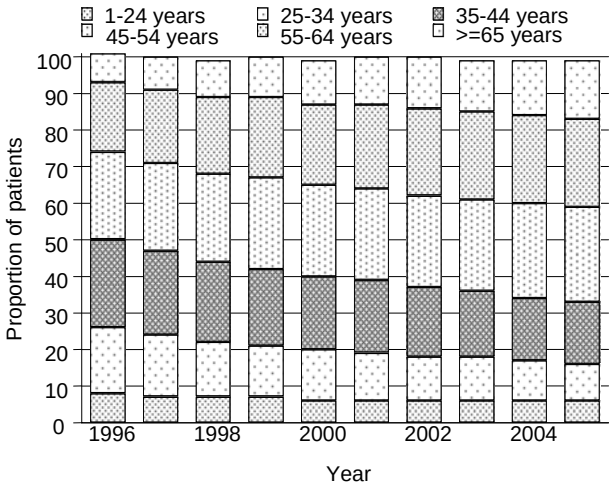
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New Dialysis patients	952	1135	1250	1543	1835	2078	2333	2573	2774	2636
% 1-14 years	2	1	2	2	1	1	2	1	1	2
% 15-24 years	5	5	5	4	4	4	5	4	4	4
% 25-34 years	13	10	11	9	9	7	8	7	6	6
% 35-44 years	17	18	17	16	16	14	13	12	12	11
% 45-54 years	25	24	24	27	27	25	25	24	25	24
% 55-64 years	23	26	27	26	26	29	28	29	27	29
% >=65 years	14	15	15	16	17	19	20	22	24	23
Dialysing at 31st December	2922	3699	4540	5540	6693	7832	9093	10384	11767	12974
% 1-14 years	2	2	2	2	1	1	1	1	1	1
% 15-24 years	6	5	5	5	5	5	5	5	5	5
% 25-34 years	18	17	15	14	14	13	12	12	11	10
% 35-44 years	24	23	22	21	20	20	19	18	17	17
% 45-54 years	24	24	24	25	25	25	25	25	26	26
% 55-64 years	19	20	21	22	22	23	24	24	24	24
% >=65 years	8	9	10	11	12	13	14	14	15	16

Figure 2.3.2(b): Age Distribution of New Dialysis patients 1996 – 2005

(i) New Dialysis patients



(ii) Dialysing patients at 31st December



2.3.3 Method and Location of dialysis

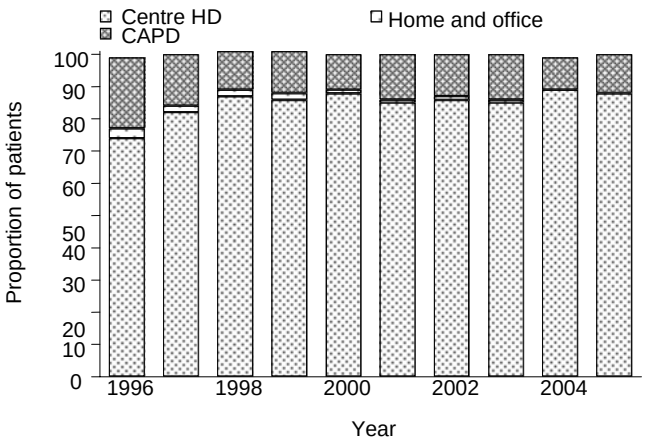
88% of new patients were accepted into centre haemodialysis in 2005. The year 2004 finally saw the demise of home/office HD - a programme introduced at a time when dialysis treatment was not easily available. Chronic PD accounted for about 12% of new dialysis patients but only 9% of prevalent dialysis patients in 2005. (table & fig 2.3.5)

Table 2.3.3: Method and Location of Dialysis 1996 – 2005

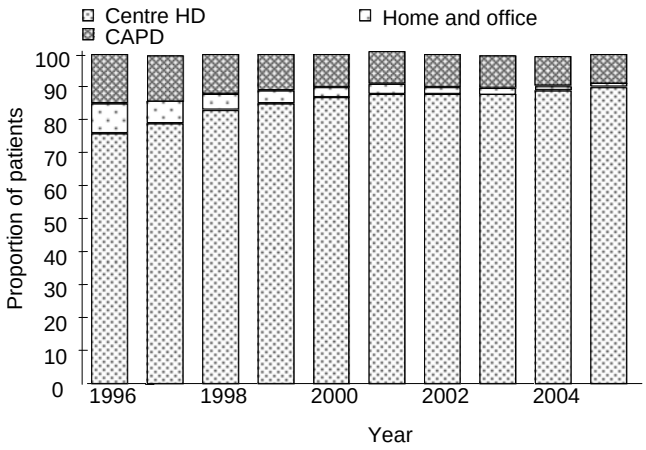
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New Dialysis patients	952	1135	1250	1543	1835	2078	2333	2573	2774	2636
% Centre HD	74	82	87	86	88	85	86	85	89	88
% Home and office HD	3	2	2	2	1	1	1	1	0	0
% CAPD	22	16	12	13	11	14	13	14	10	12
Dialysing at 31st December	2922	3699	4540	5540	6693	7832	9093	10384	11767	12974
% Centre HD	76	79	83	85	87	88	88	88	89	90
% Home and office HD	9	7	5	4	3	3	2	2	1	1
% CAPD	15	14	12	11	10	10	10	10	9	9

Figure 2.3.3: Method and Location of Dialysis Patients 1996 – 2005

(a) New Dialysis patients



(b) Dialysing patients at 31st December



2.3.4 Funding for Dialysis Treatment

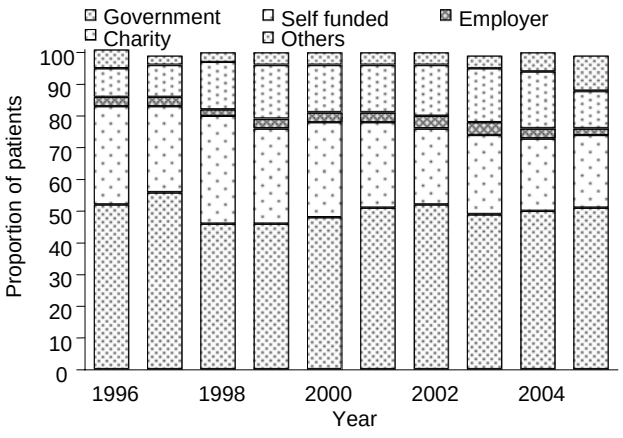
The government continued to provide almost fully subsidised dialysis treatment to about 50% of dialysis patients. The proportion of new patients who paid for their dialysis treatment shows a gradual decline over the years from about 30% in the late 1990's to about 23% in the last 3 years. The proportion of patients funded by charity organizations appeared to have decreased in 2005 to 12% from an average of 16% since 2000. (table & fig 2.3.4)

Table 2.3.4: Funding for Dialysis Treatment 1996 – 2005

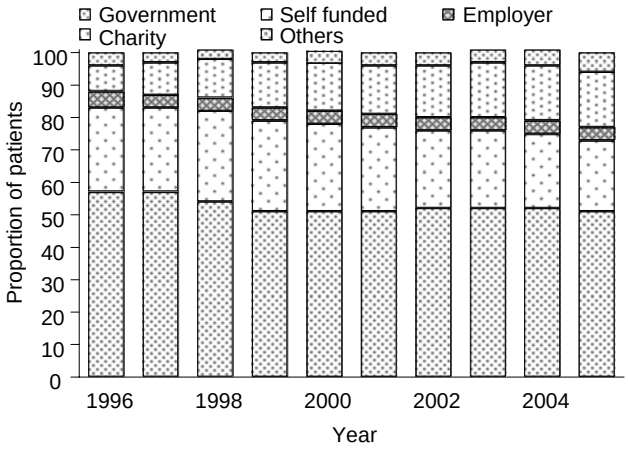
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New Dialysis patients	952	1135	1250	1543	1835	2078	2333	2573	2774	2636
% by Government	52	56	46	46	48	51	52	49	50	51
% self funded	31	27	34	30	30	27	24	25	23	23
% subsidized by Employer	3	3	2	3	3	3	4	4	3	2
% by Charity	9	10	15	17	15	15	16	17	18	12
% Others	6	3	3	4	4	4	4	4	6	11
Dialysing at 31st December	2922	3699	4540	5540	6693	7832	9093	10384	11767	12974
% by Government	57	57	54	51	51	51	52	52	52	51
% self funded	26	26	28	28	27	26	24	24	23	22
% subsidized by Employer	5	4	4	4	4	4	4	4	4	4
% by Charity	8	10	12	14	15	15	16	17	17	17
% Others	4	3	3	3	4	4	4	4	5	6

Figure 2.3.4: Funding for Dialysis Treatment 1996 – 2005

a) New Dialysis Patients



(b) Dialysing patients at 31st December



2.3.5 Distribution of dialysis patients by sector

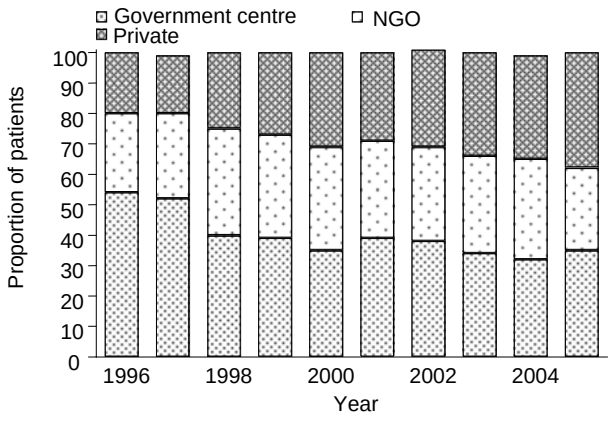
The proportion of new patients dialysed in private centres continued to increase. The proportion of new patients admitted to NGO centres in 2005 at 27% was the lowest in the last few years while the proportion dialysing in government centres increased to 35%. Over the last few years, because of a ministry of health (MOH) policy that all MOH hospitals will have a haemodialysis unit, this resulted in an increase intake into MOH centres and hence a reduction in the number of new dialysis patients referred for dialysis in NGO centres. This situation may change once these new MOH centres are filled.

Table 2.3.5: Distribution of Dialysis Patients by Sector 1996 – 2005

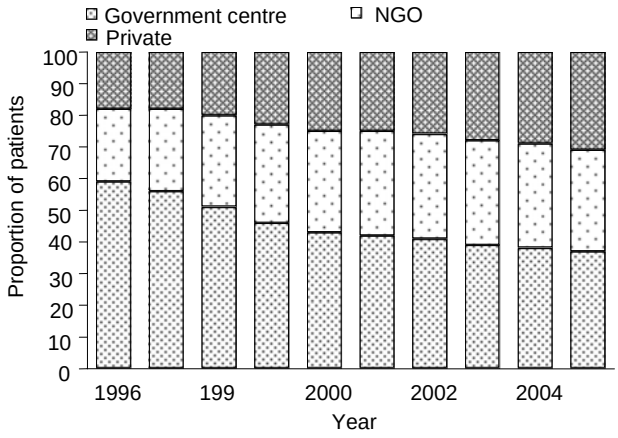
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New Dialysis patients	952	1135	1250	1543	1835	2078	2333	2573	2774	2636
% Government centre	54	52	40	39	35	39	38	34	32	35
% NGO centre	26	28	35	34	34	32	31	32	33	27
% Private centre	20	19	25	27	31	29	32	34	34	38
Dialysing at 31st December	2922	3699	4540	5540	6693	7832	9093	10384	11767	12974
% Government centre	59	56	51	46	43	42	41	39	38	37
% NGO centre	23	26	29	31	32	33	33	33	33	32
% Private centre	18	18	20	23	25	25	26	28	29	31

Figure 2.3.5: Distribution of Dialysis Patients by Sector 1996 – 2005

(a) New Dialysis Patients



(b) Dialysing Patients at 31st December



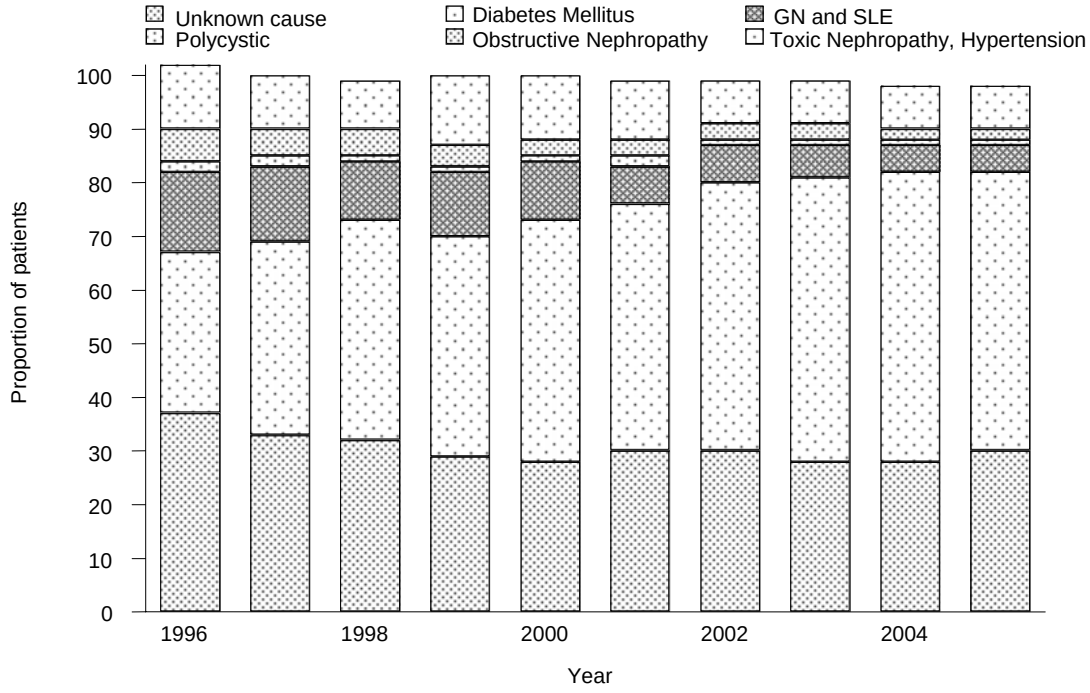
2.4: PRIMARY RENAL DISEASE

Diabetes mellitus continues to be the commonest cause of ESRD. Malaysia has the dubious honour of being the country with the highest percentage of diabetes mellitus in incident dialysis patients. However, for the first time in the last 10 years, the proportion of new dialysis patients with diabetes mellitus showed a decline rather than a rise although 52% of new ESRD was due to diabetes mellitus. Hypertension was the second commonest cause of ESRD at about 7%. The proportion of patients with unknown primary renal disease was still very high at 20% in 2005. Only 4% of ESRD was attributable to chronic glomerulonephritis (GN), 1% to systemic lupus erythematosus(SLE).

Table 2.4.1: Primary Renal Disease 1996– 2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New Dialysis patients	952	1135	1250	1543	1835	2078	2333	2573	2774	2636
% Unknown cause	37	33	32	29	28	30	30	28	28	30
% Diabetes Mellitus	30	36	41	41	45	46	50	53	54	52
% GN	13	13	10	10	9	6	6	5	4	4
% SLE	2	1	1	2	2	1	1	1	1	1
% Polycystic kidney	2	2	1	1	1	2	1	1	1	1
% Obstructive Nephropathy	6	5	5	4	3	3	3	3	2	2
% Toxic Nephropathy	1	0	0	1	0	1	0	0	0	0
% Hypertension	9	9	8	11	11	9	7	7	7	7
% Others	2	1	1	1	1	1	1	1	1	1

Figure 2.4.1: Primary Renal Disease for New Dialysis Patients 1996– 2005



CHAPTER 3

DEATH AND SURVIVAL ON DIALYSIS

Wong Hin Seng
Ong Loke Meng
Wan Shaariah Md Yusuf

3.1: Death On Dialysis

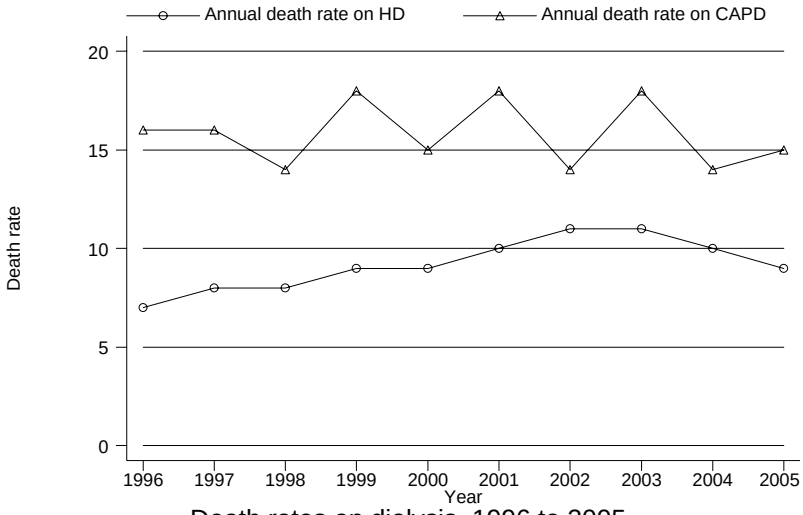
The number of deaths in dialysis patients for 2005 was 1203 (annual death rate of 9.7%). One thousand and thirty seven haemodialysis patients died in 2005 (annual rate of 9.2%) while 166 died on continuous ambulatory peritoneal dialysis (annual death rate of 14.7%).

Table 3.1.1: Deaths on Dialysis 1996 – 2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
No. of dialysis patients at risk	2579	3311	4120	5040	6117	7263	8463	9739	11076	12371
Dialysis deaths	222	315	373	487	586	810	920	1142	1188	1203
Dialysis death rate %	9	10	9	10	10	11	11	12	11	10
No. of HD patients at risk	2196	2840	3600	4473	5490	6551	7622	8754	9993	11243
HD deaths	160	241	299	387	495	680	805	964	1037	1037
HD death rate %	7	8	8	9	9	10	11	11	10	9
No. of CAPD patients at risk	383	471	520	567	627	712	841	985	1083	1128
CAPD deaths	62	74	74	100	91	130	115	178	151	166
CAPD death rate %	16	16	14	18	15	18	14	18	14	15

Figure 3.1.1 shows the annual death rate on dialysis from 1996 till 2005. The annual death rate for those on CAPD remained relatively unchanged over the last 10 years while there was an upward trend in the annual death rate for those on haemodialysis. The annual death rate for those on haemodialysis has increased by 26% over the last 10 years (from 7.3% in 1996 to 9.2% in 2005) and it peaked at 11% in 2003. This has narrowed the difference in the annual death rate between the two modalities of dialysis (from 13% in 1996 to 6% in 2005). The reasons for the marked change in the annual death rate for those treated with haemodialysis remains unclear. This may be partly contributed by the changes in demographics of patients starting dialysis in recent years with a higher proportion of diabetics (26% in 1995 to 54% in 2004) and elderly patients (in 1995, 34% were aged more than 55 years compared with 51% in 2004).

Figure 3.1.1: Death Rates on Dialysis 1996 – 2005



Death rates on dialysis, 1996 to 2005

The causes of death on dialysis are shown in Table 3.1.2. Cardiovascular disease remained the main cause of death in 2005; accounting for 25%. This has remained unchanged over the last 10 years. Death at home accounted for another 24% and a majority of these deaths were probably secondary to cardiovascular events. Death due to sepsis has decreased by 40% over the last 10 years and now accounts for only 12%.

Table 3.1.2: Causes of Death on Dialysis 1996 - 2005

Year	1996		1997		1998		1999		2000	
	No.	%	No.	%	No.	%	No.	%	No.	%
Cardiovascular	50	23	85	27	110	29	129	26	177	30
Died at home	40	18	52	17	72	19	107	22	135	23
Sepsis	45	20	53	17	66	18	84	17	85	15
CAPD peritonitis	1	0	5	2	2	1	11	2	21	4
GIT bleed	3	1	4	1	7	2	18	4	18	3
Cancer	2	1	9	3	8	2	6	1	8	1
Liver disease	2	1	3	1	5	1	7	1	14	2
Others	30	14	31	10	52	14	73	15	84	14
Unknown	49	22	73	23	51	14	52	11	44	8
TOTAL	222	100	315	100	373	100	487	100	586	100

Year	2001		2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%	No.	%
Cardiovascular	210	26	305	33	321	28	321	27	304	25
Died at home	228	28	212	23	289	25	302	25	286	24
Sepsis	128	16	141	15	182	16	149	13	140	12
CAPD peritonitis	29	4	16	2	11	1	13	1	17	1
GIT bleed	18	2	24	3	28	2	24	2	25	2
Cancer	18	2	18	2	26	2	19	2	23	2
Liver disease	11	1	16	2	23	2	27	2	21	2
Others	103	13	120	13	184	16	288	24	339	28
Unknown	65	8	68	7	78	7	45	4	48	4
TOTAL	810	100	920	100	1142	100	1188	100	1203	100

3.2: Patient Survival On Dialysis

3.2.1 Patient survival by type of dialysis modality

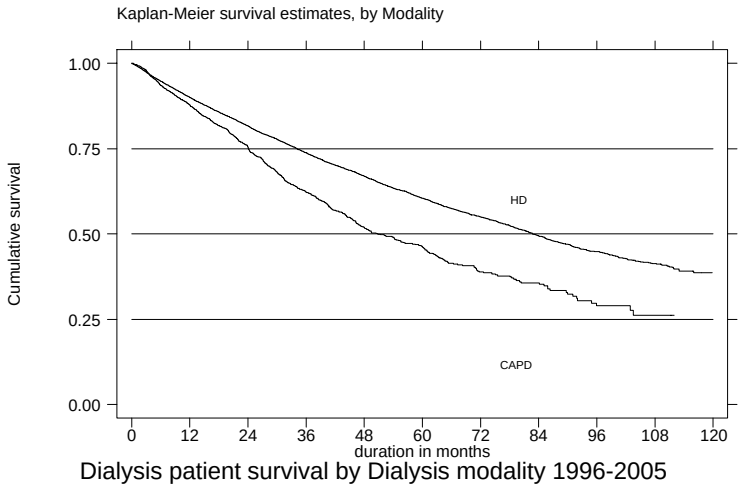
Patient survival by dialysis modality is shown in Table 3.2.1 and Figure 3.2.1. The overall unadjusted 5 year- and 10 year-patient survival on dialysis were 59% and 37% respectively. The unadjusted patient survival was superior in those on haemodialysis compared to those on CAPD and this survival difference progressively widened up to 5 years. At 5 years the unadjusted patient survival on haemodialysis was 60% compared to 46% in those on CAPD. These data contrast with those from the USRDS, Australasian and the UK registries where PD appeared to have a better survival compared to haemodialysis.

Table 3.2.1: Unadjusted patient survival by Dialysis modality, 1996-2005

Dialysis modality Interval (months)	CAPD			HD			All Dialysis		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	2374	94	0	15266	95	0	17640	95	0
12	1980	88	1	13066	90	0	15046	90	0
24	1300	76	1	9515	82	0	10813	81	0
36	769	62	1	6881	74	0	7650	72	0
48	439	52	1	4822	67	0	5261	65	0
60	267	46	1	3303	60	1	3569	59	0
72	147	39	2	2188	55	1	2335	53	1
84	89	36	2	1330	49	1	1417	48	1
96	39	29	2	716	45	1	754	43	1
108	13	26	3	278	41	1	290	40	1
120	-	-	-	17	39	1	17	37	1

* No. = Number at risk SE=standard error

Figure 3.2.1: Unadjusted patient survival by Dialysis modality, 1996-2005



Dialysis patient survival by Dialysis modality 1996-2005

3.2.2 Patient survival by year of starting dialysis

Table 3.2.2 and Fig 3.2.2 show the unadjusted patient survival by year of entry. The unadjusted 6 months survival of those starting dialysis in 2005 was 94%. Despite a progressive increase in the number of diabetic patients and older people starting dialysis in recent years, the unadjusted patient survival remained constant over the last 10 years with a 1-year and 5-year survival of 90-91% and 57-61% respectively.

Table 3.2.2: Unadjusted patient survival by year of entry, 1996-2005

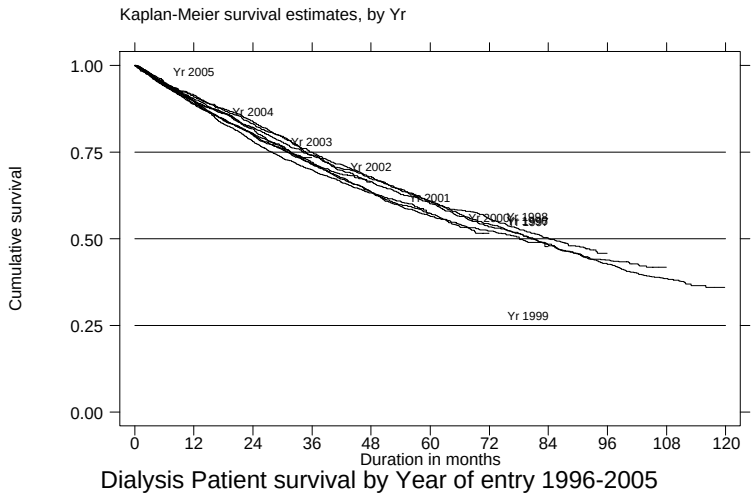
Year	1996			1997			1998			1999		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	934	95	1	1132	94	1	1241	95	1	1508	95	1
12	869	91	1	1061	90	1	1174	91	1	1411	90	1
24	768	84	1	951	82	1	1035	83	1	1216	82	1
36	656	74	1	836	74	1	910	75	1	1040	72	1
48	567	66	2	736	67	1	799	68	1	897	64	1
60	497	60	2	645	61	1	705	61	1	799	57	1
72	429	53	2	558	54	2	633	56	1	719	52	1
84	378	48	2	483	48	2	558	50	1	-	-	-
96	325	43	2	430	44	2	-	-	-	-	-	-
108	290	38	2	-	-	-	-	-	-	-	-	-
120	17	36	2	-	-	-	-	-	-	-	-	-

Year	2000			2001			2002			2003		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	1802	95	1	2059	94	1	2339	95	0	2499	94	0
12	1661	90	1	1873	89	1	2164	90	1	2306	89	1
24	1409	80	1	1592	78	1	1840	80	1	2001	80	1
36	1219	71	1	1378	70	1	1608	72	1	-	-	-
48	1056	63	1	1210	63	1	-	-	-	-	-	-
60	925	57	1	-	-	-	-	-	-	-	-	-

Year	2004			2005		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE
6	2740	95	0	1395	94	1
12	2531	90	1	-	-	-

* No. = Number at risk SE=standard error

Figure 3.2.2: Unadjusted patient survival by year of entry, 1996-2005



Dialysis Patient survival by Year of entry 1996-2005

3.2.3 Patient survival by Age at starting dialysis

The unadjusted survival for age groups <14 years, 15-24 years and 25-34 years at the start of dialysis were similar, with a 5-year survival of more than 80% as shown in Table 3.2.3.. Beyond the age of 34 years old the unadjusted survival progressively worsened as the age on starting dialysis increases. The 9-year unadjusted survival for those who started dialysis at the age of less than 15 years was 77 % compared with 13% in those more than 64 years of age at the time of initiation of dialysis.

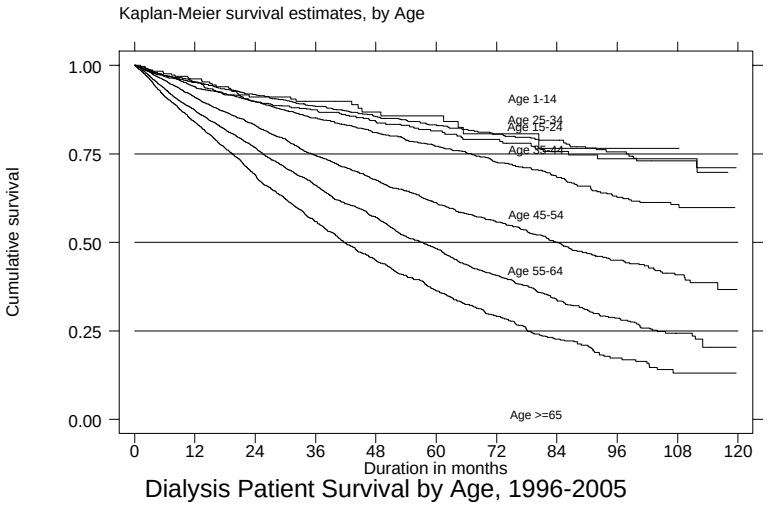
Table 3.2.3: Unadjusted patient survival by age, 1996-2005

Age group (years)	<=14			15-24			25-34			35-44		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	274	98	1	831	97	1	1540	97	0	2592	97	0
12	240	96	1	707	95	1	1353	95	1	2284	94	0
24	176	91	2	500	90	1	1048	92	1	1781	90	1
36	128	90	2	371	87	1	825	88	1	1383	85	1
48	81	87	3	263	84	2	612	85	1	1044	81	1
60	56	86	3	192	81	2	478	83	1	769	77	1
72	32	81	4	136	79	2	340	80	1	531	73	1
84	15	77	5	89	76	2	232	79	1	350	68	1
96	7	77	5	55	74	3	134	76	2	196	63	2
108	2	77	5	23	74	3	59	73	2	83	61	2
120	-	-	-	-	-	-	3	71	3	4	60	2

Age group (years)	45-54			55-64			>=65		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	4500	96	0	4684	93	0	3221	91	0
12	3849	91	0	3961	87	0	2656	84	1
24	2814	83	1	2806	77	1	1693	69	1
36	2015	75	1	1902	66	1	1030	56	1
48	1407	68	1	1247	57	1	608	45	1
60	970	61	1	773	48	1	336	36	1
72	635	56	1	479	41	1	188	29	1
84	375	50	1	263	34	1	99	23	1
96	195	45	1	133	29	1	40	17	2
108	75	41	2	42	24	2	13	13	2
120	7	37	3	3	20	2	2	13	2

* No. = Number at risk SE=standard error

Figure 3.2.3: Unadjusted patient survival by age, 1996-2005



Dialysis Patient Survival by Age, 1996-2005

3.2.4 Patient survival by Diabetic status

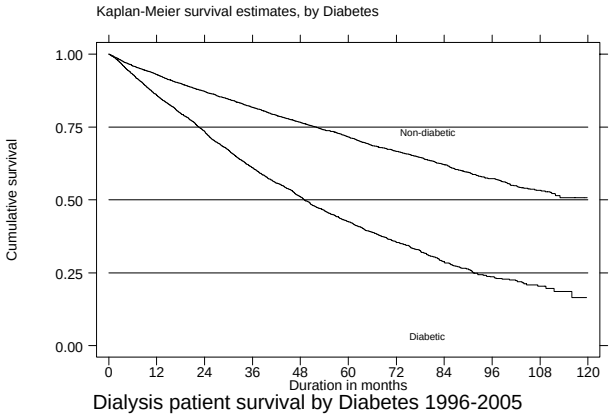
The unadjusted patient survival among diabetic and non diabetic patients is shown in Table 3.2.4 and Figure 3.2.4. The presence of diabetes mellitus has major impact on patient survival. The difference in the unadjusted patient survival appeared as early as 6 months after initiation of dialysis and increased with the time on dialysis. The 10 year unadjusted patient survival among diabetics and non diabetics were 51% and 17% respectively, a three fold difference.

Table 3.2.4: Unadjusted patient survival by Diabetes status, 1996-2005

Diabetes status	Non-Diabetic			Diabetic		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE
6	9517	96	0	8123	93	0
12	8320	93	0	6726	86	0
24	6363	87	0	4450	73	1
36	4838	82	0	2812	61	1
48	3536	77	1	1725	51	1
60	2533	72	1	1037	43	1
72	1741	67	1	594	36	1
84	1104	62	1	314	29	1
96	630	57	1	125	24	1
108	254	53	1	37	20	1
120	14	51	1	4	17	2

* No. = Number at risk SE=standard error

Figure 3.2.4: Unadjusted patient survival by Diabetes status, 1996-2005



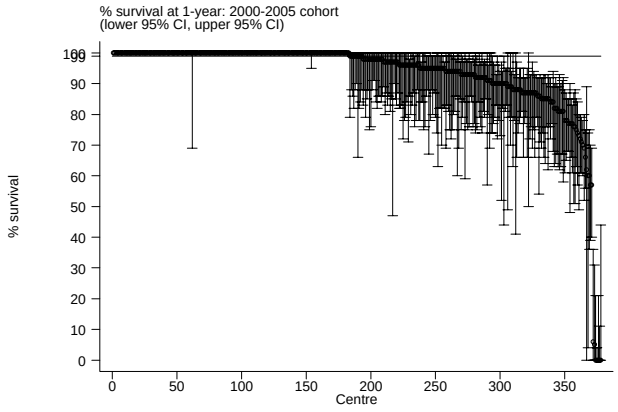
Dialysis patient survival by Diabetes 1996-2005

3.3 Survival of incident patients 2000 – 2005 by centre

3.3.1. Survival of incident haemodialysis patients 2000 – 2005 by centre

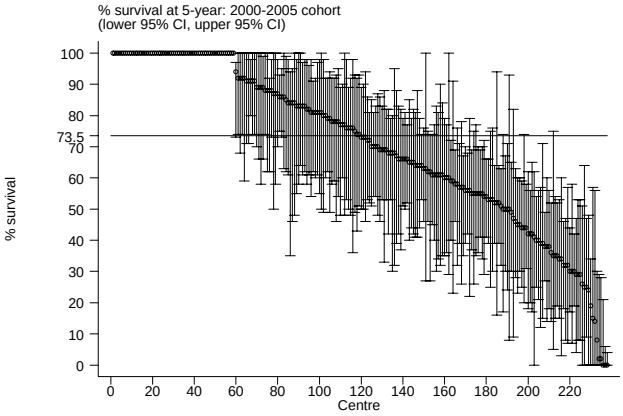
Figure 3.3.1(a) and Figure 3.3.1(b) show the patient survival (adjusted to age and diabetes) by haemodialysis centres at 1year and at 5 years respectively. The median adjusted patient survival among haemodialysis centres at 1 year and 5 years for the 2000-2005 cohort were 99% and 73.5% respectively. There was wide centre variation with regards to patient survival at one year and this became more apparent at 5 years (more than 10 fold different).

Figure 3.3.1(a): Variation in percentage survival at 1-year adjusted to age and diabetes, 2000-2005



* Horizontal line represents the median % survival among HD centres

Figure 3.3.1(b): Variation in percentage survival at 5-year adjusted to age and diabetes, 2000-2005

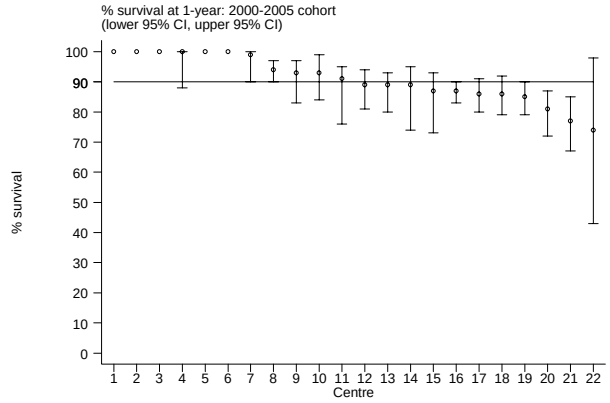


* Horizontal line represents the median % survival among HD centres

3.3.2. Survival of incident CAPD patients 2000 – 2005 by centre

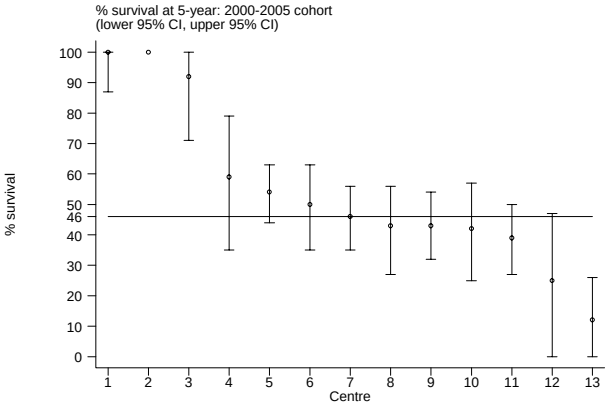
The adjusted patient survival at 1 year and at 5 years according to CAPD centres are shown in Figure 3.3.2(a) and Figure 3.3.2(b). The median adjusted patient survival among CAPD centres at one year and 5 years for the 2000-2005 cohort were 90% and 46% respectively. There was no centre variation with regards to patient survival at one year. However the adjusted CAPD patient survival at 5 years demonstrated marked centre variation.

Figure 3.3.2(a): Variation in percentage survival at 1-year adjusted to age and diabetes, 2000-2005



* Horizontal line represents the median % survival among CAPD centres

Figure 3.3.2(b): Variation in percentage survival at 5-year adjusted to age and diabetes, 2000-2005



* Horizontal line represents the median % survival among CAPD centres

CHAPTER 4

QUALITY OF LIFE AND REHABILITATION OUTCOMES OF DIALYSIS PATIENTS IN MALAYSIA

Liu Wen Jiun
Zaki Morad b. Mohd Zaher

A: QUALITY OF LIFE ON DIALYSIS

13594 patients who entered dialysis between 1997-2005 were analysed. 11424 HD patients and 2170 CAPD patients reported median QoL index score of 9 and 10 respectively (Table 4.1, Figure 4.1) Diabetics have a lower median QoL index score (8 versus 10) than nondiabetics (Table 4.2, Figure 4. 2) whilst there was no difference seen between gender (Table 4.3, Figure 4.3). There is a trend of lower median QoL index score being associated with older dialysis patients (Table 4.4, Figure 4.4). There are no obvious trends in QoL index seen either in the HD or CAPD cohort over the last 8 years. (Table 4.5, Table 4.6, Fig 4.5 and Figure 4.6)

Table 4.1: Cumulative distribution of QoL-Index score in relation to dialysis modality, All Dialysis patients 1997-2005

Dialysis modality	CAPD	HD
Number of patients	2170	11424
Centile		
0	0	0
0.05	5	4
0.10	6	5
0.25 (LQ)	8	7
0.5 (median)	10	9
0.75 (UQ)	10	10
0.90	10	10
0.95	10	10
1	10	10

Figure 4.1: Cumulative distribution of QoL-Index score in relation to Dialysis modality, All Dialysis patients 1997-2005

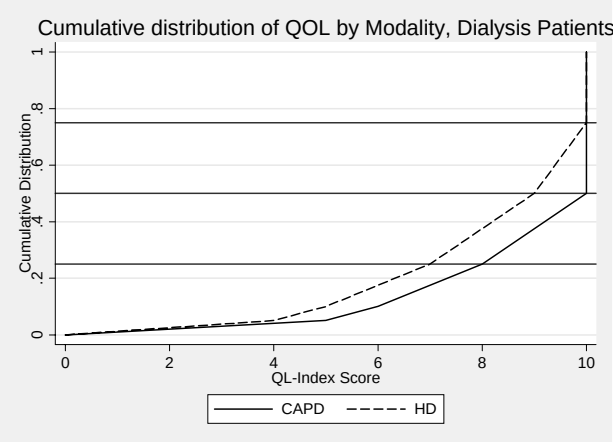


Table 4.2: Cumulative distribution of QoL-Index score in relation to Diabetes mellitus, All Dialysis patients 1997-2005

Diabetes mellitus	No	Yes
Number of patients	7480	6114
Centile		
0	0	0
0.05	6	4
0.10	7	5
0.25 (LQ)	9	6
0.5 (median)	10	8
0.75 (UQ)	10	10
0.90	10	10
0.95	10	10
1	10	10

Figure 4.2: Cumulative distribution of QoL-Index score in relation to Diabetes mellitus, All Dialysis patients 1997-2005

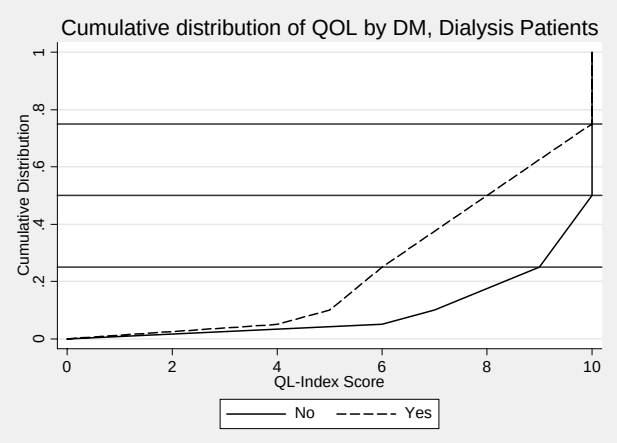


Table 4.3: Cumulative distribution of QoL-Index score in relation to Gender, All Dialysis patients 1997-2005

Gender	Male	Female
Number of patients	7523	6071
Centile		
0	0	0
0.05	5	4
0.10	6	5
0.25 (LQ)	8	7
0.5 (median)	9	9
0.75 (UQ)	10	10
0.90	10	10
0.95	10	10
1	10	10

Figure 4.3: Cumulative distribution of QoL-Index score in relation to Gender, All Dialysis patients 1997-2005

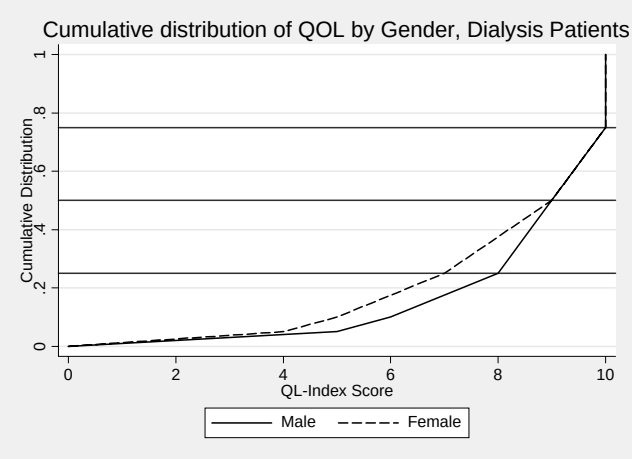


Table 4.4: Cumulative distribution of QoL-Index score in relation to Age, All Dialysis patients 1997-2005

Age group (years)	<20	20-39	40-59	>=60
Number of patients	567	2494	6635	3898
Centile				
0	0	0	0	0
0.05	6	7	5	4
0.10	8	8	6	5
0.25 (LQ)	9	9	8	6
0.5 (median)	10	10	9	8
0.75 (UQ)	10	10	10	9
0.90	10	10	10	10
0.95	10	10	10	10
1	10	10	10	10

Figure 4.4: Cumulative distribution of QoL-Index score in relation to Age, All Dialysis patients 1997-2005

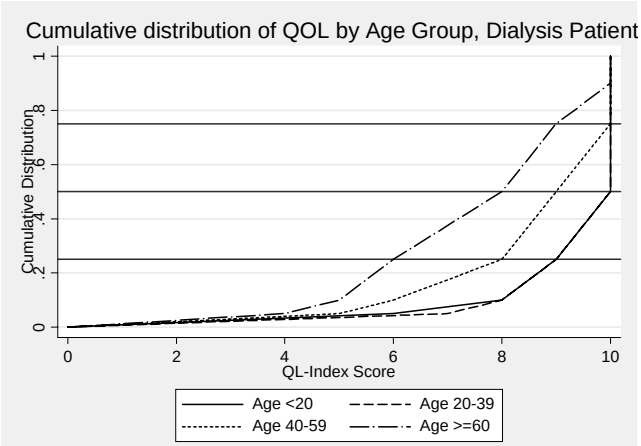


Table 4.5: Cumulative distribution of QoL-Index score in relation to Year of entry, HD patients 1997-2005

Year of Entry	1997	1998	1999	2000	2001	2002	2003	2004	2005
Number of patients	728	821	1021	1236	1384	1579	1563	1770	1322
Centile									
0	0	0	0	0	0	0	0	0	0
0.05	5	5	5	5	5	4	5	4	4
0.10	6	6	6	6	5	5	5	5	5
0.25 (LQ)	8	8	7	7	7	7	7	7	7
0.5 (median)	9	9	9	9	9	9	9	9	9
0.75 (UQ)	10	10	10	10	10	10	10	10	10
0.90	10	10	10	10	10	10	10	10	10
0.95	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10

Figure 4.5: Cumulative distribution of QoL-Index score in relation to Year of entry, HD patients 1997-2005

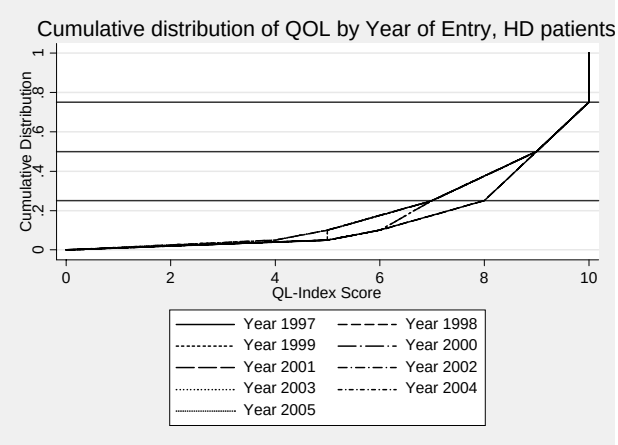


Figure 4.6: Cumulative distribution of QoL-Index score in relation to Year of entry, CAPD patients 1997-2005

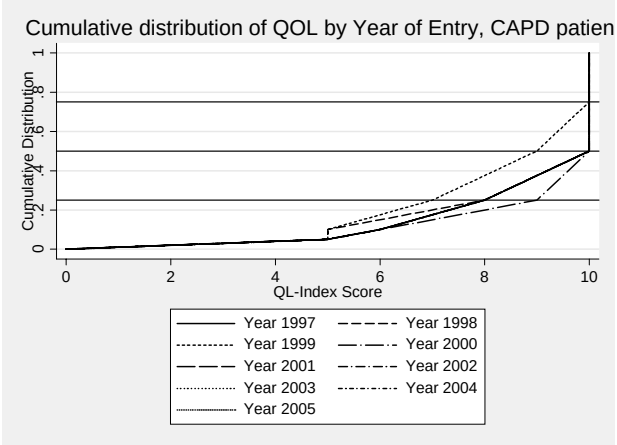


Table 4.6: Cumulative distribution of QoL-Index score in relation to Year of entry, CAPD patients 1997-2005

Year of Entry	1997	1998	1999	2000	2001	2002	2003	2004	2005
Number of patients	164	117	166	188	269	319	368	302	277
Centile									
0	0	0	0	0	0	0	0	0	0
0.05	5	5	5	5	5	5	5	5	5
0.10	6	5	5	6	6	6	6	6	6
0.25 (LQ)	8	8	7	9	8	8	8	8	8
0.5 (median)	10	10	9	10	10	10	10	10	10
0.75 (UQ)	10	10	10	10	10	10	10	10	10
0.90	10	10	10	10	10	10	10	10	10
0.95	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10

B: WORK RELATED REHABILITATION

Analysis was done on HD patients (n=4728) and CAPD patients (n=722) who entered dialysis between 1997 –2005, (Table 4.7). Only patients who were working for pay and those who were unable to work for pay due to health reasons are included. The proportion of patients on employment were comparable between the two modalities (HD = 72% vs CAPD 73%)

Amongst HD as well as CAPD patients, the proportion on employment increased with longer duration on dialysis. (Table 4.8 and Table 4.9) This may be confounded by the healthier individuals who survived longer in the earlier cohort and therefore spuriously increased the proportion on employment.

Table 4.7: Work related rehabilitation in relation to Modality, Dialysis patients 1997-2005

Modality	CAPD		HD	
	N	%	N	%
Number of patients	722		4728	
Able to return for Full or Part time for pay	529	73	3386	72
Unable to work for pay*	193	27	1342	28

* Exclude patients unable to find employment for non-health related reason

Table 4.8: Work related rehabilitation in relation to Year of Entry, HD patients 1997-2005

Year	1997		1998		1999		2000		2001		2002		2003		2004		2005	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Number of patients	371		417		508		556		560		620		607		650		439	
Able to return for Full or Part time for pay	308	83	332	80	385	76	425	76	389	69	450	73	429	71	413	64	255	58
Unable to work for pay*	63	17	85	20	123	24	131	24	171	31	170	27	178	29	237	36	184	42

* Exclude patients unable to find employment for non-health related reasons

Table 4.9: Work related rehabilitation in relation to Year of Entry, CAPD patients 1997-2005

Year	1997		1998		1999		2000		2001		2002		2003		2004		2005	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Number of patients	70		38		47		62		81		114		132		86		92	
Able to return for Full or Part time for pay	51	73	31	82	35	74	41	66	66	81	87	76	100	76	60	70	58	63
Unable to work for pay*	19	27	7	18	12	26	21	34	15	19	27	24	32	24	26	30	34	37

* Exclude patients unable to find employment for non-health related reasons

CHAPTER 5

PAEDIATRIC RENAL REPLACEMENT THERAPY

Lee Ming Lee
Lynster Liaw
Susan Pee
Wan Jazilah Wan Ismail
Lim Yam Ngo

A: RRT PROVISION FOR PAEDIATRIC PATIENTS

The paediatric RRT population in this report is defined as patients less than 20 years of age. The number of new patients commencing on dialysis had increased from 12 in 1990 to 75 in 2005 giving a dialysis acceptance rate of 7 per million age related population (pmarp) respectively. However the incidence rate has plateaued at 7 pmarp over the last 4 years ie since 2002. There has been no noticeable increase in the number of new transplants in 2005 and the transplant rate remained at 1 pmarp (as it has been since the 1990s) giving a total renal replacement treatment rate of 8 pmarp.

The number of prevalent dialysis patients continued to rise and by the end of 2005; there were a total of 429 children under 20 on dialysis. The equivalent dialysis prevalence rate increased from 4 pmarp in 1990 to 39 in 2005. The number of patients with functioning transplants increased only slightly from 38 in 1990 to 120 in 2005 (prevalence rate of 4 and 11 pmarp respectively).

Table 5.01: Stock and Flow of Paediatric Renal Replacement Therapy 1990-2005

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
New HD patients	10	6	8	10	6	7	21	21	21	23
New CAPD patients	2	2	6	7	13	12	23	20	28	29
New Transplants	8	6	6	9	10	8	5	14	6	11
HD deaths	0	2	1	2	0	2	0	3	3	2
CAPD deaths	0	2	0	0	0	2	2	3	7	2
Transplant deaths	1	0	0	0	1	0	2	0	0	0
On HD at 31st Dec	26	26	29	32	34	38	56	70	90	106
On CAPD at 31st Dec	5	5	8	14	26	32	51	62	73	91
Functioning transplant at 31st December	38	40	45	53	61	66	62	71	74	83

Year	2000	2001	2002	2003	2004	2005
New HD patients	12	24	28	33	39	28
New CAPD patients	37	39	53	39	41	47
New Transplants	14	8	11	11	9	11
HD deaths	4	1	10	6	10	7
CAPD deaths	3	8	8	9	5	9
Transplant deaths	1	0	1	1	0	1
On HD at 31st Dec	120	144	163	188	220	238
On CAPD at 31st Dec	109	123	151	161	174	191
Functioning transplant at 31st December	90	94	101	106	113	120

Dec. = December

Figure 5.01 (a): Incident cases of RRT by modality in children under 20 years old, 1990-2005

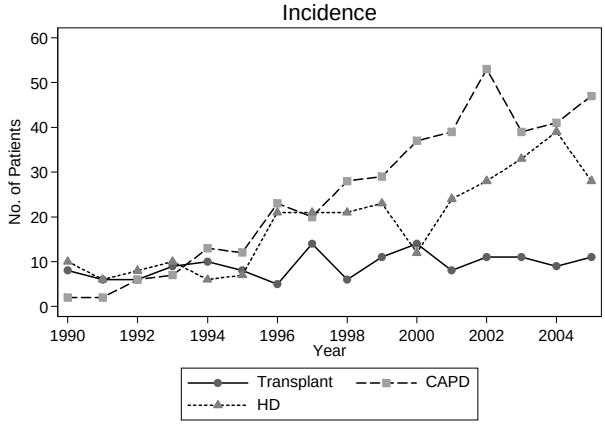


Figure 5.01 (b): Prevalent cases of RRT by modality in children under 20 years old, 1990-2005

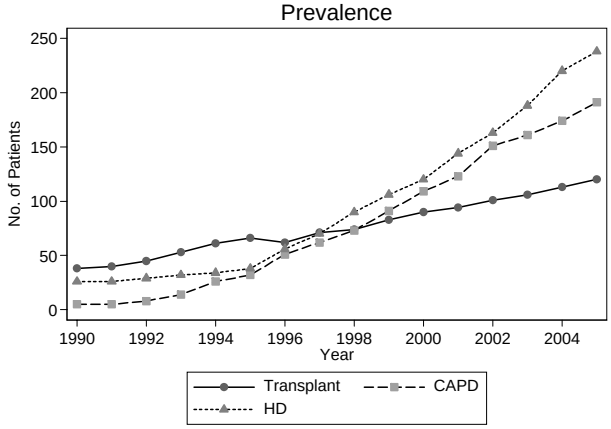


Table 5.02: Paediatric Dialysis and Transplant Treatment Rates per million age-group population 1990-2005

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Incidence Rate																
New HD	1	1	1	1	1	1	2	2	2	2	1	2	3	3	4	3
New CAPD	0	0	1	1	1	1	2	2	3	3	4	4	5	4	4	4
New Transplant	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
All RRT	2	2	2	3	3	3	5	6	6	6	6	7	9	8	8	8
Prevalence Rate																
On HD	3	3	3	4	4	4	6	7	9	11	12	14	15	17	20	22
On CAPD	1	1	1	2	3	3	5	6	7	9	11	12	14	15	16	17
Functioning Graft	4	5	5	6	7	7	7	7	8	8	9	9	9	10	10	11
All RRT	8	8	9	11	13	15	18	21	24	28	31	34	39	42	46	50

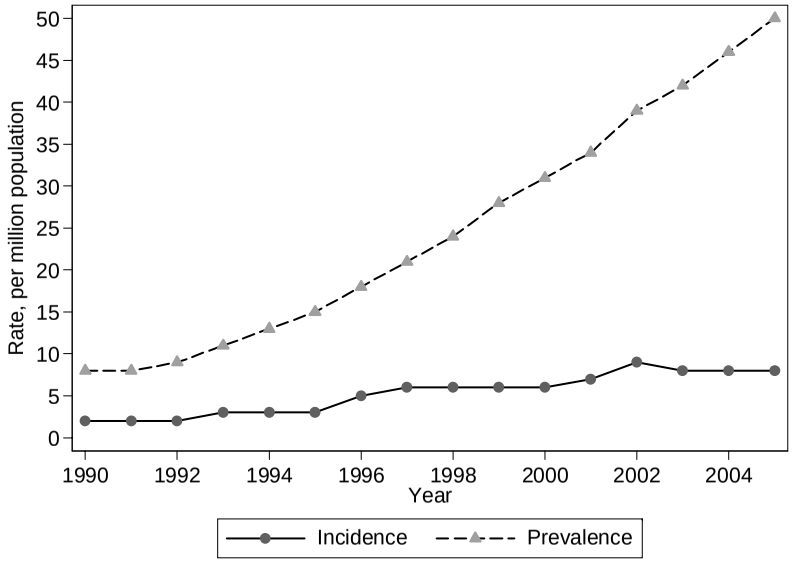


Figure 5.02: RRT Incidence and prevalence rate per million age related population, 1990-2005

B: DISTRIBUTION OF PAEDIATRIC DIALYSIS

Table 5.03a shows that the treatment rate was still noticeably higher for states in the west coast of West Malaysia compared to the east coast or East Malaysia. However in terms of absolute number of dialysis treatment by state (table 5.03b) the difference is not obvious.

Table 5.03a: Dialysis Treatment Rate by State, per million state age group population, 1990-2005.

State	1990-1994	1995-1999	2000-2005
Negeri Sembilan	2	9	15
Negeri Melaka	2	5	15
Pulau Pinang	4	4	13
Johor Darul Takzim	0	5	12
Kedah & Perlis	2	5	11
Terengganu Darul Iman	0	3	11
Selangor & W. Persekutuan	3	8	10
Perak Darul Redzuan	1	3	8
Kelantan Darul Naim	0	1	8
Pahang Darul Makmur	1	5	8
Sarawak	2	5	7
Sabah	1	1	4

Table 5.03b: Dialysis Treatment by State in absolute number; 1990-2005

State	1990-1994	1995-1999	2000-2005
Selangor & W. Persekutuan	25	71	109
Johor Darul Takzim	2	26	74
Kedah & Perlis	6	21	49
Perak Darul Redzuan	6	12	39
Sarawak	9	21	35
Pulau Pinang	10	9	34
Kelantan Darul Naim	1	3	32
Negeri Sembilan	4	17	29
Sabah	7	9	29
Terengganu Darul Iman	1	8	27
Pahang Darul Makmur	3	15	25
Negeri Melaka	3	7	22

Figure 5.04 shows persistent trend of male predominance amongst the new dialysis and transplant patients consistent with higher incidence of ESRD among males. However this trend appears more marked among the transplant recipients.

Figure 5.04: Number of New Dialysis and Transplant Patients by gender 1990-2005

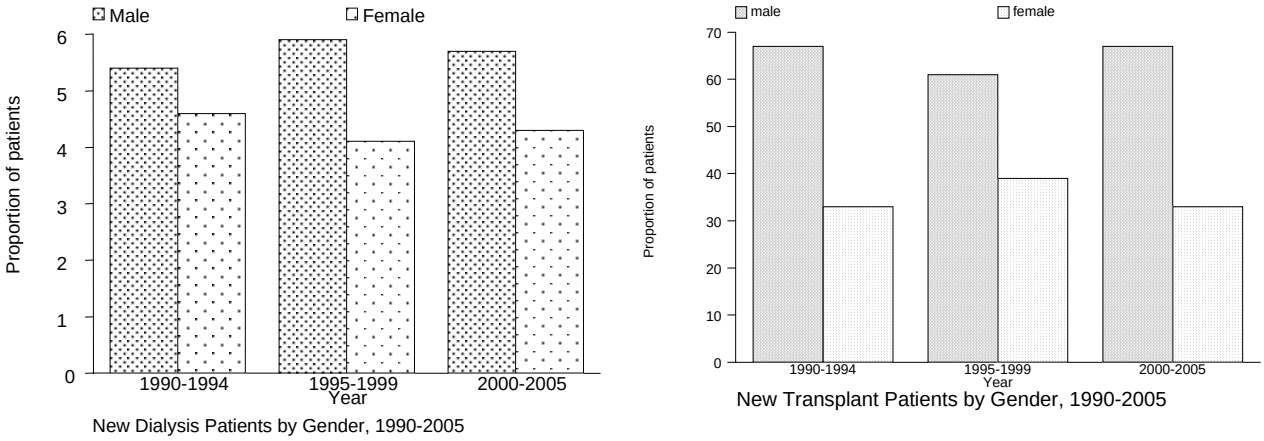


Figure 5.05 shows after the initial rise in the early 1990s; the treatment rates have begun to level off for all the age groups. It is also noted for the first time a significant drop in the treatment rates for the age 15-19 years from 20 pmarp in 2004 to 14 pmarp in 2005. The number of 0-4 year olds provided chronic dialysis treatment remained very low at 1 pmarp. The overall incidence of paediatric RRT in Malaysia remained at 8 pmarp.

Figure 5.05: Dialysis and Transplant Treatment Rate by Age group 1990-2005

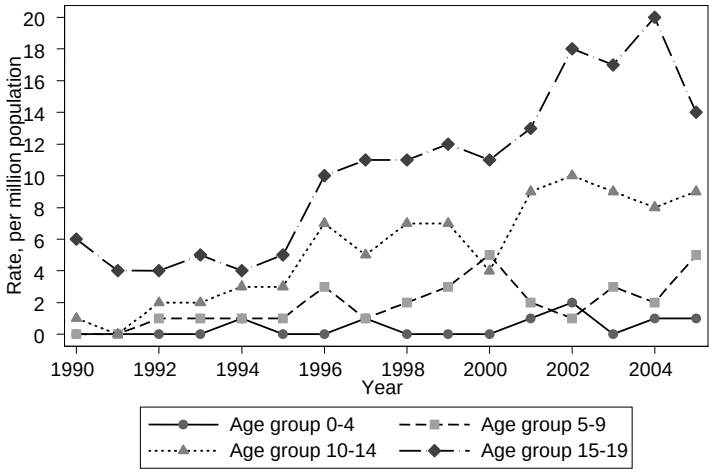


Figure 5.06 shows that CAPD was the preferred mode of dialysis as the initial treatment modality; the converse of that seen in the early 1990s when the CAPD experience was still new to nephrologist taking care of children. A significant change noted in 2005 is that up to 20% of children were started on continuous cycling peritoneal dialysis (CCPD) as the first modality of dialysis. This was made possible when the cost of CCPD/automated peritoneal dialysis was reduced through a special programme only available to children on dialysis.

Figure 5.06: New Dialysis by treatment modality 1990-2005

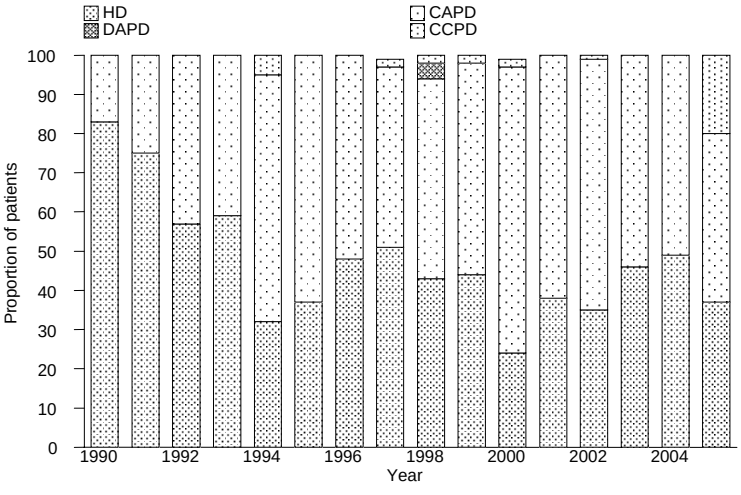
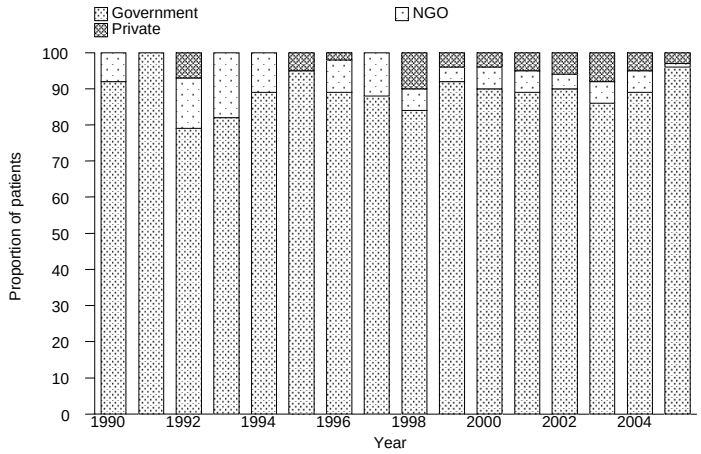


Figure 5.07 shows that more than 90% of children less than 20 years of age receive their dialysis treatment from government centres and hence government funded, unlike in adults where only one third of dialysis patients were treated in government centres.

Figure 5.07: New Dialysis by sector 1990-2005



C: PRIMARY RENAL DIASEASE

Glomerulonephritis was the commonest known cause of ESRD accounting for 28 %. Focal segemental glomeulosclerosis (FSGS) on its own accounted for 11 % of ESRD. Up to 34 % of these children still presented with ESRD of unknown aetiology ie they presented for the first time in end stage renal failure.

Table 5.08: Primary Renal Disease 1990-2005

Primary Renal Disease	Male		Female		Total	
	N	%	N	%	N	%
Glomerulonephritis	158	28	105	27	263	28
Focal Segmental Glomerulosclerosis	71	13	31	8	102	11
Reflux nephropathy	45	8	20	5	65	7
SLE	18	3	51	13	69	7
Obstructive uropathy	40	7	8	2	48	5
Renal dysplasia	17	3	12	3	29	3
Others	12	2	6	2	18	2
Hereditary nephritis	15	3	5	1	20	2
Cystic kidney disease	5	1	4	1	9	1
Drug induced nephropathy	0	0	4	1	4	0
Metabolic	1	0	0	0	1	0
Unknown	178	32	141	36	319	34
Total	560	100	387	100	947	100

D: TYPES OF RENAL TRANSPLANT

Table 5.09 shows that living related renal transplantation was still the commonest type of transplantation done but the incidence of cadaveric transplantation has increased considerably in the last 6 years. A significant number of children had their renal transplantation done overseas – the commercial cadaver and living donor programs.

Table 5.09: Types of Renal Transplant 1990-2005

Year	1990-1994		1995-1999		2000-2005	
	No.	%	No.	%	No.	%
Commercial Cadaver	1	3	9	20	13	20
Commercial Living donor	9	23	2	5	4	6
Living related donor	29	74	31	70	30	47
Cadaver	0	0	2	5	17	27
Living emotionally related	0	0	0	0	0	0
TOTAL	39	100	44	100	64	100

E: SURVIVAL ANALYSIS

Table and figure 5.10 show the obvious superiority of transplantation over CAPD and HD in terms of patient survival. Patient survival for renal transplantation was 97% for 1 year, 94% at 5 years and 94% at 10 years post transplant. Patient survival for HD was 94% for 1 year, 85% for 5 years and 78% for 10 years. CAPD patients showed the worst survival; 95% at 1 year and 81% at 5 years. There were too few CAPD patients at 10 years for meaningful analysis.

Figure 5.10 shows that patient survival for CAPD and HD were quite comparable up till 3-5 years into dialysis.

Table 5.10: Patient Survival by Modality of RRT, 1990-2005

Modality	Transplant			CAPD			HD		
Interval (years)	No.	% survival	SE	No.	% survival	SE	No.	% survival	SE
1	124	97	1	321	95	1	284	94	1
5	76	94	2	71	81	3	100	85	2
10	32	94	2	4	44	15	18	78	4
12	19	94	2	2	22	18	12	78	4
14	5	94	2	-	-	-	2	53	16

* No. = Number at risk SE = Standard Error

Figure 5.10: Patient Survival by Modality of RRT, 1990-2005

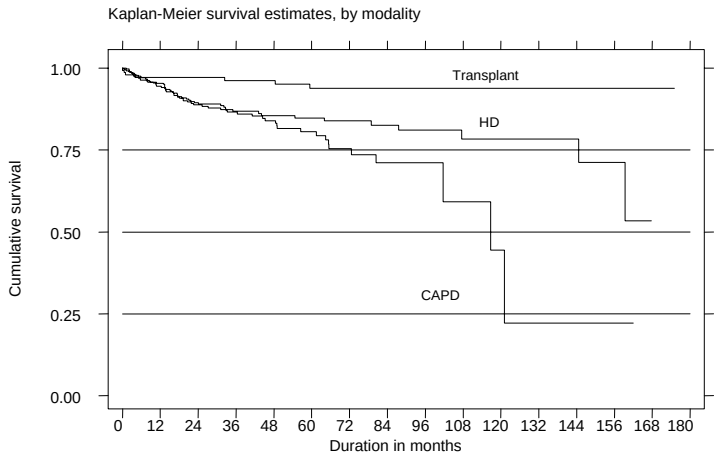


Table and Figure 5.11 below show comparable technique survival for both HD and CAPD in the first 2 years of dialysis. After that CAPD showed a progressive deterioration in technique survival compared to HD.

Table 5.11: Dialysis Technique Survival by Modality, 1990-2005

Modality	CAPD			HD		
Interval (years)	No.	% survival	SE	No.	% survival	SE
1	321	90	2	284	91	2
5	71	53	3	100	80	2
10	4	13	5	18	73	4
12	2	6	5	12	68	6
14	-	-	-	2	46	15

* No. = Number at risk SE = Standard Error

Figure 5.11: Dialysis Technique Survival by Modality, 1990-2005

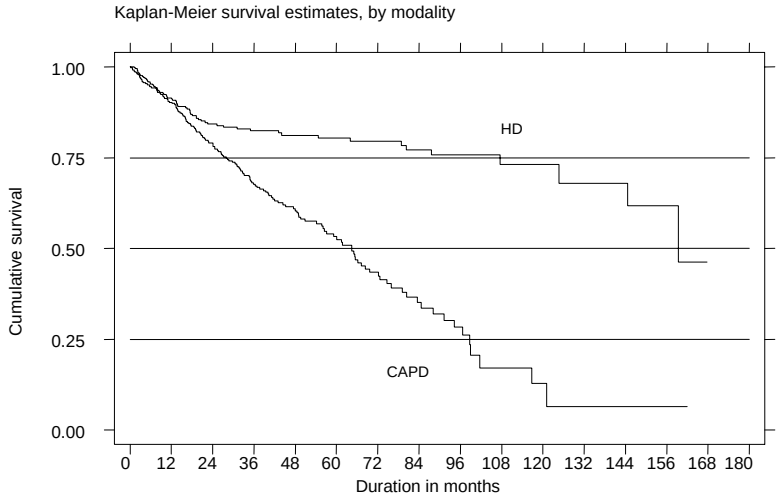


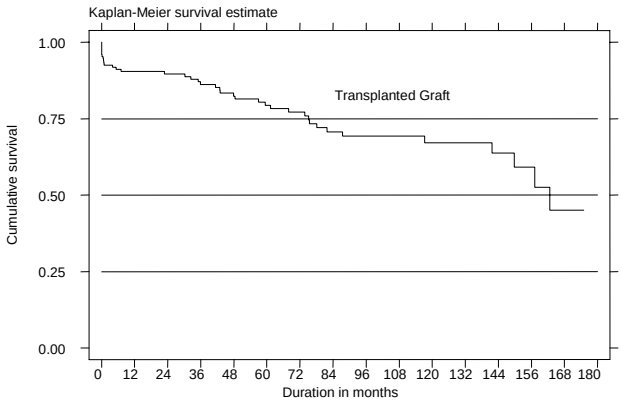
Table and Figure 5.12 show that the graft survival was 90% at 1 year, 79% at 5 years and 67% at 10 years.

Table 5.12: Transplant Graft Survival 1990-2005

Interval (years)	No.	% survival	SE
1	124	90	2
5	76	79	4
10	32	67	5
12	19	64	6
14	5	45	10

* No. = Number at risk SE = Standard Error

Figure 5.12: Transplant Graft Survival 1990-2005



CHAPTER 6

MANAGEMENT OF ANAEMIA IN DIAYSIS PATIENTS

Philip Jeremiah
Bee Boon Cheak

6.1: TREATMENT FOR ANEMIA IN DIALYSIS

From 1997 to 2005 there was an increasing percentage of patients on erythropoietin (EPO); more haemodialysis patients were on EPO; 80% compared to 72% in CAPD patients. Despite the increasing usage of EPO, the blood transfusion rate has however remained at 10 -15%. (table 6.1.1 & 6.1.2)

There were a decreasing number of patients on oral iron supplements. Encouraging though was the steadily increasing use if intravenous Iron, but this was still far from optimum (at best 11 %)

Table 6.1.1: Treatment for Anemia, HD patients 1997-2005

Year	No. of subjects	% on Erythropoietin	% received blood transfusion	% on oral Iron	% received parenteral Iron
1997	1695	46	8	92	4
1998	2141	46	13	92	4
1999	2996	51	15	90	5
2000	4392	56	15	88	5
2001	5194	62	13	88	5
2002	6108	67	10	85	7
2003	7041	71	12	83	8
2004	8064	74	11	80	10
2005	9136	80	14	75	11

Table 6.1.2: Treatment for Anemia, CAPD patients 1997-2005

Year	No. of subjects	% on Erythropoietin	% received blood transfusion	% on oral Iron	% received parenteral Iron
1997	476	37	12	96	3
1998	541	44	16	96	3
1999	610	44	14	94	0
2000	662	46	11	92	4
2001	781	45	11	91	2
2002	891	49	11	93	2
2003	1236	53	14	87	4
2004	1313	63	15	85	7
2005	1389	72	12	87	8

In 2005 the percentage of patients on EPO among HD centres varied significantly, from as low as 4% to as high as 100%. The median usage of EPO was at 83%; compared to a median of 46% in 1997. (table and figure 6.1.3)

Table 6.1.3: Variation in Erythropoietin utilization (% patients) among HD centres, 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	7	20	36	45.5	63	69	92
1998	51	0	5	33	48	57	78	86
1999	76	6	15	41.5	51	66.5	82	90
2000	110	0	20	45	57.5	69	90	100
2001	125	0	30	50	62	74	89	100
2002	153	7	25	55	68	78	92	100
2003	173	16	40	60	73	82	95	100
2004	198	0	38	64	77	86	97	100
2005	228	4	55	74	83	90.5	100	100

Figure 6.1.3: Variation in Erythropoietin utilization (% patients) among HD centres, 2005

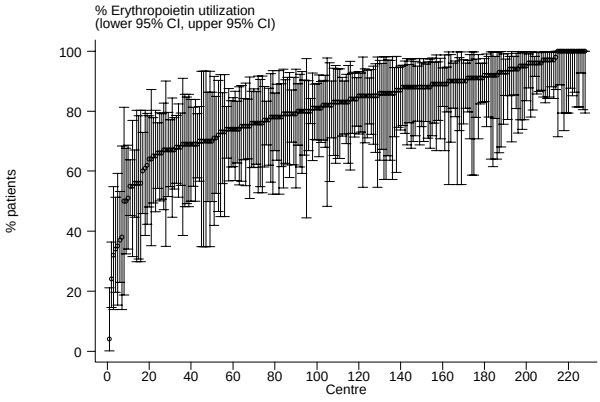
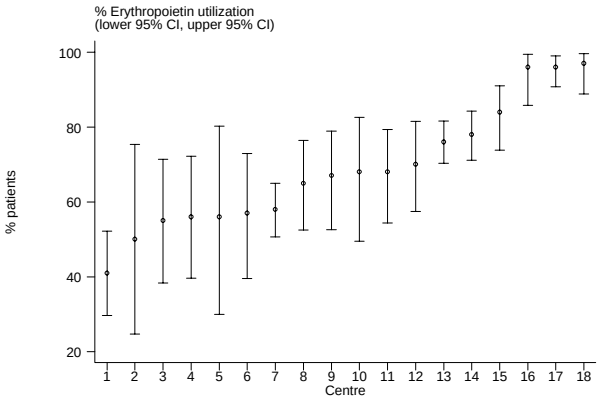


Figure 6.1.4: Variation in Erythropoietin utilization (% patients) among CAPD centres, 2005



In contrast to HD, the percentage of patients on EPO, among CAPD centres varied between 41 to 97%, with the median at 68%. (table & figure 6.1.4)

Table 6.1.4: Variation in Erythropoietin utilization (% patients) among CAPD centres, 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	19	19	21	41	49	53	53
1998	9	15	15	30	47	56	64	64
1999	10	22	22	32	41	54	79	79
2000	11	26	26	33	47	53	68	68
2001	12	25	25	33.5	47.5	55	85	85
2002	14	26	26	41	50.5	56	68	68
2003	18	25	25	34	49.5	58	92	92
2004	18	5	5	54	63	74	97	97
2005	18	41	41	56	67.5	78	97	97

From 1997 to 2005, the median weekly EPO dose has remained at 4000 units in both HD and CAPD centres. In both HD and CAPD centres, at the 5th and 95th centile, 5% of centres have their weekly EPO dose at 2000 units and 8000 units respectively. (table & figure 6.1.5)

There appears to be an increasing use of higher EPO dosage in CAPD centres (table & figure 6.1.6)

Table 6.1.5: Variation in median weekly Erythropoietin dose (u/week) among HD centres 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	30	2000	2000	4000	4000	4000	6000	8000
1998	34	2000	2000	4000	4000	4000	4000	4000
1999	51	2000	2000	2000	4000	4000	4000	4000
2000	78	2000	2000	2000	4000	4000	4000	6000
2001	93	2000	2000	2000	4000	4000	5000	8000
2002	117	2000	2000	4000	4000	4000	5000	6000
2003	140	2000	2000	4000	4000	4000	6000	8000
2004	169	2000	2000	4000	4000	4000	6000	8000
2005	193	2000	2000	4000	4000	8000	8000	18000

Figure 6.1.5: Variation in median weekly Erythropoietin dose among HD centres 2005

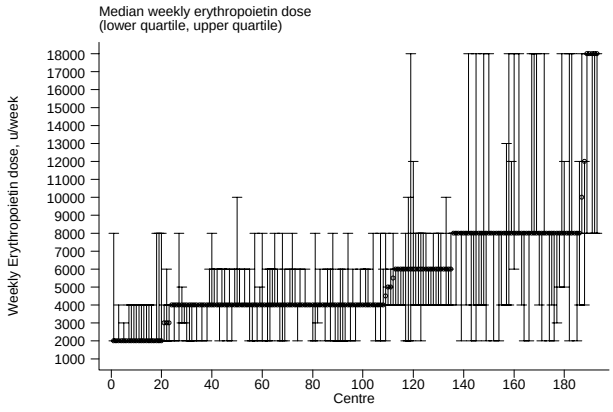


Figure 6.1.6: Variation in median weekly Erythropoietin dose among CAPD centres 2005

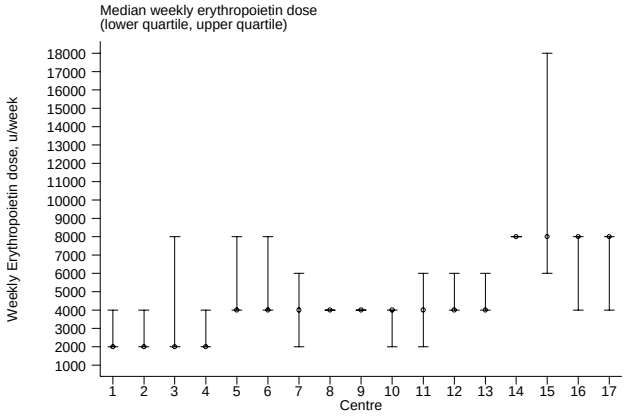


Table 6.1.6: Variation in median weekly Erythropoietin dose (u/week) among CAPD centres 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	6	4000	4000	4000	4000	4000	4000	4000
1998	6	4000	4000	4000	4000	4000	4000	4000
1999	7	2000	2000	2000	4000	4000	4000	4000
2000	9	2000	2000	4000	4000	4000	4000	4000
2001	11	2000	2000	4000	4000	4000	4000	4000
2002	12	2000	2000	4000	4000	4000	4000	4000
2003	14	2000	2000	4000	4000	4000	5000	5000
2004	13	2000	2000	4000	4000	4000	4000	4000
2005	17	2000	2000	4000	4000	4000	8000	8000

In HD patients, the median usage of blood transfusion has increased from 7.5% in 2004 to 11% in 2005. This however has remained at 12.5% for CAPD patients. The blood transfusion rate among both HD and CAPD centres varied significantly between 0 to 45% (table and figures 6.1.7, 6.1.8)

Table 6.1.7: Variation in use of blood transfusion (% patients) among HD centres, 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	0	0	0	7	14	37	71
1998	51	0	0	4	10	17	36	48
1999	76	0	0	4	10	21.5	42	56
2000	110	0	0	4	11.5	22	48	75
2001	125	0	0	5	12	20	36	46
2002	153	0	0	3	7	17	40	67
2003	173	0	0	3	8	19	35	65
2004	198	0	0	2	7.5	16	38	54
2005	228	0	0	5	11	21	45	90

Figure 6.1.7: Variation in use of blood transfusion (% patients) among HD centres, 2005

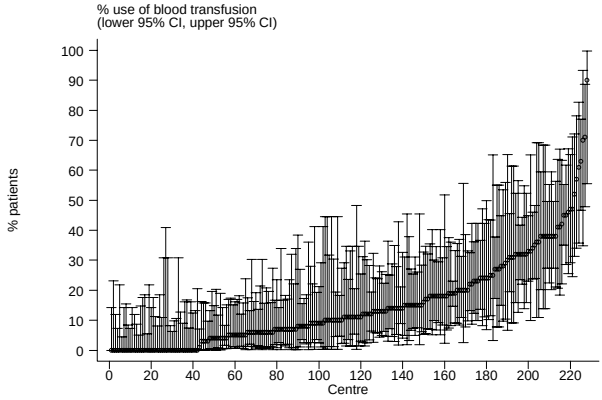


Figure 6.1.8: Variation in use of blood transfusion (% patients) among CAPD centres, 2005

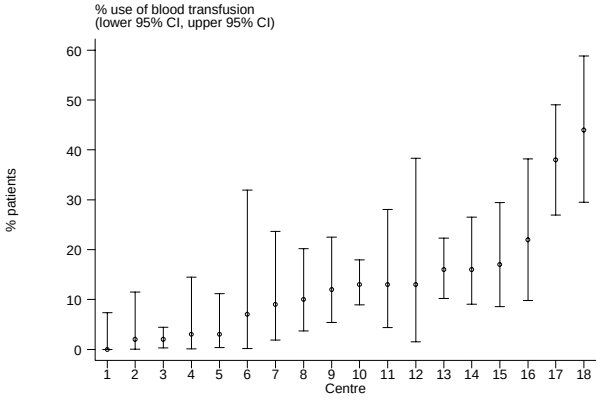


Table 6.1.8: Variation in use of blood transfusion (% patients) among CAPD centres, 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	1	1	4	6	29	47	47
1998	9	0	0	7	11	17	47	47
1999	10	0	0	0	6.5	23	47	47
2000	11	0	0	0	9	16	42	42
2001	12	0	0	0	4	15.5	37	37
2002	14	0	0	5	8	21	41	41
2003	18	0	0	4	13	24	57	57
2004	18	0	0	7	12.5	19	34	34
2005	18	0	0	3	12.5	16	44	44

6.2: IRON STATUS ON DIALYSIS

In HD and CAPD patients with or without EPO, the mean and median serum ferritin and transferrin saturation have slowly increased over the years except in 2005 when the transferrin saturation showed a decrease.

Up to 98% of patients have serum ferritin of at least 100 ng/ml and transferrin saturation greater than 20%. This is more so in CAPD compared to HD. (table and figures 6.2.1 to 6.2.8)

Table 6.2.1: Distribution of Serum Ferritin without Erythropoietin, HD patients 1997 –2005

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≥100 ng/ml
1997	280	493.1	349.3	435.5	162.5	850.5	86
1998	224	430.8	383.2	297.5	128.4	636.5	80
1999	337	517.9	424.3	402.8	162.8	809.5	86
2000	571	487.5	416.8	363.2	152.5	741	83
2001	758	537.6	453.9	383.5	172	828	87
2002	803	519.5	447.3	373	168.5	781	85
2003	916	551.6	434.2	456.7	190	827.7	87
2004	1044	590.1	463.4	473	218	908.5	89
2005	1008	616.8	499.2	482.5	223.5	901.5	90

Figure 6.2.1: Cumulative distribution of Serum Ferritin without Erythropoietin, HD patients 1997-2005

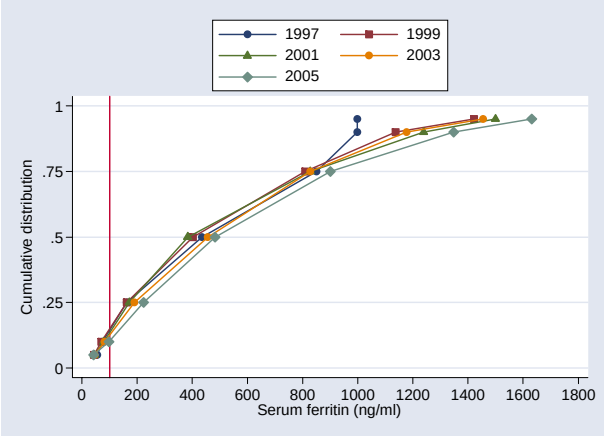


Figure 6.2.2: Cumulative distribution of Serum Ferritin without Erythropoietin, CAPD patients 1997-2005

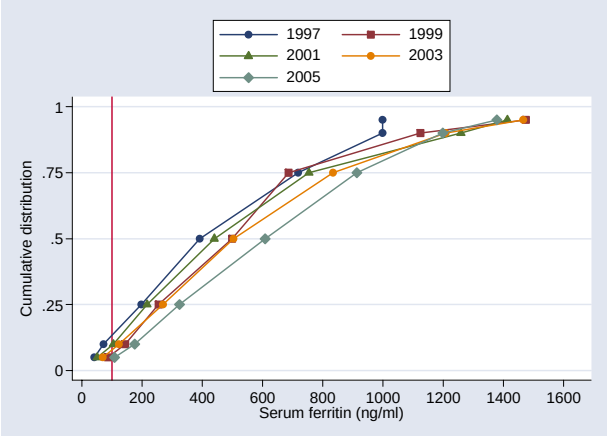


Table 6.2.2: Distribution of Serum Ferritin without Erythropoietin, CAPD patients 1997–2005

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≥100 ng/ml
1997	133	469	333.5	392	198	718	88
1998	92	492.4	368.3	405	208.2	687.5	87
1999	124	553.7	400.1	499.3	255.3	686.8	94
2000	144	505.9	433.8	420	152.3	675.5	88
2001	223	543.8	417.5	440	216.9	754	91
2002	236	634.8	491.2	514.9	226	924.6	93
2003	330	602.8	428.5	503.9	269	834	93
2004	303	608.4	385.7	522.7	330	882	94
2005	225	651.4	397.8	609	324	913.3	96

Table 6.2.3: Distribution of Serum Ferritin on Erythropoietin, HD patients 1997 – 2005

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≥100 ng/ml
1997	471	543.3	347	495.5	219	973	90
1998	328	549.9	382.4	476.5	248	809.8	91
1999	586	560.4	418.6	453	225	829	93
2000	1174	588.3	456.6	475.5	219	860	91
2001	1637	597.5	444.2	491	236	894.2	91
2002	2224	593.1	459.3	464.8	231.3	878.2	91
2003	3138	640.9	428	562.8	298.5	932	94
2004	3902	669.9	460.5	571	306	977	94
2005	5026	683.2	470.7	599.5	317	972.8	93

Figure 6.2.3: Cumulative distribution of Serum Ferritin on Erythropoietin, HD patients 1997-2005

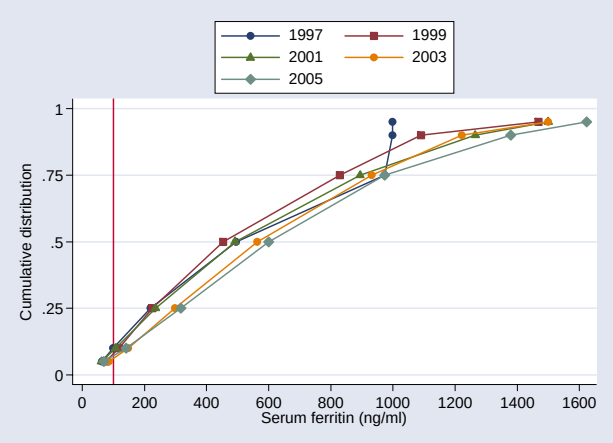


Figure 6.2.4: Cumulative distribution of Serum Ferritin on Erythropoietin, CAPD patients 1997-2005

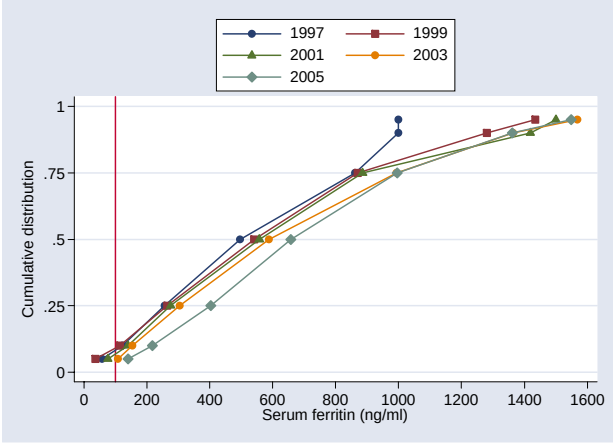


Table 6.2.4: Distribution of Serum Ferritin on Erythropoietin, CAPD patients 1997 – 2005

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≥100 ng/ml
1997	129	550.8	323.7	496	256	862	93
1998	135	611.2	438.3	524.7	257	839.5	93
1999	136	604.8	436.3	540.6	264.6	870.1	93
2000	180	608.2	416.7	560	295.2	846.3	92
2001	261	645.9	449.2	557.5	275.7	885.4	93
2002	345	666.8	462.4	538.5	284	999.5	94
2003	518	689.6	459.5	588.4	304	993.2	96
2004	541	728.1	427.1	655	405.5	986	98
2005	766	732.2	433.5	657.3	403.6	996.6	97

Table 6.2.5: Distribution of transferrin saturation without Erythropoietin, HD patients 1997 –2005

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≥20%
1997	723	34.1	16.6	29.8	22.7	40.4	84
1998	599	33.3	16.2	29.5	22.1	41.7	82
1999	654	32.9	16.3	29.9	20.9	42.4	78
2000	800	32.7	16.9	28.6	20.9	41.4	78
2001	836	36.9	18.5	32.5	23.9	45.8	84
2002	811	36.5	18.9	32	22.9	45.7	83
2003	921	40.3	18.6	36	27.2	51.1	91
2004	1031	41.2	18.1	37.5	28.5	50.1	92
2005	1106	37.7	17.8	34.5	25.6	46.2	87

Figure 6.2.5: Cumulative distribution of transferrin saturation without Erythropoietin, HD patients 1997-2005

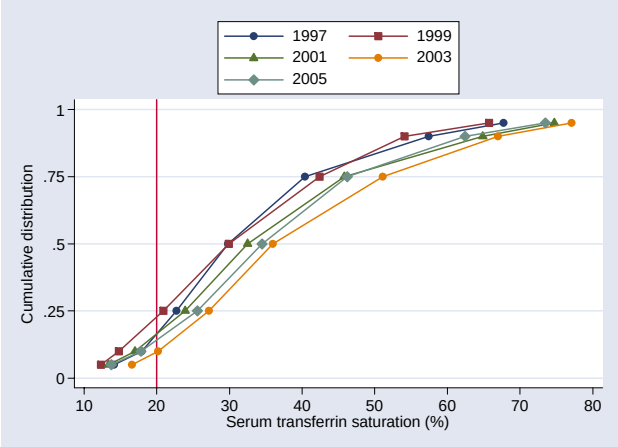


Figure 6.2.6: Cumulative distribution of transferrin saturation without Erythropoietin, CAPD patients 1997-2005

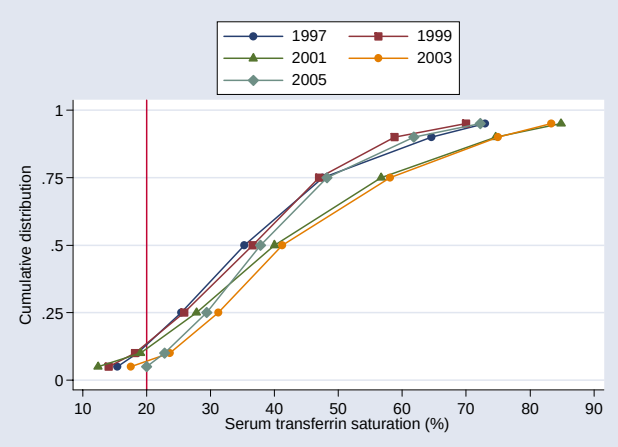


Table 6.2.6: Distribution of transferrin saturation without Erythropoietin, CAPD patients 1997–2005

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≥20%
1997	246	38.7	17.9	35.3	25.4	47.6	88
1998	184	37.7	15.7	37.3	25.6	47	85
1999	194	37.7	16.2	36.6	25.9	47	88
2000	237	37.9	18.5	34.2	25	48	86
2001	279	43.2	20.8	40	27.8	56.7	89
2002	332	42.7	19.1	38.1	28.3	54.5	92
2003	398	45.1	19.7	41.2	31.2	58.1	93
2004	379	44.5	18.2	41.6	30.9	55.5	98
2005	287	40.6	16.2	37.8	29.4	48.2	95

Table 6.2.7: Distribution of transferrin saturation on Erythropoietin, HD patients 1997 – 2005

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≥20%
1997	636	35.9	17.3	31.4	24.2	43.3	87
1998	549	34.9	15.5	32	24.4	42.5	86
1999	703	34.5	16	31.6	23.2	42	85
2000	1247	34.9	16.7	30.4	23	44	84
2001	1634	36.2	17.9	32.3	23.6	45	84
2002	1995	34.6	17.6	30.6	22.2	43.6	81
2003	2646	39.6	18.4	36	26.6	49	90
2004	3269	39.6	17	36.1	27.8	48.1	93
2005	4735	36.7	17.3	32.8	24.6	45	87

Figure 6.2.7: Cumulative distribution of transferrin saturation on Erythropoietin, HD patients 1997-2005

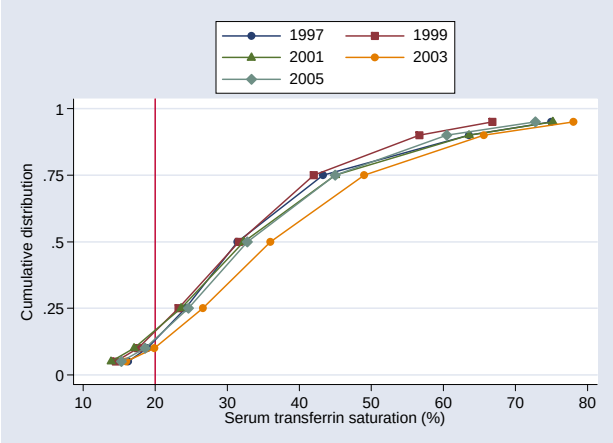


Figure 6.2.8: Cumulative distribution of transferrin saturation on Erythropoietin, CAPD patients 1997-2005

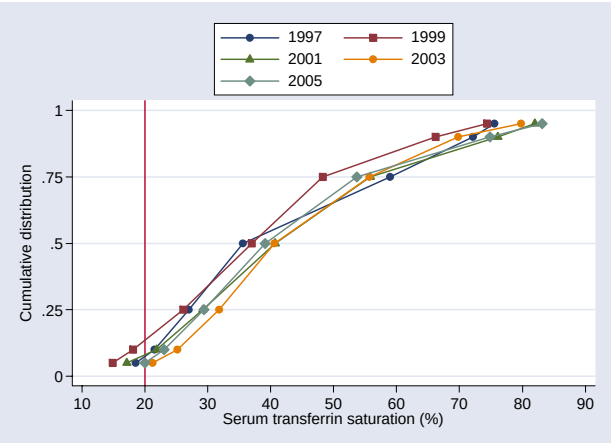


Table 6.2.8: Distribution of transferrin saturation on Erythropoietin, CAPD patients 1997 – 2005

Year	No of subjects	Mean	Std Dev	Median	LQ	UQ	% Patients ≥20%
1997	147	42.2	19.7	35.6	27	59	91
1998	111	39.4	13.8	38.5	28.8	47.4	94
1999	137	38.9	17	37	26.1	48.3	86
2000	238	38.9	18.7	36	24.5	51.1	86
2001	292	44.1	19.6	40.7	29.2	55.8	94
2002	363	43.6	18.6	39.7	30	54.3	94
2003	461	44.7	17.8	40.6	31.8	55.7	96
2004	698	44.7	18.7	40.8	30.8	54.5	96
2005	819	43.5	19.3	39.1	29.4	53.7	95

From 1997 to 2005, the median for both serum ferritin levels and transferrin saturation of all HD centres have increased. (table 6.2.9). There was a wide variation in median ferritin levels between HD centres in 2005 ranging from 257 to >1000 ng/ml. More than 90% of patients on EPO have serum ferritin greater than 100 ng/ml and more than 80% have transferrin saturation greater than 20%. (table and figures 6.2.9)

A similar trend but with higher levels of ferritin and transferrin saturation was seen in the CAPD centers (table and figures 6.2.10)

Table 6.2.9: Variation in iron status outcomes among HD centres 2005

(a) Median serum ferritin among patients on erythropoietin

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	21	220.5	291.5	390	495.5	623	792	809.3
1998	13	205	205	423	472.2	560.3	722.8	722.8
1999	22	189.5	202	351.8	419	569	940.5	949.5
2000	43	154	205.3	369	534.8	683.8	813.5	1232
2001	52	217	238.3	393	514.3	676.2	883.3	1191.3
2002	71	106.6	192	366	456	611.6	890.5	1070.8
2003	99	138	299.5	442	549.3	711.6	997	1742.8
2004	123	99.5	327	448.4	566	735	1001.5	2000
2005	157	1.6	257	451.5	621.5	725.5	1024	2000

Figure 6.2.9(a): Variation in median serum ferritin among patients on erythropoietin, HD centres 2005

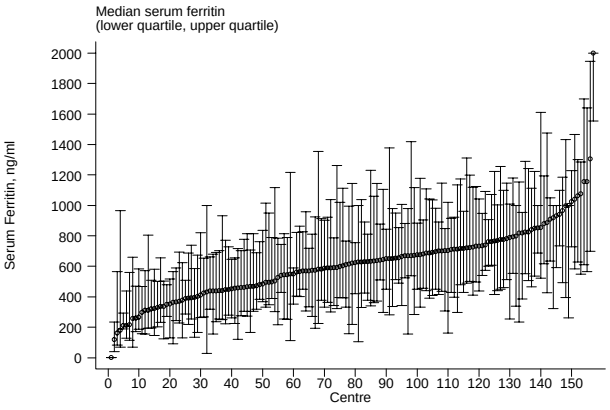
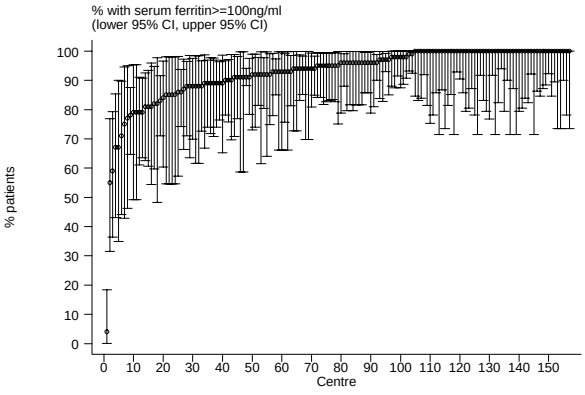


Figure 6.2.9(b): Variation in proportion of patients on erythropoietin with serum ferritin ≥ 100 ng/ml, HD centres 2005



(b) Proportion of patients on erythropoietin with serum ferritin ≥ 100 ng/ml

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	21	71	73	86	91	93	100	100
1998	13	73	73	90	92	95	100	100
1999	22	73	76	92	96	100	100	100
2000	43	70	72	85	93	97	100	100
2001	52	71	73	87	93	97	100	100
2002	71	55	73	88	93	97	100	100
2003	99	60	75	91	95	100	100	100
2004	123	50	84	92	96	100	100	100
2005	157	4	77	89	95	100	100	100

(c) Median transferrin saturation among patients on erythropoietin

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	26	22.6	25.7	28.8	32	37.1	68.5	69.2
1998	22	22.8	24.1	27.2	32.3	35.6	44.4	51.9
1999	26	16.4	20.7	26.3	31.5	34	43.8	44.8
2000	42	16	23.6	27.8	31.1	36.2	44.1	57.5
2001	53	21.9	22.5	27.2	30.3	36.6	48	76.6
2002	62	15.3	20.5	25.1	30.2	36	51.1	59.7
2003	91	19.2	24.2	30.5	33.9	41.6	57.3	71.6
2004	111	23	26.7	32.5	37	41.4	54.3	67.6
2005	146	15.2	24.1	29	32.6	37.3	49.5	71.9

Figure 6.2.9(c): Variation in median transferrin saturation among patients on erythropoietin, HD centres 2005

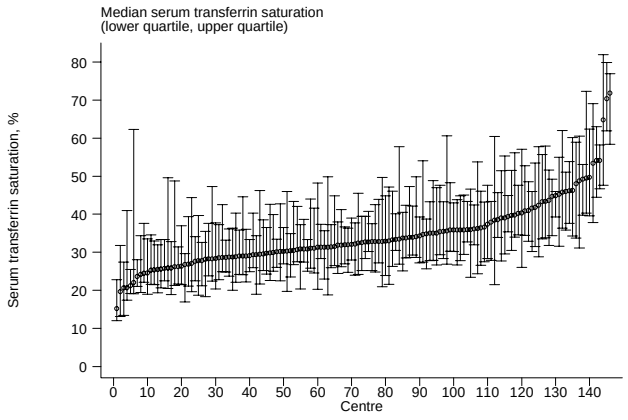
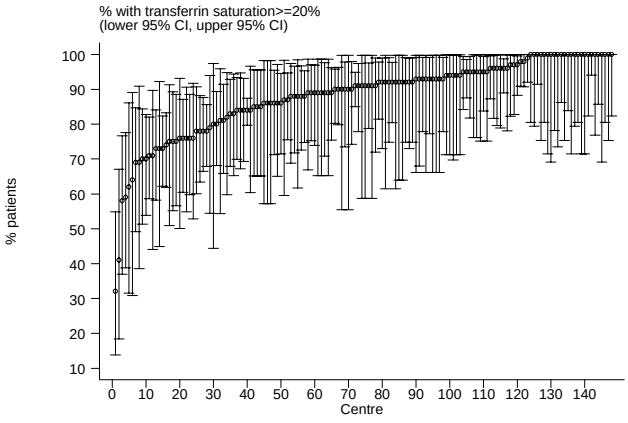


Figure 6.2.9(d): Variation in proportion of patients on erythropoietin with transferrin saturation ≥20%, HD centres 2005



(d) Proportion of patients on erythropoietin with transferrin saturation ≥ 20%

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	26	69	75	82	90	94	100	100
1998	22	57	64	78	88	95	100	100
1999	26	30	57	83	87	94	100	100
2000	42	20	62	77	85.5	94	100	100
2001	53	53	60	76	89	95	100	100
2002	62	33	53	69	81.5	92	100	100
2003	91	47	69	85	92	100	100	100
2004	111	55	71	91	94	100	100	100
2005	148	32	69	84	91	95.5	100	100

Table 6.2.10: Variation in iron status outcomes among CAPD centres 2005

(a) Median serum ferritin among patients on erythropoietin

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	4	377.5	377.5	404.8	457.3	530	577.5	577.5
1998	4	418.4	418.4	468.7	534.3	606.3	663	663
1999	5	320.4	320.4	330	459.5	495.6	719.5	719.5
2000	6	315.5	315.5	437.3	668.8	773	793.1	793.1
2001	9	243	243	508	597.3	639.4	908	908
2002	10	360.4	360.4	450.8	477.4	588	826.5	826.5
2003	12	307.6	307.6	442.5	534.3	726.2	963.6	963.6
2004	13	312.4	312.4	527.8	625	760.9	1011	1011
2005	16	225	225	564.4	677.8	794.7	823.9	823.9

Figure 6.2.10(a): Variation in median serum ferritin among patients on erythropoietin, CAPD centres 2005

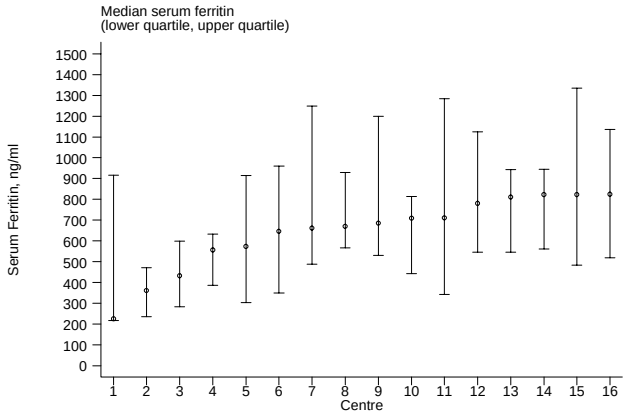
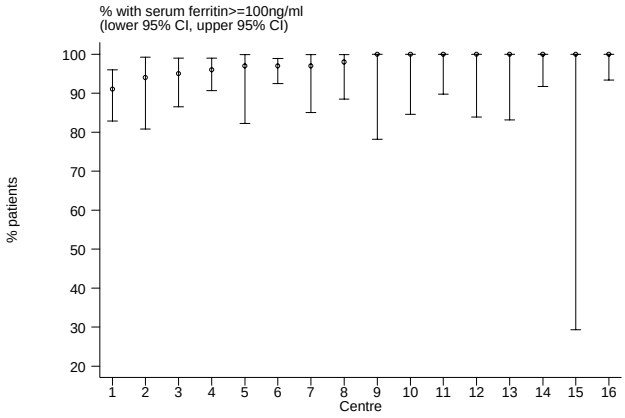


Figure 6.2.10(b): Variation in proportion of patients on erythropoietin with serum ferritin ≥100 ng/ml, CAPD centres 2005



(b) Proportion of patients on erythropoietin with serum ferritin ≥100 ng/ml

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	4	84	84	88.5	93.5	97	100	100
1998	4	83	83	89	97.5	100	100	100
1999	5	84	84	93	95	100	100	100
2000	6	88	88	88	94.5	100	100	100
2001	9	80	80	85	91	100	100	100
2002	10	87	87	92	95	100	100	100
2003	12	86	86	95	97	98	100	100
2004	13	90	90	95	100	100	100	100
2005	16	91	91	96.5	99	100	100	100

(c) Median transferrin saturation among patients on erythropoietin

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	6	26.7	26.7	27.6	33.6	42.5	70.5	70.5
1998	4	34.2	34.2	35.5	37	41.6	46.2	46.2
1999	6	24	24	27.2	35.2	39.4	42.4	42.4
2000	6	22.3	22.3	26.5	35.6	37.6	52.5	52.5
2001	8	28.4	28.4	31.3	35.7	44.9	79.1	79.1
2002	9	29.7	29.7	36.5	37.7	40.7	59.6	59.6
2003	12	33.7	33.7	35.6	40.6	48.3	63.3	63.3
2004	16	29.1	29.1	36.4	40.6	44.9	82.5	82.5
2005	16	31.1	31.1	36.3	37.9	42.6	73.4	73.4

Figure 6.2.10(c): Variation in median transferrin saturation among patients on erythropoietin, CAPD centres 2005

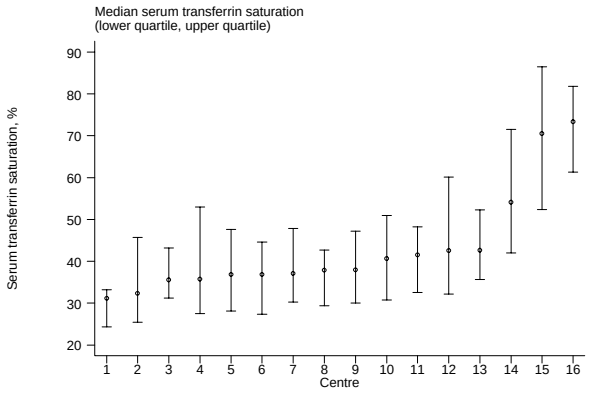
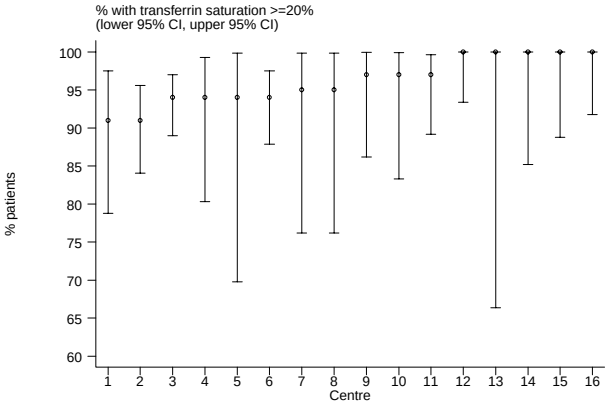


Figure 6.2.10(d): Variation in proportion of patients on erythropoietin with transferrin saturation ≥20%, CAPD centres 2005



(d) Proportion of patients on erythropoietin with transferrin saturation ≥20%

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	6	70	70	88	90.5	100	100	100
1998	4	81	81	88	95.5	96.5	97	97
1999	6	53	53	85	87	94	100	100
2000	6	68	68	74	89.5	100	100	100
2001	8	85	85	90.5	94	96	97	97
2002	9	78	78	91	92	98	100	100
2003	12	92	92	95	96	99	100	100
2004	16	90	90	95.5	97.5	100	100	100
2005	16	91	91	94	96	100	100	100

6.3: HAEMOGLOBIN OUTCOMES ON DIALYSIS

The mean and median haemoglobin concentration in all dialysis patients with or without EPO is steadily increasing; in 2005 the mean and median haemoglobin ranged from 9.9 to 10.8 g/dl. The percentage of patients with the haemoglobin of > 10 or > 11 g/dl is also steadily increasing. In 2005, the percentage of patients with the haemoglobin > 10 gm/dl varied between 54% in HD to 72 % in CAPD patients. Similarly, the percentage of patient with the haemoglobin > 11 gm/dl was 38% and 40% respectively. (tables and figures 6.3.1-6.3.4)

Table 6.3.1: Distribution of Haemoglobin Concentration without Erythropoietin, HD patients 1997 – 2005

Year	No. of subjects	Mean	Std Dev	Median	LQ	UQ	% Patient ≤10 g/ dL	% Patient >10 g/ dL	% Patient ≤11 g/ dL	% Patient >11 g/ dL
1997	896	9.3	1.9	9	8	10.5	69	31	82	18
1998	1119	9.1	1.9	8.9	7.8	10.3	71	29	83	17
1999	1400	9.1	1.9	8.9	7.8	10.3	70	30	85	15
2000	1754	9.4	2.1	9.1	7.9	10.6	67	33	80	20
2001	1809	9.4	1.9	9.3	8	10.6	64	36	81	19
2002	1795	9.6	2.1	9.4	8.1	10.9	62	38	76	24
2003	1803	9.7	2.1	9.5	8.3	11	60	40	75	25
2004	1927	10.1	2.2	9.9	8.6	11.5	53	47	68	32
2005	1658	10.5	2.3	10.3	8.8	12	46	54	62	38

Figure 6.3.1: Cumulative distribution of haemoglobin Concentration without Erythropoietin, HD patients 1997-2005

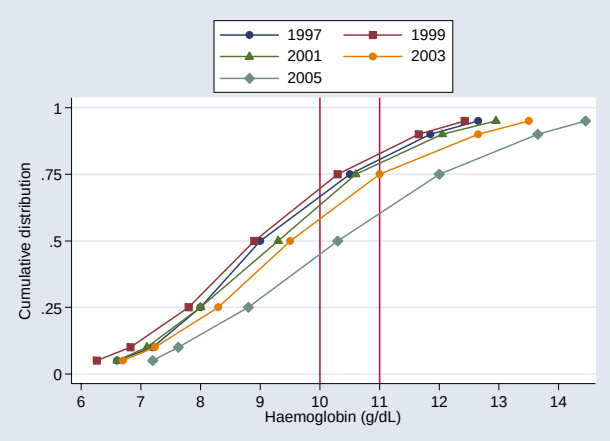


Figure 6.3.2: Cumulative distribution of haemoglobin concentration without Erythropoietin, CAPD patients 1997-2005

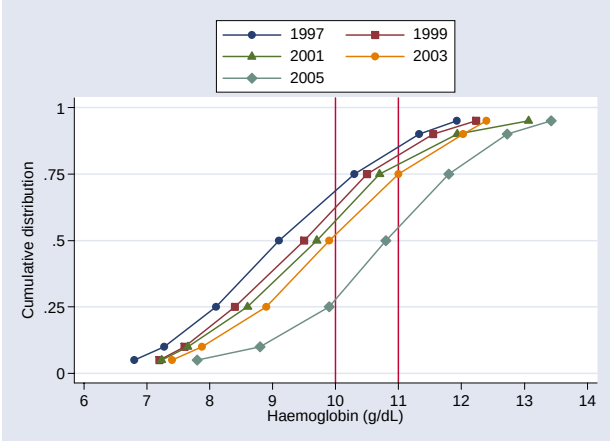


Table 6.3.2: Distribution of Haemoglobin Concentration without Erythropoietin, CAPD patients 1997– 2005

Year	No. of subjects	Mean	Std Dev	Median	LQ	UQ	% Patient ≤10 g/ dL	% Patient >10 g/ dL	% Patient ≤11 g/ dL	% Patient >11 g/ dL
1997	297	9.2	1.6	9.1	8.1	10.3	72	28	86	14
1998	301	9.3	1.8	9.2	8.1	10.3	68	32	84	16
1999	336	9.5	1.6	9.5	8.4	10.5	66	34	84	16
2000	342	9.8	1.7	9.7	8.7	10.9	58	42	79	21
2001	405	9.8	1.8	9.7	8.6	10.7	59	41	78	22
2002	434	10	1.8	9.9	8.8	11	54	46	76	24
2003	543	10	1.7	9.9	8.9	11	52	48	76	24
2004	481	10.4	1.6	10.3	9.4	11.4	42	58	67	33
2005	375	10.8	1.6	10.8	9.9	11.8	28	72	60	40

Table 6.3.3: Distribution of Haemoglobin Concentration on Erythropoietin, HD patients 1997 – 2005

Year	No. of subjects	Mean	Std Dev	Median	LQ	UQ	% Patient ≤10 g/ dL	% Patient >10 g/ dL	% Patient ≤11 g/ dL	% Patient >11 g/ dL
1997	773	8.9	1.6	8.9	7.8	9.9	76	24	90	10
1998	971	9.1	1.6	9.1	7.9	10.2	71	29	88	12
1999	1503	9.2	1.5	9.1	8.1	10.2	71	29	89	11
2000	2332	9.4	1.7	9.4	8.3	10.5	65	35	85	15
2001	3049	9.4	1.6	9.4	8.3	10.5	65	35	85	15
2002	3859	9.5	1.7	9.5	8.4	10.7	62	38	81	19
2003	4786	9.6	1.6	9.6	8.5	10.7	61	39	81	19
2004	5804	9.8	1.6	9.9	8.8	10.9	54	46	77	23
2005	7025	10	1.6	10	8.9	11.1	50	50	74	26

Figure 6.3.3: Cumulative distribution of Haemoglobin Concentration on Erythropoietin, HD patients 1997-2005

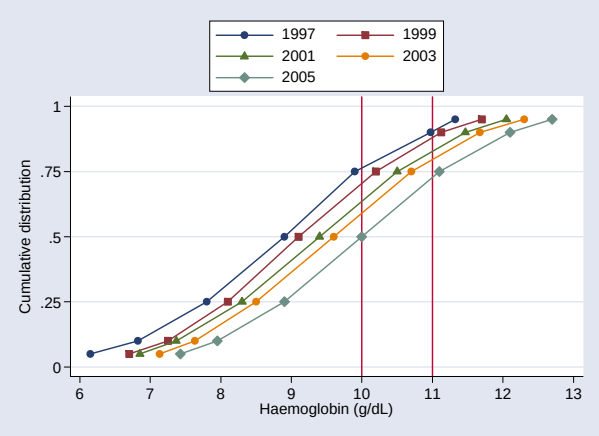


Figure 6.3.4: Cumulative distribution of Haemoglobin Concentration on Erythropoietin, CAPD patients 1997-2005

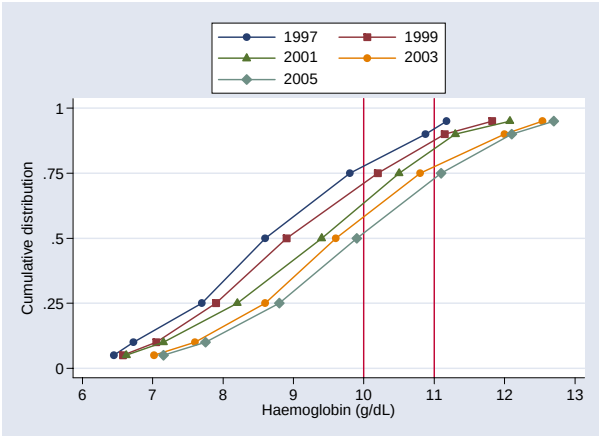


Table 6.3.4: Distribution of Haemoglobin Concentration on Erythropoietin, CAPD patients 1997 – 2005

Year	No. of subjects	Mean	Std Dev	Median	LQ	UQ	% Patient ≤10 g/ dL	% Patient >10 g/ dL	% Patient ≤11 g/ dL	% Patient >11 g/ dL
1997	175	8.8	1.5	8.6	7.7	9.8	79	21	94	6
1998	238	9	1.6	8.8	8	10.1	74	26	88	12
1999	262	9	1.6	8.9	7.9	10.2	73	27	89	11
2000	299	9.4	1.7	9.2	8.1	10.6	65	35	82	18
2001	345	9.3	1.6	9.4	8.2	10.5	65	35	86	14
2002	432	9.4	1.6	9.3	8.4	10.4	69	31	83	17
2003	640	9.7	1.7	9.6	8.6	10.8	60	40	78	22
2004	799	9.8	1.7	9.8	8.6	11	54	46	76	24
2005	969	9.9	1.7	9.9	8.8	11.1	53	47	73	27

Table 6.3.5: Variation in Haemoglobin outcomes among HD centres 2005

(a) Median haemoglobin level among patients on erythropoietin

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	30	7.8	7.9	8.5	9	9.3	10.4	10.6
1998	34	7.6	7.6	8.5	9.1	9.4	10.4	10.5
1999	51	7.8	8.1	8.6	9.1	9.6	10.2	10.3
2000	77	7.8	8.1	8.8	9.3	9.8	10.5	14.6
2001	93	7.9	8.3	8.9	9.4	9.9	10.4	11.1
2002	115	8.2	8.5	8.9	9.5	10.1	10.9	11.5
2003	144	7.8	8.5	9.1	9.5	10	10.7	11.5
2004	175	7.8	8.6	9.2	9.7	10.3	11	11.2
2005	204	8.4	8.8	9.4	10	10.4	11.2	12

In 2005 for HD patients on EPO, the median haemoglobin in HD centres ranged between 8.4 to 12 g/dl with the median at 10 g/dl. A similar trend wais noted in CAPD centres.

In 2005, for HD patients on EPO, the proportion of patients with Hb >10g/dl varied between 0 -100% with median at 49%. Similarly for patients >11g/dl the range was from 0 -73% with the median at 23.5%. This wide variation was not seen in the CAPD patients. (see table & figures 6.3.5 – 6.3.6)

Figure 6.3.5(a): Variation in median haemoglobin level among patients on Erythropoietin, HD centres 2005

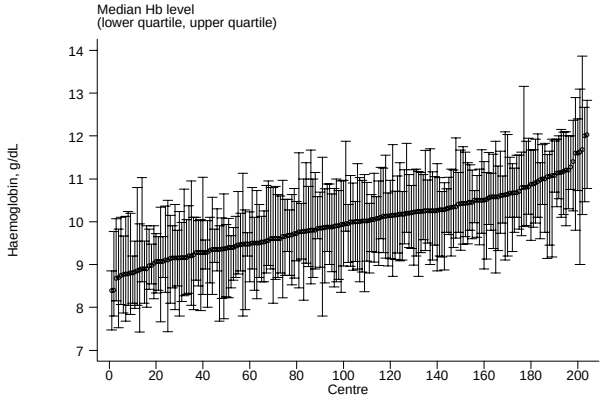
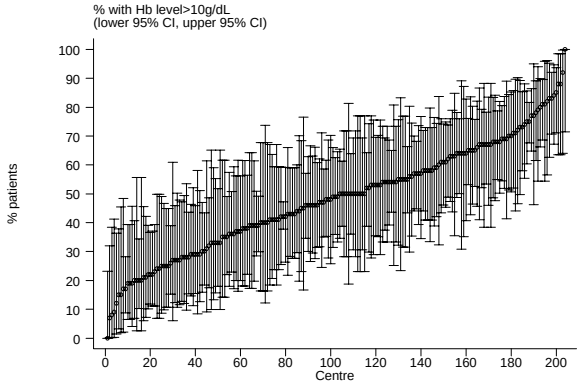


Figure 6.3.5(b): Variation in proportion of patients on erythropoietin with haemoglobin level > 10 g/dL, HD centres 2005



(b) Proportion of patients on erythropoietin with haemoglobin level > 10 g/dL

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	30	0	0	13	23.5	29	60	82
1998	34	0	0	13	27	38	57	71
1999	51	0	5	15	28	38	58	61
2000	77	0	4	20	31	43	64	97
2001	93	4	12	24	33	45	67	69
2002	115	8	15	27	35	51	71	86
2003	144	0	10	27	36	50	67	100
2004	175	8	17	31	41	58	73	85
2005	204	0	19	34	49	63	81	100

(c) Proportion of patients on erythropoietin with haemoglobin level > 11 g/dL

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	30	0	0	0	6.5	13	21	33
1998	34	0	0	0	7	17	25	38
1999	51	0	0	3	8	16	29	37
2000	77	0	0	7	12	20	33	92
2001	93	0	0	8	13	22	38	50
2002	115	0	5	11	18	27	47	71
2003	144	0	0	7	14	26.5	43	61
2004	175	0	0	11	19	29	49	55
2005	204	0	4	13	23.5	33	55	73

Figure 6.3.5(c): Variation in proportion of patients on erythropoietin with haemoglobin level > 11 g/dL, HD centres 2005

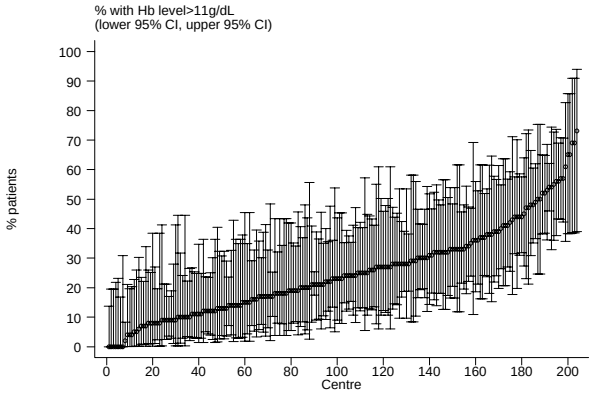


Figure 6.3.6(a): Variation in median haemoglobin level among patients on Erythropoietin, CAPD centres 2005

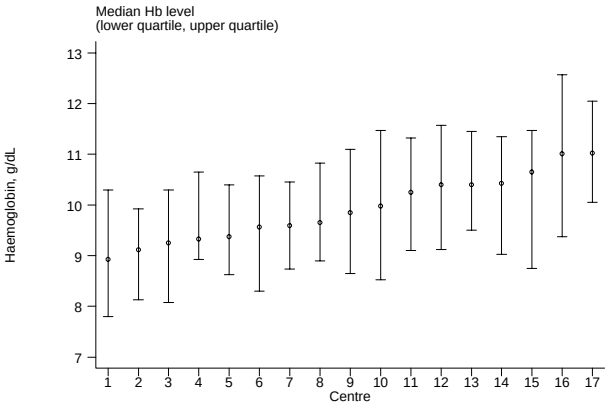


Table 6.3.6: Variation in Haemoglobin outcomes among CAPD centres 2005
(a) Median haemoglobin level among patients on erythropoietin

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	6	7.8	7.8	7.8	8.7	9	9.5	9.5
1998	6	7.9	7.9	8.3	8.9	9.3	9.5	9.5
1999	7	8.1	8.1	8.4	8.7	9.3	9.5	9.5
2000	9	8.2	8.2	8.9	9.1	9.3	10.3	10.3
2001	11	9	9	9.2	9.4	9.6	9.7	9.7
2002	12	8.8	8.8	9	9.3	9.5	9.9	9.9
2003	15	8.9	8.9	9.3	9.6	10	11.3	11.3
2004	16	8.5	8.5	9.2	9.7	10.2	11.2	11.2
2005	17	8.9	8.9	9.4	9.9	10.4	11	11

(b) Proportion of patients on erythropoietin with haemoglobin level > 10 g/dL

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	6	0	0	10	19	31	38	38
1998	6	16	16	19	26.5	29	40	40
1999	7	13	13	20	25	35	40	40
2000	9	18	18	30	36	38	55	55
2001	11	20	20	31	36	42	47	47
2002	12	15	15	24.5	32	39	48	48
2003	15	8	8	29	38	50	76	76
2004	16	13	13	31.5	42.5	57.5	72	72
2005	17	24	24	35	46	57	76	76

Figure 6.3.6(b): Variation in proportion of patients on erythropoietin with haemoglobin level > 10 g/dL, CAPD centres 2005

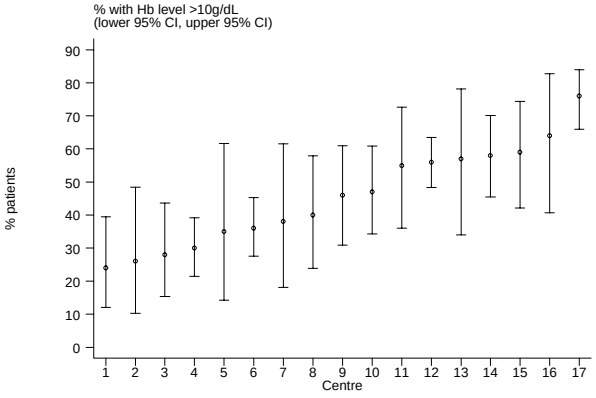
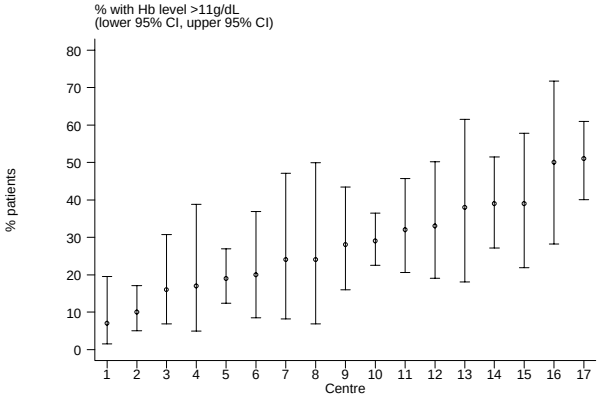


Figure 6.3.6(c): Variation in proportion of patients on erythropoietin with haemoglobin level > 11 g/dL, CAPD centres 2005



(c) Proportion of patients on erythropoietin with haemoglobin level > 11 g/dL

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	6	0	0	0	5.5	8	10	10
1998	6	4	4	8	11	15	16	16
1999	7	0	0	8	9	13	16	16
2000	9	12	12	16	18	21	24	24
2001	11	7	7	10	15	20	23	23
2002	12	10	10	13	18	21.5	27	27
2003	15	5	5	12	17	24	52	52
2004	16	0	0	11	19	31	54	54
2005	17	7	7	19	28	38	51	51

CHAPTER 7

NUTRITIONAL STATUS ON DIALYSIS

Tilakavati Karupaiah
Ahmad Fauzi Abdul Rahman

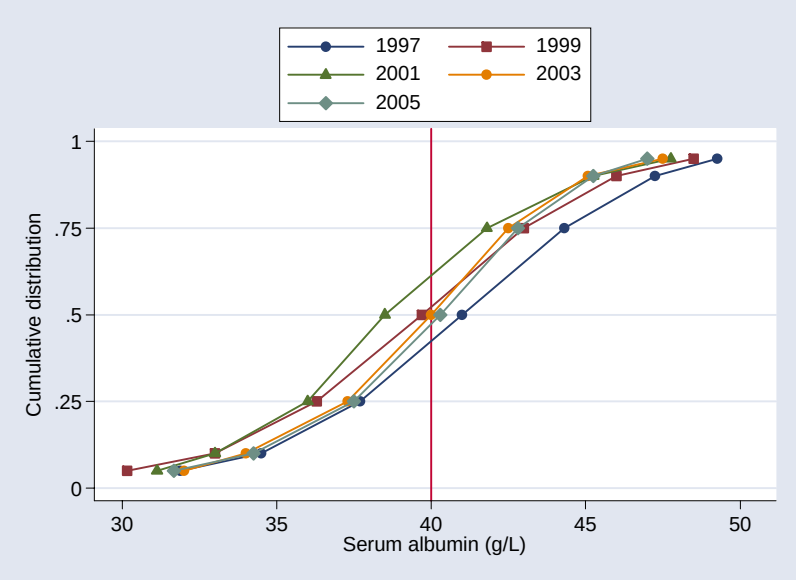
7.1: SERUM ALBUMIN LEVELS ON DIALYSIS

Despite patient numbers increasing by 931 for HD in 2005, mean serum albumin levels was 40 g/L, which is just at the borderline for mortality risk (>40 g/L). This trend has stabilised since 2003 as reflected in the median, LQ and UQ values. For the years 1997 to 2005, the percentage of patients having mean serum albumin levels <35 g/L ranged between 11 to 18% with a decreasing trend seen since 2003 (12-13%) and hence improving trends in mean serum albumin levels. (Table and figure 7.1.1)

Table 7.1.1: Distribution of serum Albumin (g/L), HD patients 1997-2005

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <30g/L	% patients 30-<35g/L	% patients 35-<40g/L	% patients ≥40g/L
1997	1644	40.9	6.2	41	37.7	44.3	3	8	30	59
1998	2075	41.2	6.5	41	37.5	44.7	3	9	28	59
1999	2755	39.7	6.1	39.7	36.3	43	4	13	35	49
2000	3733	38.6	7	39	36	42	5	11	41	43
2001	4666	39	5.6	38.5	36	41.8	3	15	44	38
2002	5568	39.2	5.6	39	36.5	42	3	12	42	43
2003	6529	39.9	5.4	40	37.3	42.5	3	9	35	52
2004	7581	39.9	5.3	40	37	42.8	3	10	34	53
2005	8512	40	5.3	40.3	37.5	42.8	3	9	32	56

Figure 7.1.1: Cumulative distribution of Albumin, HD patients 1997-2005



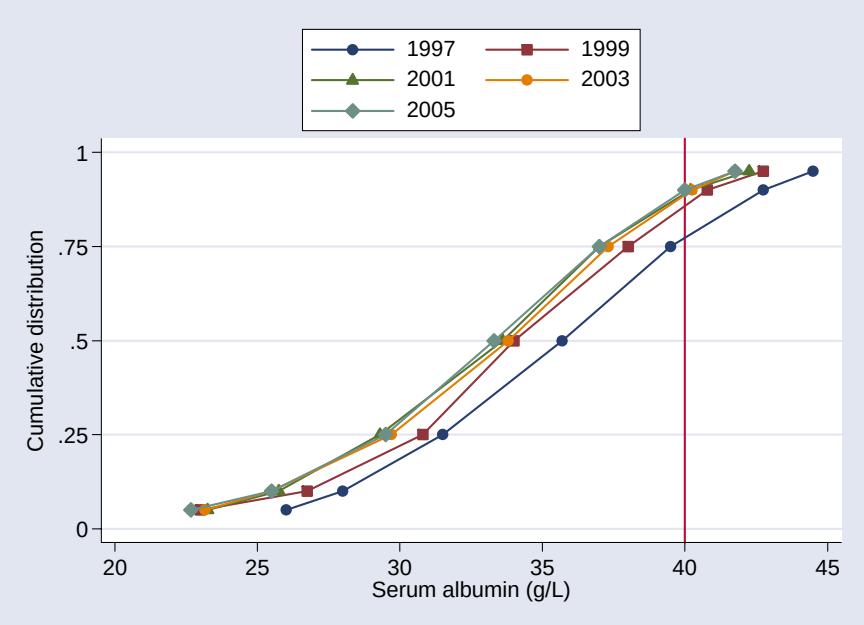
The downward trend in mean serum albumin levels for patients on CAPD continued - from 35.7 g/L in 1997 to 33.3% in 2005. Percentage of patients at increased mortality risk (<35 g/L) increased from 44% in 1997 to 60% by 2005 despite a 2.9-fold increase in patient numbers. This may be explained by the acceptance of elderly diabetic patients for CAPD.

Table 7.1.2: Distribution of serum Albumin, CAPD patients 1997-2005

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <30g/L	% patients 30-<35g/L	% patients 35-<40g/L	% patients ≥40g/L
1997	471	35.7	6.8	35.7	31.5	39.5	16	28	34	22
1998	536	35.8	6.7	36	32	39.7	16	25	35	24
1999	597	34.1	6.6	34	30.8	38	21	33	32	14
2000	640	34.3	6.1	35	31	38.3	20	28	37	14
2001	750	33.3	6.2	33.6	29.3	37	27	33	28	12
2002	862	33.9	5.9	34.3	30.8	37.5	21	35	33	12
2003	1182	33.3	5.8	33.8	29.7	37.3	26	33	30	11
2004	1285	33	6	33.8	29.5	37.3	27	32	30	11
2005	1345	33.2	6.4	33.3	29.5	37	27	33	30	10

The cumulative distribution for 2005, reflects the trend that the patient percentage <35 g/L is increasing.

Figure 7.1.2: Cumulative distribution of Albumin, CAPD patients 1997-2005



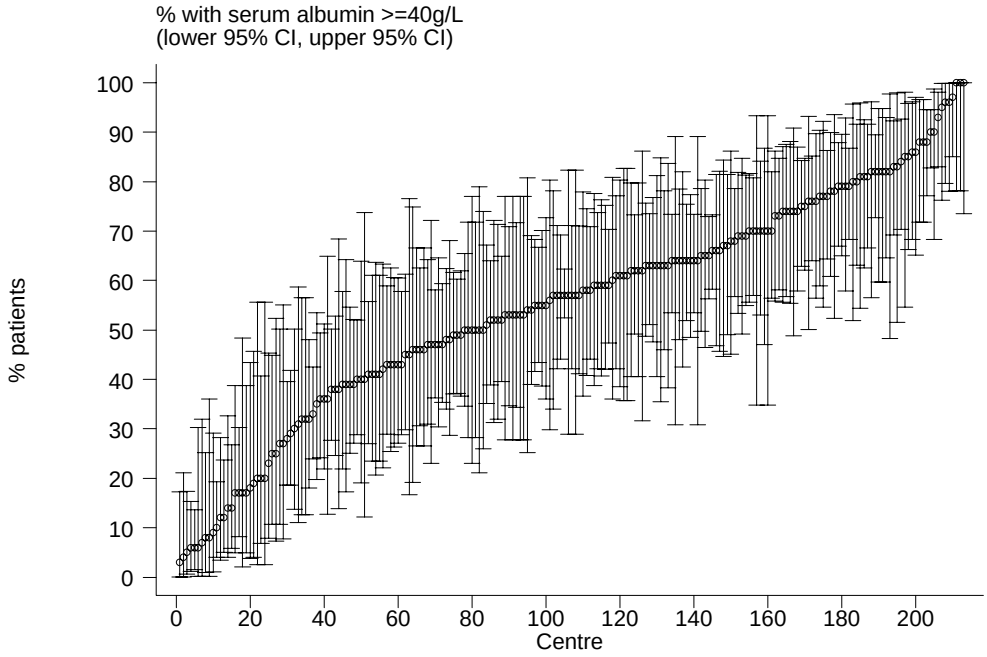
Huge variation was observed in serum albumin results amongst 213 HD centers for 2005.
The best centre had all (100%) patients achieving serum albumin ≥ 40g/L (target albumin), while the worst center had only 3% of patients achieving this target. For all HD centres, greater than 8-fold variation in meeting albumin target was observed.

Table 7.1.3: Variation in Proportion of patients with serum albumin ≥40g/L among HD centres 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	0	10	30	59.5	77	95	97
1998	50	7	15	31	59	80	95	96
1999	70	2	7	23	52.5	67	100	100
2000	95	0	9	23	42	61	82	93
2001	116	0	3	18	40	56.5	82	100
2002	140	0	7.5	25.5	43.5	63	85.5	100
2003	166	0	14	39	55.5	70	92	100
2004	191	0	9	36	57	74	89	100
2005	213	3	10	41	57	70	88	100

Figure 7.1.3 indicates the wide variation amongst 213 HD centers reporting the proportion of patients achieving the target serum albumin ≥ 40g/L for the year 2005.

Figure 7.1.3: Variation in Proportion of patients with serum albumin ≥ 40g/L, HD centres 2005



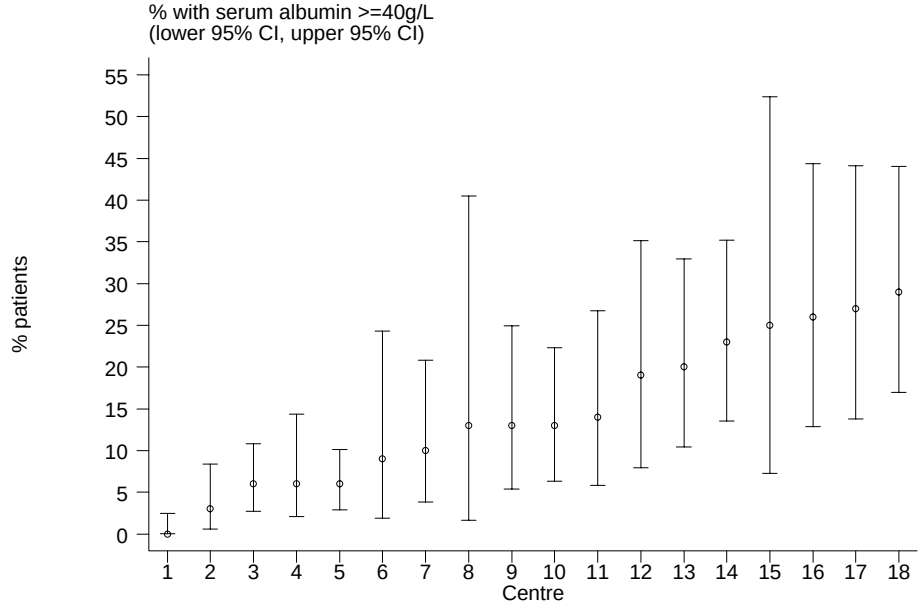
For the 18 CAPD centers in 2005, the maximum proportion of patients achieving the target serum albumin ≥ 40g/L was only 29% whilst some centers reported no patients achieving this target. For all CAPD centres, greater than 29-fold variation in meeting albumin target was observed.

Table 7.1.4: Variation in Proportion of patients with serum albumin ≥40g/L among CAPD centres 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	5	5	10	28	29	59	59
1998	9	5	5	18	27	34	44	44
1999	10	2	2	9	14.5	18	29	29
2000	11	0	0	5	12	28	42	42
2001	12	1	1	4.5	16	27.5	36	36
2002	14	4	4	6	12.5	16	36	36
2003	18	0	0	5	12	15	48	48
2004	18	0	0	5	12.5	22	34	34
2005	18	0	0	6	13	23	29	29

Figure 7.1.4 shows the wide variation amongst 18 CAPD centers reporting the proportion of patients achieving the target serum albumin ≥ 40g/L for the year 2005. For the years 1997 to 2005, the percentage of patients having mean serum albumin levels <35 g/L ranged between 11 to 18% with a decreasing trend seen since 2003 (12-13%)

Figure 7.1.4: Variation in Proportion of patients with serum albumin ≥ 40g/L, CAPD centres 2005



7.2: BODY MASS INDEX (BMI) ON DIALYSIS

Table 7.2.1 indicates that mean BMI for HD patients from 1997 to 2005 is stabilising at 23 [23 to 24.2] but from 2000 onwards an improving trend [23.0 in 2000 to 23.4 in 2005] is detected despite a 2-fold increase in patient numbers. An increasing trend of improved BMI is observed for HD patients, with the percentage of HD patients with BMI $\geq$ 25 increasing from 20% in 1997 to 29% in 2005. This may perhaps reflect an increased number of diabetic patients coming into dialysis.

Table 7.2.1: Distribution of BMI, HD patients 1997-2005

Year	No of subjects	Mean	SD	Median	LQ	UQ	% patients <18.5	% patients 18.5-25	% patients >=25
1997	1543	23.7	16.8	21.5	19.1	24.3	19	61	20
1998	1979	24.2	19	21.6	19.1	24.3	19	60	21
1999	2706	23.6	16.6	21.4	19.2	24.4	18	61	21
2000	3851	23	12.4	21.6	19.3	24.5	18	60	22
2001	4537	23.1	11.6	21.9	19.3	24.7	18	59	23
2002	5077	23.2	11.3	22	19.5	24.9	16	59	24
2003	5959	23.2	10.5	22.1	19.5	25.1	16	58	26
2004	6721	23.3	9.5	22.4	19.8	25.4	15	58	28
2005	7536	23.4	9.5	22.5	19.8	25.6	14	57	29

Figure 7.2.1: Cumulative distribution of BMI, HD patients 1997-2005

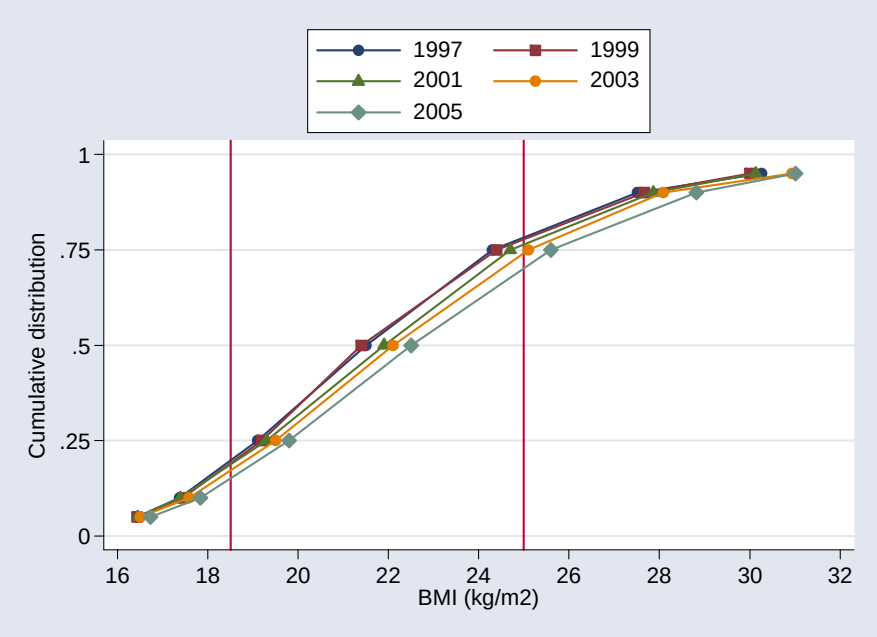


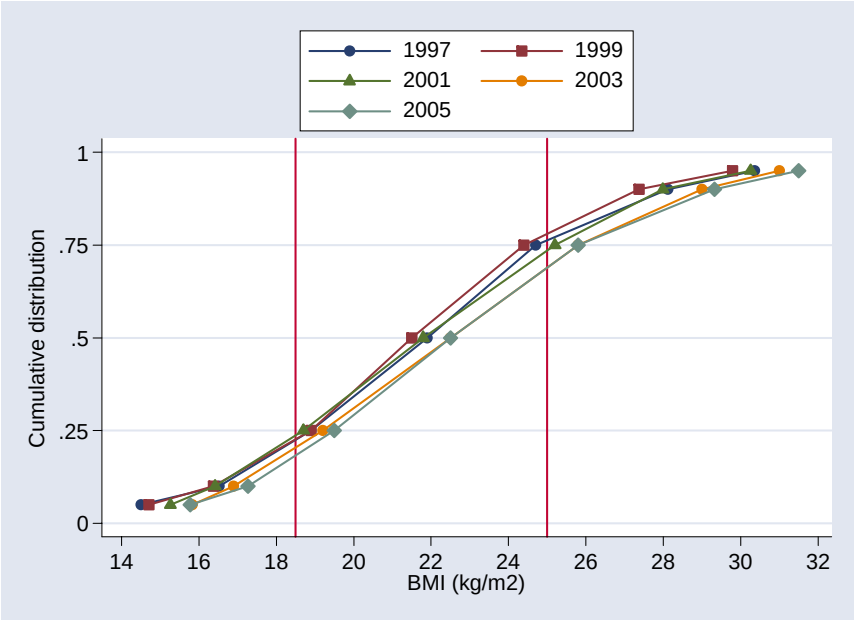
Table 7.2.2 indicates that mean BMI for CAPD patients from 1997 to 2005 is increasing [22.6 to 23.1] despite a 2.9-fold increase in patient numbers. The percentage of CAPD patients with BMI ≥25 increased from 23% in 1997 to 30% in 2005. This may perhaps reflect an increased number of diabetic patients coming into dialysis.

Table 7.2.2: Distribution of BMI, CAPD patients 1997-2005

Year	No of subjects	Mean	SD	Median	LQ	UQ	% patients <18.5	% patients 18.5-25	% patients >=25
1997	420	22.6	12.5	21.9	18.9	24.7	21	56	23
1998	491	22.1	11.1	21.3	18.7	24	23	57	20
1999	552	21.8	4.4	21.5	18.9	24.4	22	56	22
2000	602	21.7	4.4	21.5	18.6	24.6	25	53	22
2001	663	22.2	4.9	21.8	18.7	25.2	23	50	27
2002	750	22.3	4.8	22.1	18.7	25.5	23	47	30
2003	1066	22.9	6.7	22.5	19.2	25.8	20	50	30
2004	1169	23.2	7.1	22.6	19.5	26	18	51	31
2005	1214	23.1	7.1	22.5	19.5	25.8	19	52	30

Figure 7.2.2 reflects the increasing BMI trends as the curve for 2005 is moving to the right.

Figure 7.2.2: Cumulative distribution of BMI, CAPD patients 1997-2005



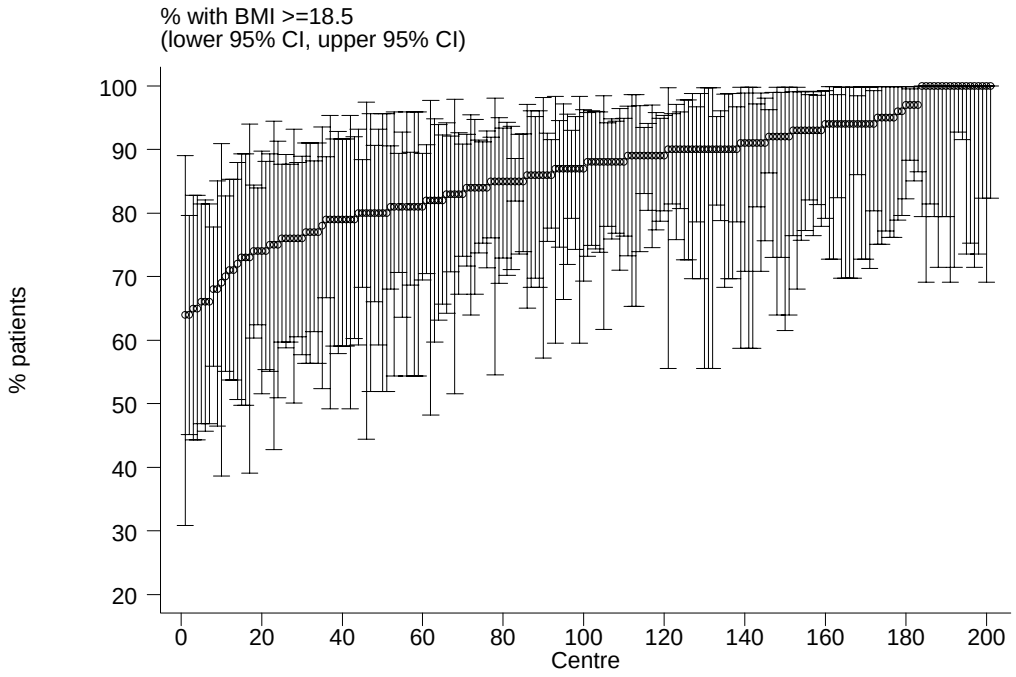
Less variation was observed in BMI measurements amongst 213 HD centers for 2005.
The best centre had all (100%) patients achieving BMI ≥18.5 (target), while the worst center had 64% of patients achieving this target. For all HD centres, there was 1.4-fold variation in meeting target was BMI (≥ 18.5). (table 7.2.3)

Table 7.2.3: Variation in Proportion of patients with BMI ≥ 18.5 among HD centres 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	60	64	75	81	88	100	100
1998	49	61	65	75	81	85	95	100
1999	72	59	62	77	83.5	90	95	100
2000	96	55	65	75.5	82.5	89	95	100
2001	113	30	67	77	83	88	94	100
2002	127	55	71	78	85	89	100	100
2003	155	58	69	79	84	91	100	100
2004	181	60	70	81	86	90	100	100
2005	201	64	70	80	88	92	100	100

Figure 7.2.3 shows the variation amongst 213 HD centers reporting the proportion of patients achieving the target BMI ≥ 18.5 for the year 2005.

Figure 7.2.3: Variation in Proportion of patients with BMI ≥ 18.5, HD centres 2005



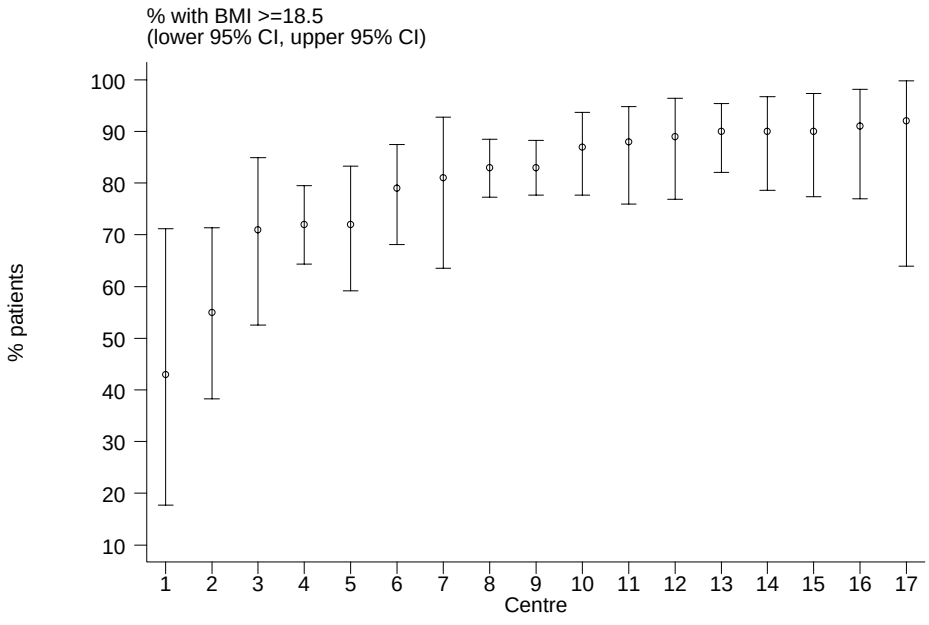
For the 18 CAPD centers in 2005, the maximum proportion of patients achieving the target BMI ≥ 18.5 was 92% whilst the worst centres reported 43% of the patients achieving this target. This represented a 2-fold difference in variation.

Table 7.2.4: Variation in Proportion of patients with BMI ≥18.5 among CAPD centres 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	50	50	74	81	88	93	93
1998	9	0	0	71	80	87	91	91
1999	9	0	0	71	75	83	92	92
2000	11	11	11	65	76	87	90	90
2001	11	14	14	72	77	87	92	92
2002	14	24	24	73	82.5	84	86	86
2003	18	18	18	75	85	88	100	100
2004	18	38	38	71	83.5	89	95	95
2005	17	43	43	72	83	90	92	92

Figure 7.2.4 indicates that only one center reported the lowest proportion of patients achieving the target BMI ≥18.5 whilst a second center reported a proportion of about 55% whilst the rest reported higher proportions (>70%).

Figure 7.2.4: Variation in Proportion of patients with BMI ≥18.5, CAPD centres 2005



CHAPTER 8

BLOOD PRESSURE CONTROL AND DYSLIPIDAEMIA

S Prasad Menon
Lee Wan Tin

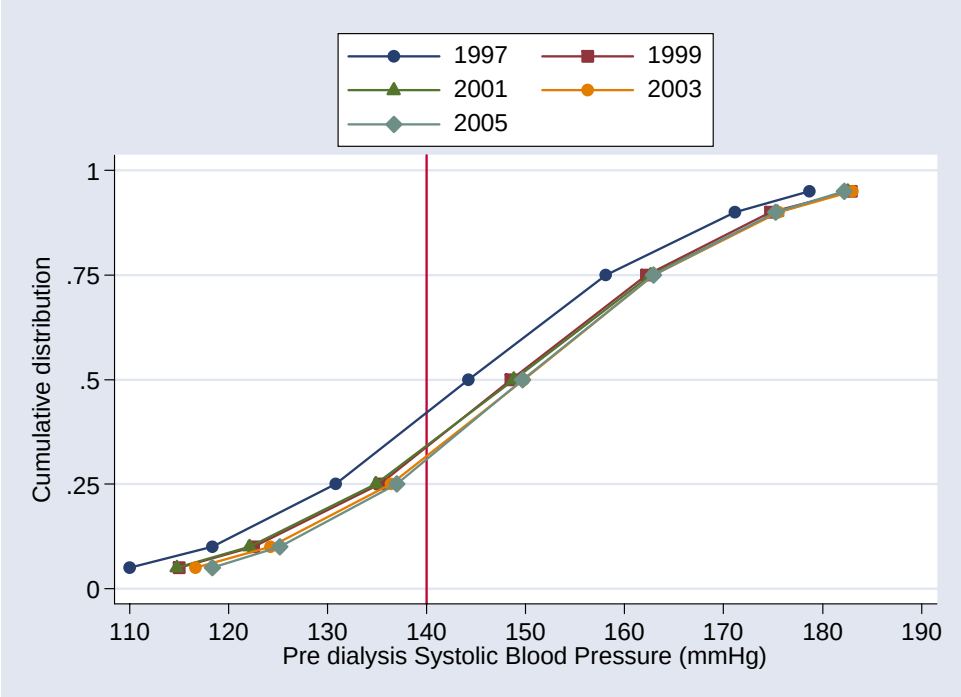
8.1: BLOOD PRESSURE CONTROL ON DIALYSIS

In 2005, systolic BP in haemodialysis patients remained high with mean and median predialysis systolic BP at 149.9 mmHg and 149.7 mmHg respectively (Table and figure 8.1.1). The proportion of HD patients with predialysis systolic BP < 140 mmHg remained low at 30%, similar to the 2004 figures.

Table 8.1.1: Distribution of Pre dialysis Systolic Blood Pressure, HD patients 1997-2005

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <120 mmHg	% patients 120-<140 mmHg	% patients 140-<160 mmHg	% patients 160-<180 mmHg	% patients ≥180 mmHg
1997	1659	144.5	20.8	144.2	130.8	158.1	11	30	35	19	4
1998	2108	146	20.5	146.7	133.2	159.2	10	27	39	19	5
1999	2965	148.7	20.8	148.5	135.3	162.2	8	25	38	23	6
2000	4310	148	20.6	147.8	134.8	161.7	9	25	38	23	6
2001	5147	148.8	20.9	148.8	134.9	162.6	8	25	37	23	7
2002	5911	149.2	20.6	149	135.8	163.3	8	24	38	24	6
2003	6839	149.7	20.2	149.8	136.4	162.9	7	24	39	23	7
2004	7937	149.7	20	150	136.6	163.1	7	23	39	25	6
2005	9016	149.9	19.5	149.7	137	162.9	6	24	40	24	6

Figure 8.1.1: Cumulative distribution of Pre dialysis Systolic Blood Pressure, HD patients 1997-2005

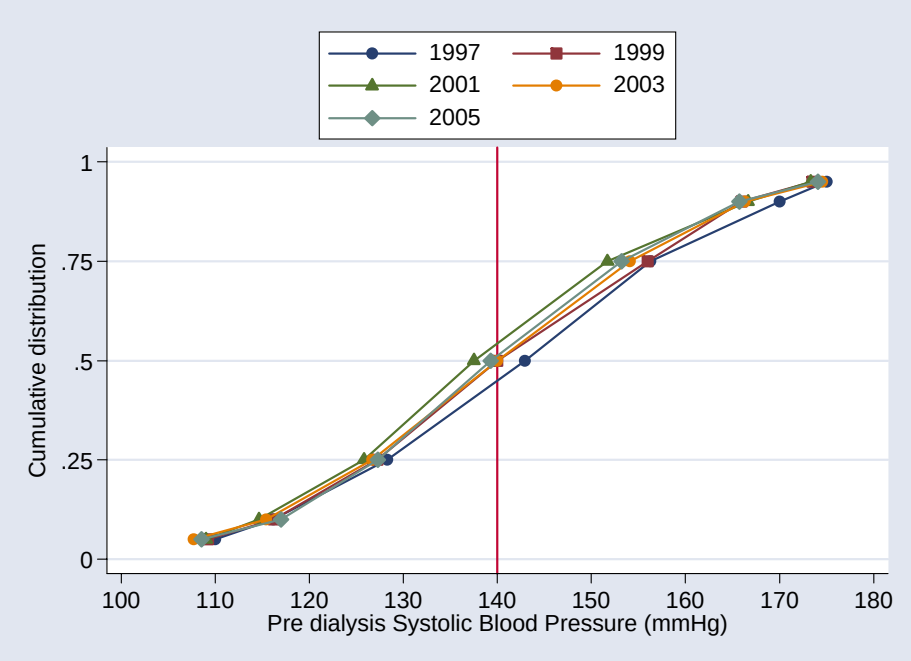


Compared to haemodialysis patients, systolic BP in CAPD patients was better controlled with mean and median predialysis systolic BP at 140.4 mmHg and 139.3 mmHg respectively (Table 8.1.2). It is also noted that compared to 2004, the proportion of CAPD patients with prediastolic systolic BP < 140 mmHg has increased from 47% to 51% in 2005.

Table 8.1.2: Distribution of Pre dialysis Systolic Blood Pressure, CAPD patients 1997-2005

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <120 mmHg	% patients 120-<140 mmHg	% patients 140-<160 mmHg	% patients 160-<180 mmHg	% patients ≥180 mmHg
1997	468	142.7	20.3	142.9	128.3	156.3	13	31	37	17	3
1998	519	141	21.2	140	126.4	157.5	16	34	29	18	3
1999	576	141	19.8	140	127.2	156	14	35	34	15	2
2000	638	137.2	20.4	136.1	123.3	150	18	39	29	13	2
2001	739	139	20.2	137.5	125.8	151.7	16	38	30	13	3
2002	843	139.8	20.5	140	127.1	151.8	14	36	34	12	4
2003	1156	140.5	20.1	140	126.7	154.1	15	35	32	15	3
2004	1260	141	19.8	140.9	127.5	154.4	13	34	36	13	3
2005	1350	140.4	20.2	139.3	127.3	153.2	13	38	33	14	3

Figure 8.1.2: Cumulative distribution of Pre dialysis Systolic Blood Pressure, CAPD patients 1997-2005

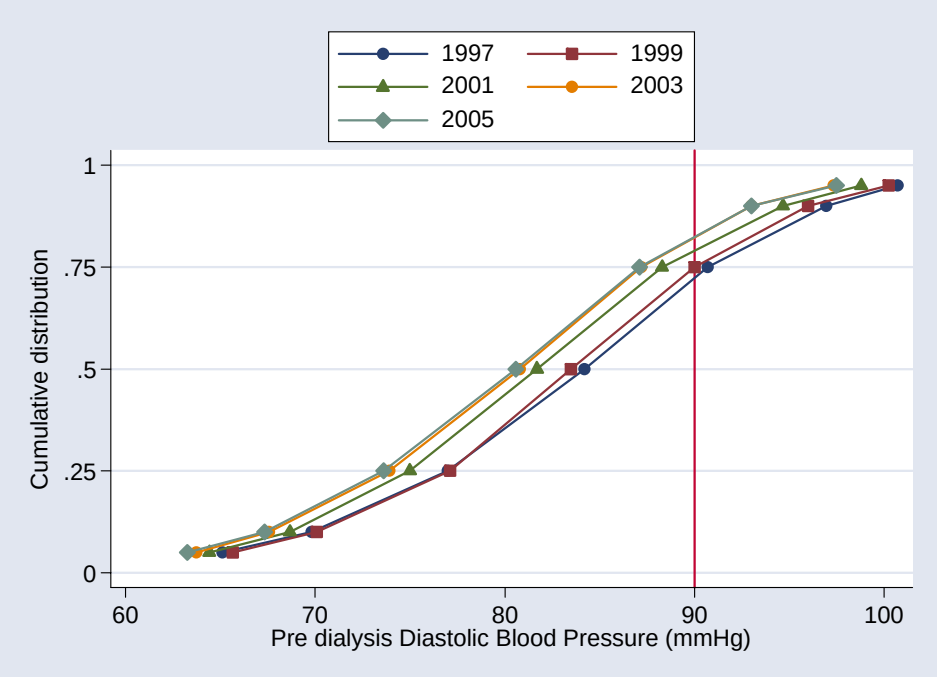


In 2005, predialysis diastolic BP is better controlled than predialysis systolic BP in haemodialysis patients, with mean and median predialysis BP at 80.5 mmHg and 80.6 mmHg respectively (Table 8.1.3). The proportion of HD patients with predialysis diastolic BP < 90 mmHg remained at 47%, similar to 2004 figures. These figures indicate a widening of the pulse pressure. This is consistent with a dialysis population consisting of more elderly and diabetic patients.

Table 8.1.3: Distribution of Pre dialysis Diastolic Blood Pressure, HD patients 1997-2005

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <70 mmHg	% patients 70-<80 mmHg	% patients 80-<90 mmHg	% patients 90-<100 mmHg	% patients ≥100 mmHg
1997	1660	83.7	10.9	84.2	77	90.7	10	23	38	22	6
1998	2108	83.5	10.7	83.9	76.9	90.6	10	24	38	23	5
1999	2965	83.5	10.5	83.5	77.1	90	10	24	40	21	6
2000	4309	82.2	10.4	82.3	75.7	89	11	28	39	18	4
2001	5146	81.6	10.4	81.7	75	88.3	12	30	37	17	4
2002	5907	81.2	10.4	81.3	74.5	88.1	13	30	37	16	3
2003	6837	80.6	10.2	80.8	73.9	87.2	14	32	37	14	3
2004	7935	80.3	10.2	80.3	73.6	86.9	15	33	36	14	3
2005	9016	80.5	10.5	80.6	73.6	87.1	15	32	37	14	3

Figure 8.1.3: Cumulative distribution of Pre dialysis Diastolic Blood Pressure, HD patients 1997-2005

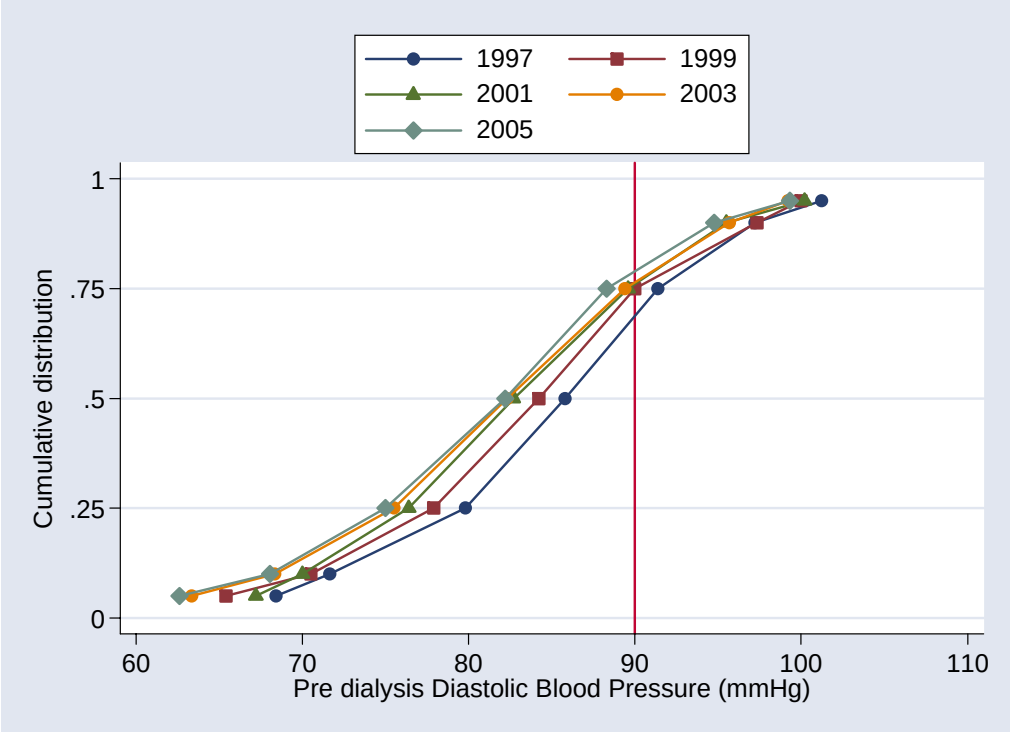


In 2005, diastolic BP control in CAPD patients remained excellent with mean and median predialysis diastolic BP at 80.5 mmHg and 80.4 mmHg respectively (Table 8.1.4). The proportion of CAPD patients with diastolic BP < 90 mmHg is higher than HD patients at 83%.

Table 8.1.4: Distribution of Pre dialysis Diastolic Blood Pressure, CAPD patients 1997-2005

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <70 mmHg	% patients 70-<80 mmHg	% patients 80-<90 mmHg	% patients 90-<100 mmHg	% patients ≥100 mmHg
1997	467	85.3	10.6	85.8	79.8	91.4	6	19	41	26	8
1998	519	84.3	11.3	85	77.1	90.1	8	24	36	24	8
1999	576	84	10.9	84.2	77.9	90	9	20	44	20	7
2000	638	82.9	11	83.3	76.6	89.6	10	24	41	20	5
2001	739	83.1	10.9	82.7	76.4	89.6	9	29	38	18	6
2002	843	82.8	10.8	83.4	76.1	90	11	24	41	21	5
2003	1158	82.2	10.9	82.3	75.5	89.4	12	26	38	19	4
2004	1259	82.2	10.5	83	75.4	89.2	11	28	38	18	4
2005	1350	81.6	10.9	82.2	75	88.3	12	29	40	15	5

Figure 8.1.4: Cumulative distribution of Pre dialysis Diastolic Blood Pressure, CAPD patients 1997-2005



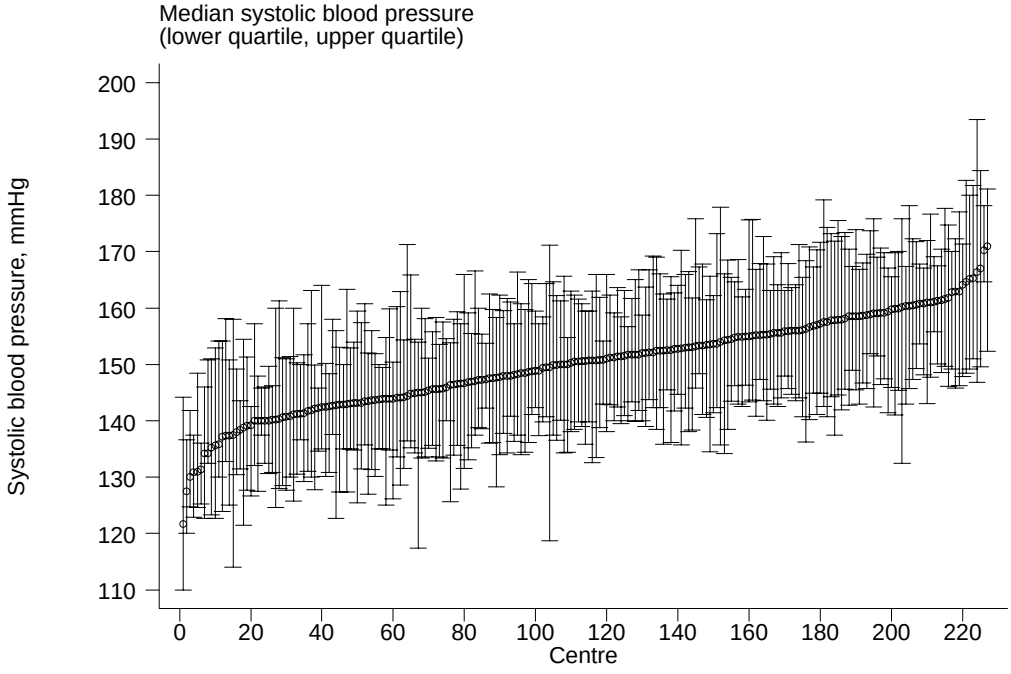
The mild variation in median systolic BP among HD centres in 2005 is similar to previous years (Table 8.1.5).

Table 8.1.5: Variation in BP control among HD centres 2005

(a) Median Systolic blood pressure among HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	119.3	130.4	140	144.9	151.8	158	161.2
1998	49	132.1	135.8	141.3	146.3	151	158.7	159.9
1999	75	133.4	135.5	143.3	148.6	153.8	163.6	167.3
2000	108	130.6	135.8	142.7	147.5	155.3	162.6	180
2001	124	127.9	135.7	142.9	148.5	155	161.9	168.5
2002	148	123.3	136.3	144	149.1	154.6	163	170.9
2003	170	126.7	135.8	144.8	150.4	155.5	162.7	173.7
2004	196	120	136.4	144.2	150.3	155.2	162.5	171
2005	227	121.7	137.2	143.8	150.6	155.9	161.8	171

Figure 8.1.5(a): Variation in median systolic blood pressure among HD patients, HD centres 2005



There is also mild variation in median diastolic BP among HD centres in 2005, similar to previous years (Table 8.1.5).

(b) Median Diastolic blood pressure among HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	70	78.3	81.5	83.6	85.5	88	93.3
1998	49	77.1	78.8	82	83.8	86.7	88.3	90
1999	75	75.3	77	81.7	83.8	85.4	88.8	91.3
2000	108	75.3	76.7	80	82.3	84.4	89.2	94.4
2001	124	74.1	76.2	79.8	81.9	83.8	87.5	91.3
2002	148	71.9	75.3	79.1	81.4	83.8	87.8	101.4
2003	170	73.3	75	78.4	80.9	83.5	86.3	97.5
2004	196	71.7	73.3	78.3	80.9	82.9	86.8	92.8
2005	227	68	73.5	78	80.8	83.3	87.3	91.7

Figure 8.1.5(b): Variation in median diastolic blood pressure among HD patients, HD centres 2005

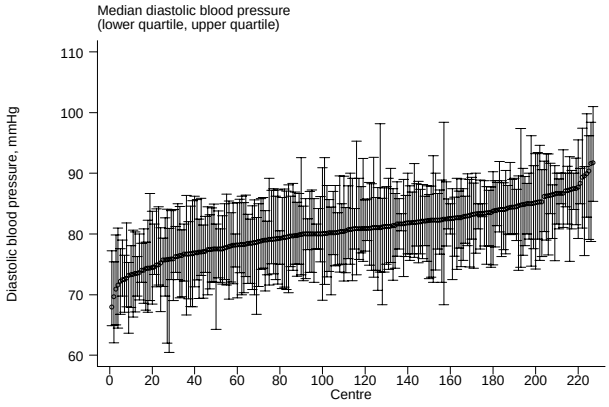
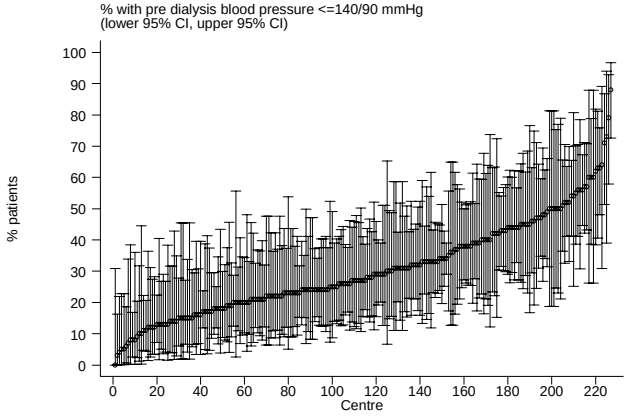


Figure 8.1.5(c): Variation in proportion of HD patients with pre dialysis blood pressure ≤ 140/90 mmHg, HD centres 2005



The past 9 years witnessed a continuing trend in poor predialysis BP control (BP <140/90 mmHg), with 2005 registering a median of 27% achieving such control. This overall poor BP control mainly reflects the poor control in systolic BP in HD patients.

(c) Proportion of HD patients with Pre dialysis Blood Pressure <140/90 mmHg

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	14	17	29	38	45	76	87
1998	49	9	19	27	35	43	55	72
1999	75	4	11	23	32	42	60	70
2000	108	0	9	23	32.5	43.5	63	81
2001	124	2	10	22	31.5	43.5	59	76
2002	148	0	10	22	29.5	40	58	77
2003	170	4	10	21	29	39	59	81
2004	196	0	8	20	29	38	58	91
2005	227	0	10	20	27	40	57	88

Similar to HD centres, the variation in median systolic BP among CAPD centres in 2005 is mild, and is similar to previous years (Table 8.1.65).

Table 8.1.6: Variation in BP control among CAPD centres 2005
(a) Median Systolic blood pressure among CAPD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	124	124	139.4	142.5	150	151.6	151.6
1998	9	110.3	110.3	135	138.6	140.8	147.5	147.5
1999	9	116.7	116.7	132.5	137.8	140	152.8	152.8
2000	11	114.1	114.1	131.1	135	139.7	149.1	149.1
2001	11	119.6	119.6	136.3	137.6	138.8	149	149
2002	14	124.4	124.4	133.7	139.6	144.2	148.2	148.2
2003	18	122.2	122.2	131	142.2	147.5	151.5	151.5
2004	18	115.9	115.9	135	139.8	143.3	149.8	149.8
2005	18	122.4	122.4	134.8	137.3	141	158	158

Figure 8.1.6(a): Variation in median systolic blood pressure among CAPD patients, CAPD centres 2005

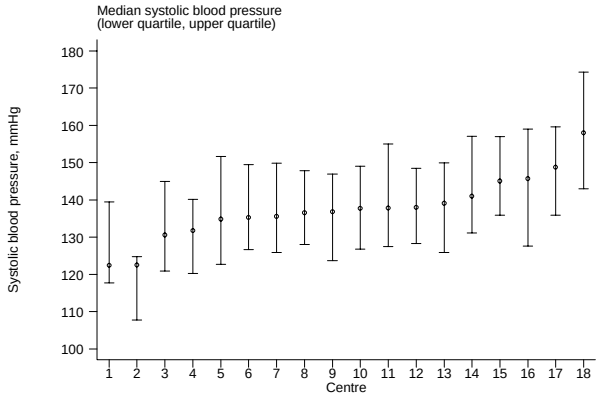
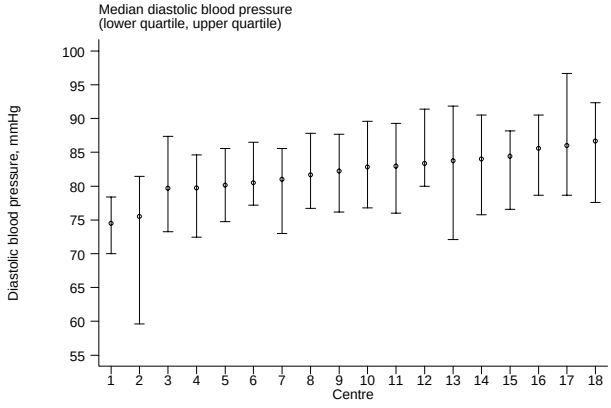


Figure 8.1.6(b): Variation in median diastolic blood pressure among CAPD patients, CAPD centres 2005



There is also only mild variation in diastolic BP control among CAPD centres in 2005 (Table 8.1.6b).

(b) Median Diastolic blood pressure (mmHg) among CAPD patients

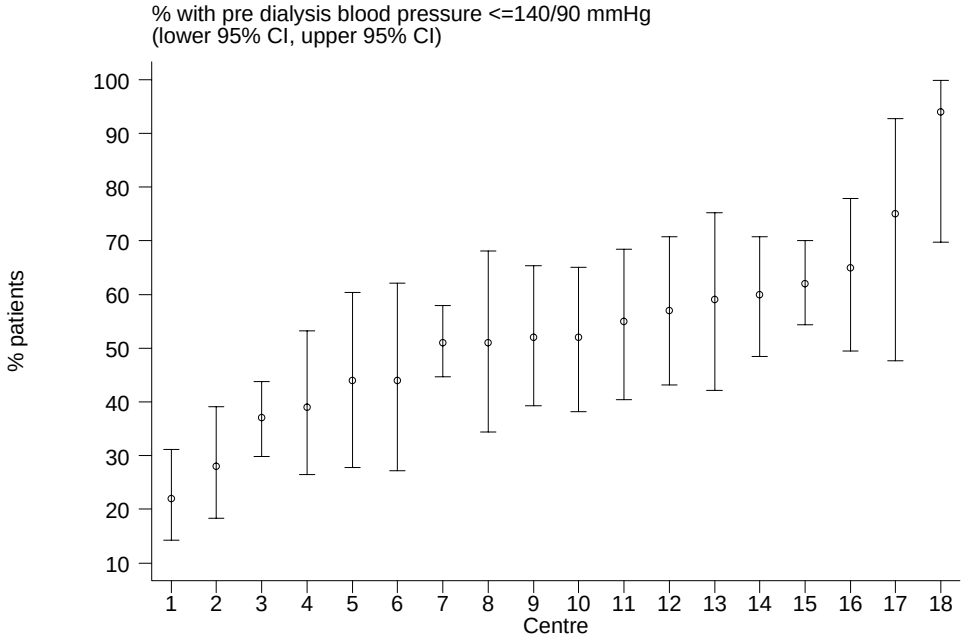
Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	82.5	82.5	85.3	86	86	88.7	88.7
1998	9	75	75	85.2	85.8	86	88.8	88.8
1999	9	77.5	77.5	84.2	85	85.7	86.7	86.7
2000	11	73.1	73.1	80.5	83	84.4	88	88
2001	11	79	79	80.9	83	84.8	88	88
2002	14	79.2	79.2	81.7	83.5	85.3	86.8	86.8
2003	18	63.8	63.8	80.9	82.2	84.4	89	89
2004	18	75.5	75.5	80.8	83.7	84.5	87.5	87.5
2005	18	74.5	74.5	80.1	82.5	84	86.7	86.7

In 2005 the proportion of CAPD patients with good BP control (< 140/90) is higher than HD patients (Table 8.1.6c), reflecting better systolic and diastolic BP control in CAPD patients. However it is noted that the variation in BP control in CAPD patients is relatively large (more than 4 times variation between 5th percentile centre versus 95th percentile centre) as illustrated in Figure 8.1.6c.

(c) Proportion of CAPD patients with Pre dialysis Blood Pressure < 140/90 mmHg

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	26	26	35	41	46	59	59
1998	9	36	36	44	47	47	100	100
1999	9	30	30	41	52	58	100	100
2000	11	24	24	47	56	65	92	92
2001	11	36	36	46	52	60	85	85
2002	14	21	21	35	49	53	71	71
2003	18	24	24	36	44.5	66	100	100
2004	18	29	29	39	47.5	57	82	82
2005	18	22	22	44	52	60	94	94

Figure 8.1.6(c): Variation in proportion of CAPD patients with pre dialysis blood pressure ≤ 140/90 mmHg, CAPD centres 2005



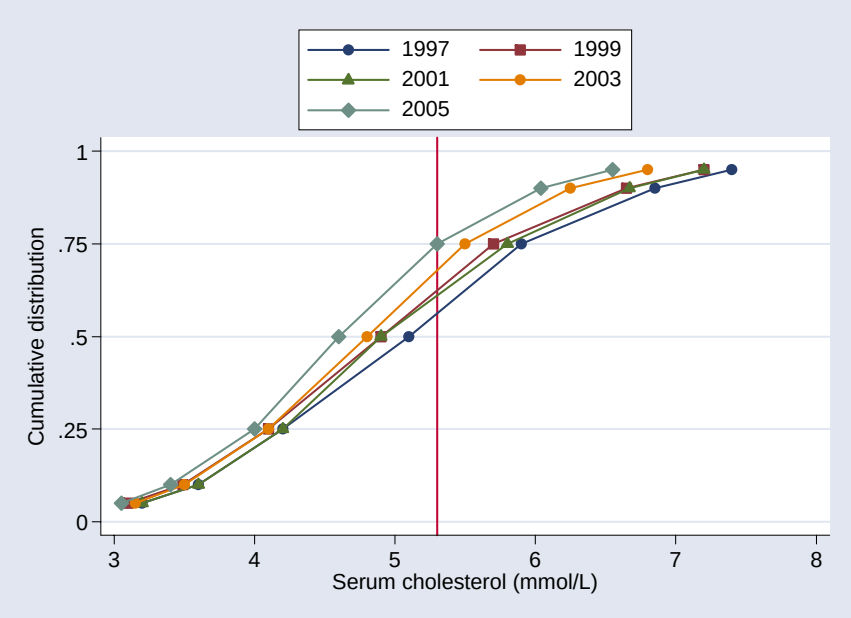
8.2: DYSLIPIDAEMIA IN DIALYSIS PATIENTS

The previous trend of better total cholesterol control in HD patients continued in 2005, with 73% of HD patients achieving total cholesterol level of < 5.3 mmol/l (Table 8.2.1)

Table 8.2.1: Distribution of serum Cholesterol, HD patients 1997-2005

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <3.5 mmol/L	% patients 3.5-<5.3 mmol/L	% patients 5.3-<6.2 mmol/L	% patients ≥6.2 mmol/L
1997	1158	5.1	1.4	5.1	4.2	5.9	8	49	24	19
1998	1166	5.1	1.3	5	4.2	5.8	7	53	22	17
1999	1871	5	1.3	4.9	4.1	5.7	10	54	20	15
2000	2956	5	1.2	4.9	4.2	5.8	8	53	23	16
2001	3898	5.1	1.3	4.9	4.2	5.8	8	52	24	16
2002	4751	5	1.2	4.9	4.2	5.7	9	55	24	13
2003	5811	4.8	1.1	4.8	4.1	5.5	9	59	21	11
2004	6710	4.7	1.1	4.7	4	5.4	11	60	21	8
2005	7776	4.7	1.1	4.6	4	5.3	12	61	19	8

Figure 8.2.1: Cumulative distribution of Cholesterol, HD patients 1997-2005



Similarly, in 2005, the trend towards better cholesterol control in CAPD patients continued with 60% of CAPD patients achieving total cholesterol < 5.3 mmol/l.(Table 8.2.2). This level of cholesterol control in CAPD patients is less than that in HD patients (60% versus 73%).

Table 8.2.2: Distribution of serum Cholesterol (mmol/L), CAPD patients 1997-2005

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <3.5 mmol/L	% patients 3.5-<5.3 mmol/L	% patients 5.3-<6.2 mmol/L	% patients ≥6.2 mmol/L
1997	420	6.1	1.4	6	5.1	6.9	2	27	28	43
1998	348	6	1.4	5.9	5	6.8	3	29	28	41
1999	434	5.7	1.4	5.6	4.9	6.4	3	37	30	31
2000	526	5.9	1.6	5.7	4.9	6.7	3	31	30	36
2001	581	5.8	1.4	5.7	4.8	6.6	2	36	27	35
2002	766	5.6	1.4	5.5	4.6	6.4	4	38	28	29
2003	1106	5.4	1.4	5.3	4.4	6.1	5	45	27	23
2004	1231	5.3	1.4	5.2	4.4	6.1	5	48	26	21
2005	1241	5.2	1.3	5	4.3	5.9	5	55	22	18

Figure 8.2.2: Cumulative distribution of Cholesterol, CAPD patients 1997-2005

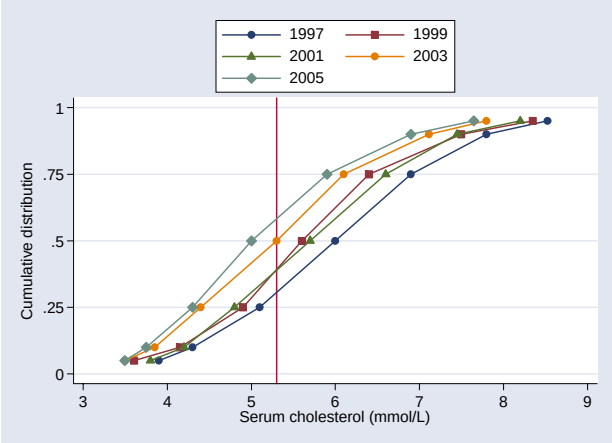
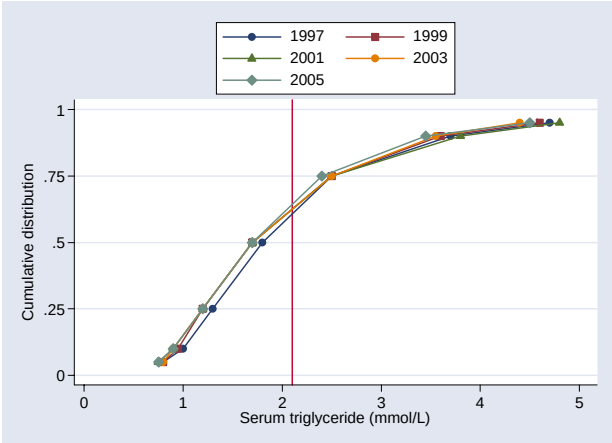


Figure 8.2.3: Cumulative distribution of serum Triglyceride, HD patients 1997-2005



Serum triglyceride control in HD patients in 2005 remain similar to past few years with 72% of CAPD patients having serum triglyceride < 2.3 mmol/l (Table 8.2.3).

Table 8.2.3: Distribution of serum Triglyceride, HD patients 1997-2005

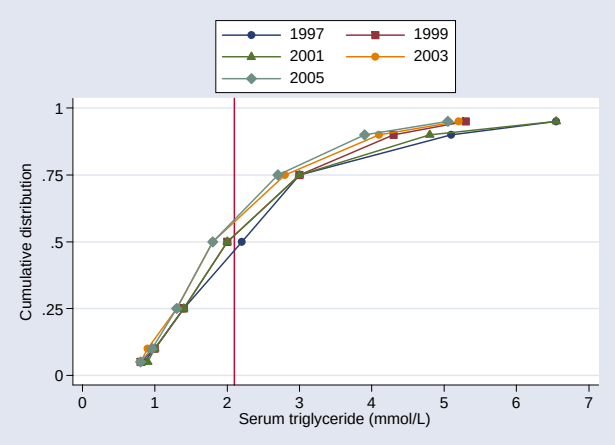
Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <1.7 mmol/L	% patients 1.7-<2.3 mmol/L	% patients 2.3-<3.5 mmol/L	% patients ≥3.5 mmol/L
1997	1074	2.1	1.4	1.8	1.3	2.5	45	24	18	12
1998	1089	2.2	1.5	1.8	1.3	2.6	42	26	20	12
1999	1633	2.1	1.3	1.7	1.2	2.5	49	21	18	11
2000	2393	2.1	1.4	1.7	1.3	2.6	48	22	19	12
2001	3162	2.1	1.4	1.7	1.2	2.5	48	22	17	13
2002	3861	2.1	1.4	1.8	1.2	2.5	47	22	18	12
2003	4715	2	1.3	1.7	1.2	2.5	48	23	18	11
2004	5607	2	1.2	1.7	1.2	2.4	51	23	17	10
2005	6851	2	1.3	1.7	1.2	2.4	50	22	18	10

The proportion of CAPD patients with serum triglyceride < 2.3 mmol/l (67%) is less than that in HD patients in 2005 (Table 8.2.4). This situation is similar to previous years.

Table 8.2.4: Distribution of serum Triglyceride, CAPD patients 1997-2005

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients <1.7 mmol/L	% patients 1.7-<2.3 mmol/L	% patients 2.3-<3.5 mmol/L	% patients ≥3.5 mmol/L
1997	413	2.6	1.9	2.2	1.4	3	36	22	25	18
1998	344	2.4	1.8	1.8	1.3	3	42	22	17	19
1999	421	2.4	1.6	2	1.4	3	38	25	18	19
2000	520	2.7	2.2	2.1	1.5	3	33	24	23	21
2001	576	2.6	1.8	2	1.4	3	36	22	22	20
2002	767	2.5	1.7	2	1.4	3	39	21	22	18
2003	1102	2.3	1.6	1.8	1.3	2.8	45	20	21	14
2004	1224	2.2	1.6	1.8	1.3	2.6	47	23	17	13
2005	1240	2.2	1.5	1.8	1.3	2.7	43	24	18	14

Figure 8.2.4: Cumulative distribution of serum Triglyceride, CAPD patients 1997-2005



In 2005, there was mild variation in median serum cholesterol level among HD centres, similar to 2004. It is noted that the median serum cholesterol level in HD centres has gradually declined from 5.0 mmol/l in 1997 to 4.6 mmol/l in 2005.

Table 8.2.5: Variation in dyslipidaemia among HD centres 2005
(a) Median serum cholesterol level among HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	34	4.1	4.3	4.6	5	5.3	5.8	5.9
1998	32	4.2	4.4	4.7	5	5.3	5.4	5.5
1999	48	3.5	4.1	4.6	4.8	5	5.6	5.8
2000	78	4.1	4.3	4.8	5	5.2	5.5	5.8
2001	93	4.1	4.4	4.7	5	5.2	5.6	6.3
2002	126	4.4	4.5	4.7	4.9	5.1	5.5	6
2003	150	4.2	4.3	4.6	4.8	5	5.3	5.8
2004	174	3.6	4.2	4.5	4.7	4.9	5.3	6.2
2005	198	3.8	4.2	4.4	4.6	4.8	5.2	5.5

Figure 8.2.5(a): Variation in median serum cholesterol level among HD patients, HD centres 2005

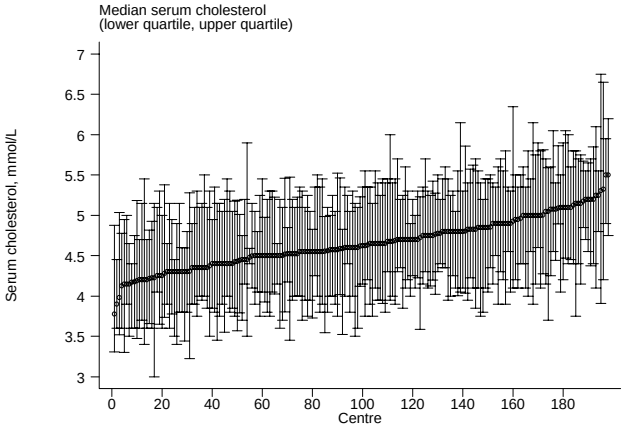
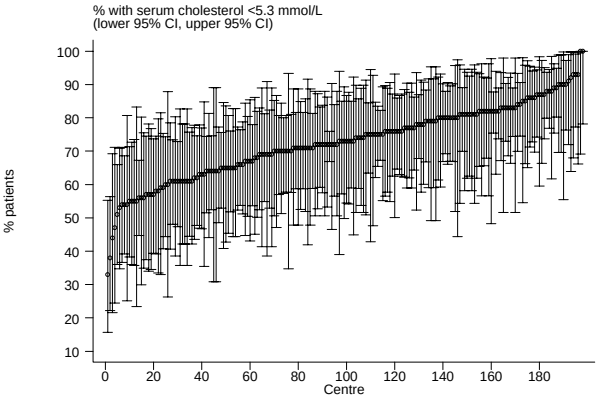


Figure 8.2.5(b): Variation in proportion of patients with serum cholesterol < 5.3 mmol/L, HD centres 2005



In 2005, there is mild variation in the proportion of patients with target serum cholesterol level <5.3 mmol/l among HD centres, similar to 2004. It is noted that the proportion of patients with target serum cholesterol control for the 50th percentile centre has increased from 57% in 1997 to 73% in 2005.

(b) Proportion of patients with serum cholesterol < 5.3 mmol/L, HD Centres

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	34	32	35	48	57	64	83	92
1998	32	30	36	50	62.5	69	90	91
1999	48	35	38	58.5	64	76.5	85	93
2000	78	27	36	51	61	68	86	100
2001	93	14	36	54	60	68	77	82
2002	126	32	45	56	64	71	76	92
2003	150	36	44	60	68	75	83	92
2004	174	25	47	63	71	77	90	94
2005	198	33	55	65	73	81	90	100

In 2005, there is mild variation in median serum triglyceride level among HD centres, similar to 2004.

(c) Median serum triglyceride level among HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	33	1.3	1.3	1.6	1.8	1.9	2.5	2.9
1998	30	1.4	1.4	1.7	1.8	2	2.1	2.3
1999	43	1.2	1.4	1.5	1.7	1.9	2.4	2.7
2000	61	1.2	1.4	1.5	1.8	2	2.5	2.8
2001	80	1.1	1.4	1.5	1.7	1.9	2.2	2.7
2002	99	1.1	1.4	1.6	1.8	1.9	2.3	2.8
2003	126	1.2	1.3	1.5	1.7	1.9	2.2	2.5
2004	156	1	1.3	1.5	1.7	1.9	2.2	2.8
2005	180	.9	1.3	1.5	1.7	1.8	2.2	2.5

Figure 8.2.5(c): Variation in median serum triglyceride level among HD patients, HD centres 2005

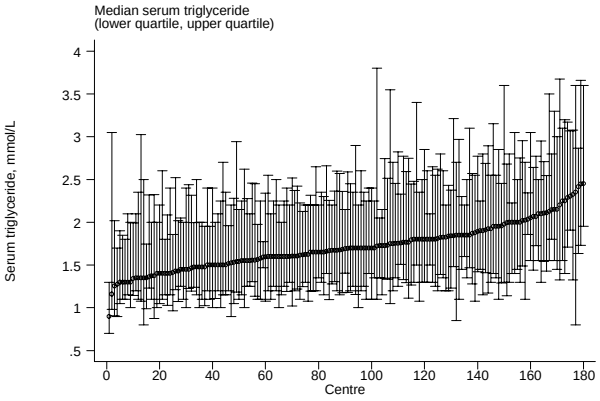
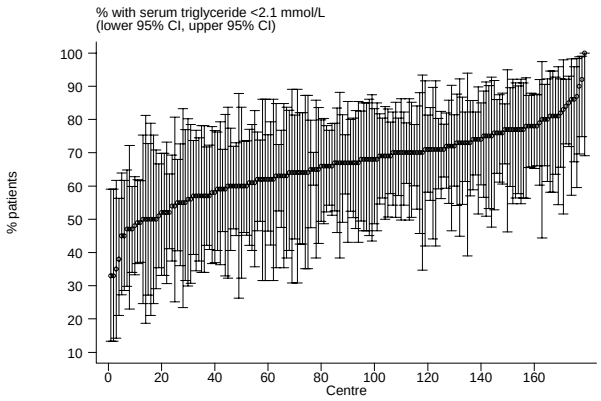


Figure 8.2.5(d): Variation in proportion of patients with serum triglyceride < 2.1 mmol/L, HD centres 2005



In 2005, there is mild variation in proportion of patients with serum triglyceride < 2.1 mmol/l among HD centres, similar to 2004.

(d) Proportion of patients with serum triglyceride < 2.1 mmol/L, HD centres

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	33	23	36	59	65	77	85	87
1998	30	44	50	56	63	72	82	90
1999	43	27	47	59	68	73	81	92
2000	61	23	40	57	66	73	83	92
2001	80	38	45	56.5	65	75.5	83	90
2002	99	9	46	58	66	72	81	94
2003	126	30	45	57	67	76	89	100
2004	156	21	46	60	68.5	78	86	100
2005	179	33	47	60	67	73	83	100

In 2005, there is mild variation in median serum cholesterol level among CAPD centres, similar to 2004. It is noted that the median serum cholesterol level for the 50th percentile CAPD centre has decreased from 5.9 mmol/l in 1997 to 5.0 mmol/l n 2005.

Table 8.2.6: Variation in dyslipidaemia among CAPD centres 2005
(a) Median serum cholesterol level among CAPD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	6	5.8	5.8	5.9	5.9	6.1	6.1	6.1
1998	6	4.8	4.8	5.6	5.8	6.1	6.2	6.2
1999	8	5.1	5.1	5.4	5.7	5.8	6	6
2000	10	5.3	5.3	5.4	5.6	5.9	6.4	6.4
2001	10	5	5	5.6	5.9	6.1	6.2	6.2
2002	14	5	5	5.4	5.6	5.7	6.3	6.3
2003	18	4.6	4.6	5.2	5.4	5.8	6.1	6.1
2004	18	4.6	4.6	4.9	5.2	5.5	5.8	5.8
2005	18	4.4	4.4	4.7	5	5.3	5.9	5.9

Figure 8.2.6(a): Variation in median serum cholesterol level among CAPD patients, CAPD centres 2005

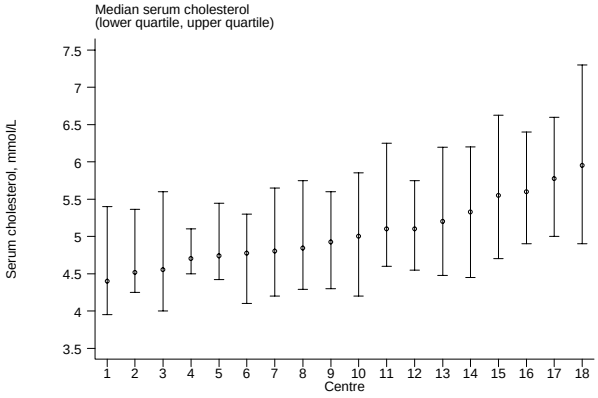
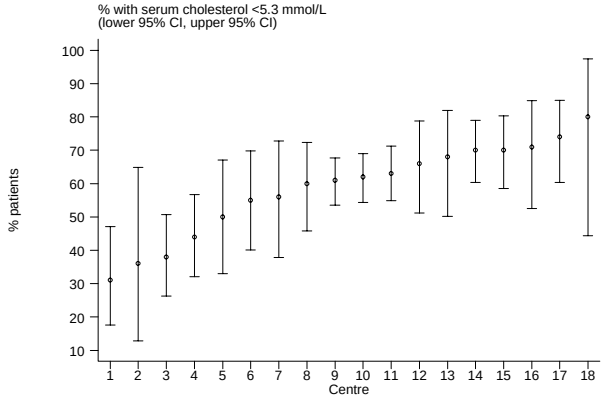


Figure 8.2.6(b): Variation in proportion of patients with serum cholesterol < 5.3 mmol/L, CAPD centres 2005



The variation in the proportion of patients with serum cholesterol < 5.3 mmol/l remains significant (more than 2 fold difference between 5th percentile centre versus 95th percentile centre), reflecting the difference in lipid control between the CAPD centres contributing data in 2005.

(b) Proportion of patients with serum cholesterol < 5.3 mmol/L, CAPD centres

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	6	27	27	27	29	31	33	33
1998	6	24	24	27	32	37	56	56
1999	8	10	10	37	39.5	45	53	53
2000	10	11	11	18	31.5	46	50	50
2001	10	22	22	30	34	45	62	62
2002	14	25	25	35	41.5	43	65	65
2003	18	0	0	35	46.5	55	74	74
2004	18	9	9	41	52.5	60	70	70
2005	18	31	31	50	61.5	70	80	80

In 2005, there is mild variation in median serum triglyceride level among CAPD centres, similar to 2004

(c) Median serum triglyceride level among CAPD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	6	1.7	1.7	1.9	2.1	2.2	2.4	2.4
1998	6	1.2	1.2	1.5	1.7	1.9	2.1	2.1
1999	8	1.7	1.7	1.9	2	2.1	2.6	2.6
2000	10	1.8	1.8	2	2.3	2.5	2.5	2.5
2001	10	1.5	1.5	1.8	2	2.1	3	3
2002	14	1.5	1.5	1.9	2	2.1	2.4	2.4
2003	18	1.1	1.1	1.7	1.8	2	2.3	2.3
2004	18	1.3	1.3	1.6	1.8	1.9	2.3	2.3
2005	18	1.3	1.3	1.6	1.9	2	2.2	2.2

Figure 8.2.6(c): Variation in median serum triglyceride level among CAPD patients, CAPD centres 2005

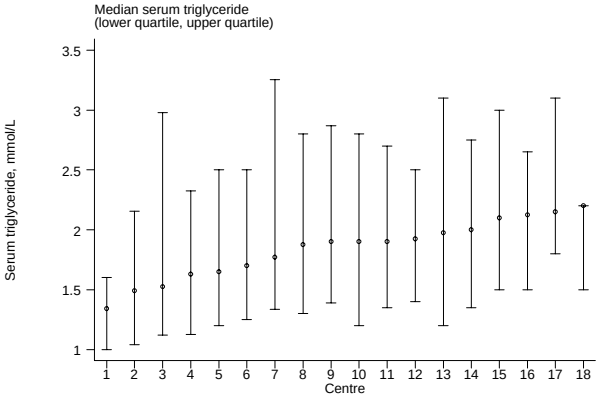
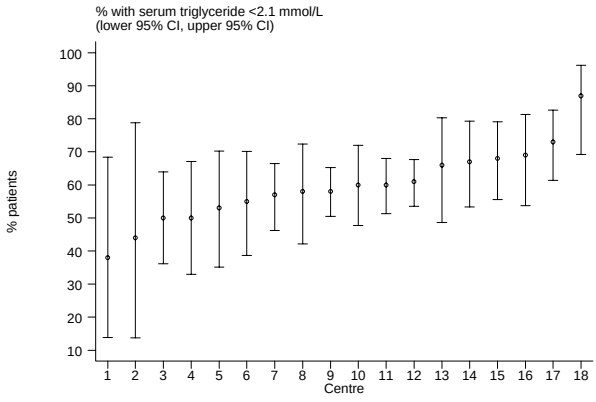


Figure 8.2.6(d): Variation in proportion of patients with serum triglyceride < 2.1 mmol/L, CAPD centres 2005



The variation in the proportion of patients with serum triglyceride < 2.1 mmol/l remains significant (more than 2 fold difference between 5th percentile centre versus 95th percentile centre) in 2005.

(d) Proportion of patients with serum triglyceride < 2.1 mmol/L

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	6	40	40	46	52	56	61	61
1998	6	51	51	55	61	70	85	85
1999	8	37	37	53.5	56	59	64	64
2000	10	18	18	44	49	54	62	62
2001	10	27	27	50	53	58	67	67
2002	14	37	37	52	54	57	74	74
2003	18	49	49	54	58.5	62	100	100
2004	18	40	40	60	62.5	64	89	89
2005	18	38	38	53	59	67	87	87

CHAPTER 9

MANAGEMENT OF RENAL BONE DISEASE IN DIALYSIS PATIENTS

Rozina Bt Ghazalli
Fan Kin Sing
Shahnaz Shah Firdaus Khan

9.1: TREATMENT OF RENAL BONE DISEASE

In 2005 no major changes were found in the treatment of renal bone disease. The majority of dialysis patients on both HD (91%) and CAPD (84%) received calcium carbonate as a phosphate binder. The usage of aluminium phosphate binders continued to be low since its sharp fall from 1997 onwards. Vitamin D was used in an increasing number of patients in the HD group (tables 9.1.1 & 9.1.2).

Table 9.1.1: Treatment for Renal Bone Disease, HD patients 1997-2005

Year	No. of subjects	No. of subjects on $CaCO_3$	% on $CaCO_3$	No. of subjects on $Al(OH)_3$	% on Al $(OH)_3$	No. of subjects on Vitamin D	% on Vitamin D
1997	1695	1543	91	417	25	694	41
1998	2141	1956	91	343	16	652	30
1999	2996	2693	90	244	8	770	26
2000	4392	3977	91	239	5	1084	25
2001	5194	4810	93	145	3	1145	22
2002	6108	5536	91	171	3	1375	23
2003	7043	6430	91	118	2	1692	24
2004	8243	7408	90	106	1	2029	25
2005	9255	8392	91	92	1	2445	26

Table 9.1.2: Treatment for Renal Bone Disease, CAPD patients 1997-2005

Year	No. of subjects	No. of subjects on $CaCO_3$	% on $CaCO_3$	No. of subjects on $Al(OH)_3$	% on Al $(OH)_3$	No. of subjects on Vitamin D	% on Vitamin D
1997	476	393	83	57	12	114	24
1998	541	425	79	46	9	110	20
1999	610	450	74	36	6	75	12
2000	662	522	79	15	2	96	15
2001	781	588	75	5	1	84	11
2002	891	713	80	6	1	130	15
2003	1237	1040	84	10	1	238	19
2004	1341	1125	84	18	1	304	23
2005	1403	1185	84	13	1	314	22

9.2: SERUM CALCIUM AND PHOSPHATE CONTROL

The median corrected serum calcium level remained at 2.3 mmol/L in HD patients (table 9.2.1 & fig 9.2.1) and 2.4 mmol/L amongst CAPD patients (table 9.2.2 & fig 9.2.2). In 2005, 59% of patients in HD and 68% of CAPD patients have achieved the target serum calcium of 2.2 to 2.6 mmol/L as required in the MOH renal replacement therapy guidelines. The percentage of patients achieving this range increased in the CAPD population but dropped slightly in the HD patients.

Table 9.2.1: Distribution of corrected Serum Calcium, HD patients 1997-2005

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	% patients ≥2.2 & ≤2.6 mmol/L
1997	1633	2.3	.3	2.3	2.2	2.5	57
1998	2060	2.3	.3	2.3	2.2	2.5	60
1999	2732	2.3	.3	2.3	2.2	2.5	59
2000	3703	2.4	.3	2.3	2.2	2.5	61
2001	4618	2.4	.2	2.4	2.2	2.5	64
2002	5485	2.3	.3	2.3	2.2	2.5	60
2003	6471	2.3	.2	2.3	2.2	2.4	62
2004	7536	2.3	.2	2.3	2.2	2.4	62
2005	8468	2.3	.2	2.3	2.1	2.4	59

Figure 9.2.1: Cumulative distribution of corrected Serum Calcium, HD patients 1997-2005

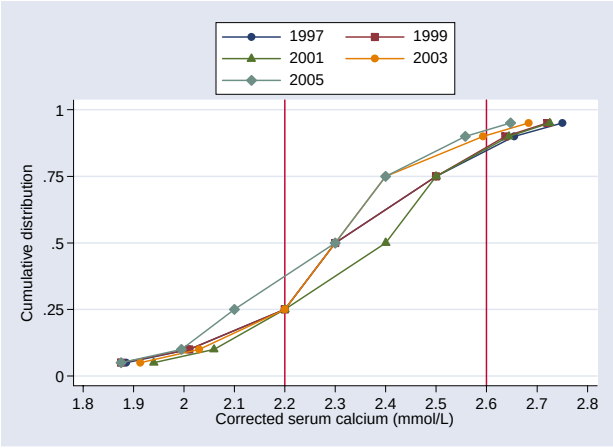


Figure 9.2.2: Cumulative distribution of corrected Serum Calcium, CAPD patients 1997-2005

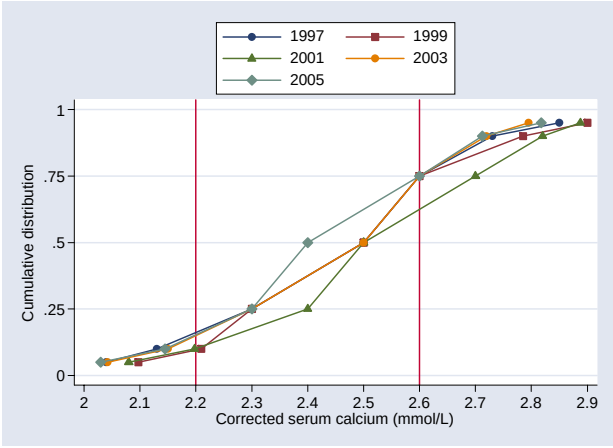


Table 9.2.2: Distribution of corrected Serum Calcium, CAPD patients 1997-2005

Year	No. of Subjects	Mean	SD	Median	LQ	UQ	% patients ≥2.2 & ≤2.6 mmol/L
1997	469	2.5	.3	2.5	2.3	2.6	57
1998	535	2.4	.3	2.4	2.3	2.6	59
1999	593	2.5	.2	2.5	2.3	2.6	63
2000	635	2.5	.2	2.5	2.3	2.6	60
2001	744	2.5	.3	2.5	2.4	2.7	56
2002	859	2.5	.2	2.5	2.3	2.6	63
2003	1169	2.4	.2	2.5	2.3	2.6	62
2004	1277	2.5	.2	2.5	2.3	2.6	66
2005	1337	2.4	.2	2.4	2.3	2.6	68

The median serum phosphate levels were higher among patients on HD (1.8mmol/L) compared to CAPD patients (1.5 mmol/L) (tables and figs 9.2.3 & 9.2.4).

Table 9.2.3: Distribution of Serum Phosphate, HD patients 1997-2005

Year	No of Subjects	Mean	SD	Median	LQ	UQ	% patients ≥1.6 & <1.8 mmol/L	% patients ≥1.8 & <2.2 mmol/L	% patients ≥2.2 & ≤2.6 mmol/L
1997	1649	1.9	.5	1.9	1.6	2.3	16	27	19
1998	2051	1.9	.5	1.9	1.6	2.2	16	33	17
1999	2861	1.9	.5	1.9	1.5	2.2	15	28	18
2000	4080	1.9	.6	1.8	1.5	2.2	16	29	15
2001	4765	1.9	.5	1.8	1.5	2.2	17	27	16
2002	5679	1.9	.5	1.8	1.5	2.2	17	27	17
2003	6593	1.8	.5	1.8	1.5	2.2	17	26	15
2004	7620	1.8	.5	1.8	1.5	2.2	17	25	15
2005	8657	1.8	.5	1.7	1.4	2.1	17	25	13

Figure 9.2.3: Cumulative distribution of Serum Phosphate, HD patients 1997-2005

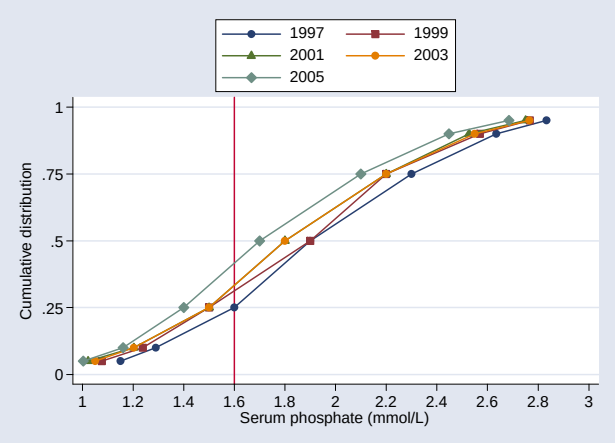


Figure 9.2.4: Cumulative distribution of Serum Phosphate, CAPD patients 1997-2005

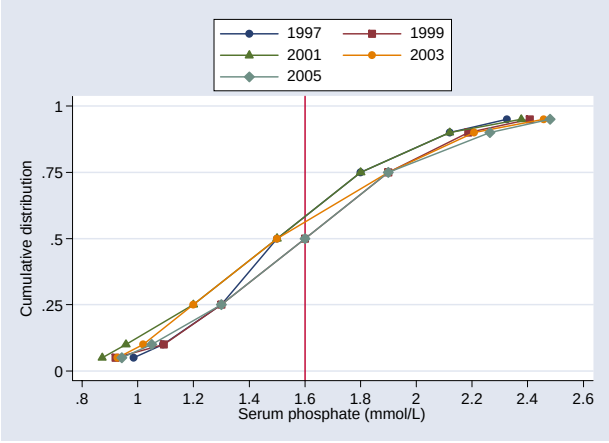


Table 9.2.4: Distribution of Serum Phosphate, CAPD patients 1997-2005

Year	No of Subjects	Mean	SD	Median	LQ	UQ	% patients ≥1.6 & <1.8 mmol/L	% patients ≥1.8 & <2.2 mmol/L	% patients ≥2.2 & ≥2.6 mmol/L
1997	470	1.6	.4	1.5	1.3	1.8	17	20	6
1998	537	1.6	.5	1.6	1.3	1.9	17	20	8
1999	583	1.6	.5	1.6	1.3	1.9	16	22	7
2000	633	1.5	.5	1.5	1.3	1.8	14	19	6
2001	732	1.5	.5	1.5	1.2	1.8	14	17	5
2002	862	1.5	.5	1.5	1.2	1.8	15	16	7
2003	1175	1.6	.5	1.5	1.2	1.9	14	19	8
2004	1279	1.6	.5	1.6	1.3	1.9	16	20	8
2005	1342	1.6	.5	1.6	1.3	1.9	16	20	9

The median corrected calcium phosphate product has declined from 4.1 $mmol^2/L^2$ in 2004 to 3.9 in 2005 in HD but remained stable at 3.7 $mmol^2/L^2$ in the CAPD patients (tables and figs 9.2.5 & 9.2.6). The percentage of patients within the 4 to 4.5 $mmol^2/L^2$ range has remained unchanged in both groups.

Table 9.2.5: Distribution of corrected calcium x phosphate product, HD patients 1997-2005

Year	No of Subjects	Mean	SD	Median	LQ	UQ	% patients <3.5 $mmol^2/L^2$	% patients >3.5 & <4 $mmol^2/L^2$	% patients ≥4 & <4.5 $mmol^2/L^2$	% patients ≥4.5 & <5 $mmol^2/L^2$	% patients ≥5 & <5.5 $mmol^2/L^2$	% patients ≥5.5 $mmol^2/L^2$
1997	1615	4.5	1.3	4.5	3.6	5.3	23	14	15	17	12	20
1998	2020	4.5	1.2	4.4	3.7	5.2	21	15	18	15	13	19
1999	2698	4.4	1.3	4.3	3.4	5.2	27	14	15	14	11	18
2000	3650	4.4	1.3	4.3	3.5	5.2	25	15	16	15	10	19
2001	4555	4.3	1.3	4.2	3.4	5.2	27	16	16	13	11	18
2002	5403	4.4	1.3	4.3	3.4	5.2	27	16	15	13	10	19
2003	6388	4.2	1.3	4.1	3.3	5.1	30	16	15	13	10	16
2004	7414	4.2	1.3	4.1	3.3	5	32	16	15	12	10	15
2005	8350	4	1.3	3.9	3.2	4.8	36	17	15	11	9	12

Figure 9.2.5: Cumulative distribution of corrected Calcium x Phosphate product, HD patients 1997-2005

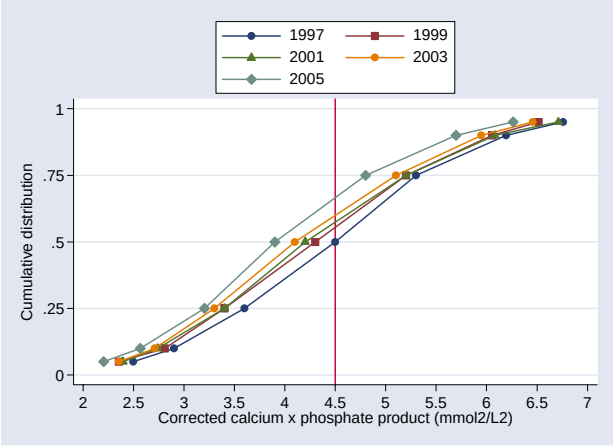


Figure 9.2.6: Cumulative distribution of corrected Calcium x Phosphate product, CAPD patients 1997-2005

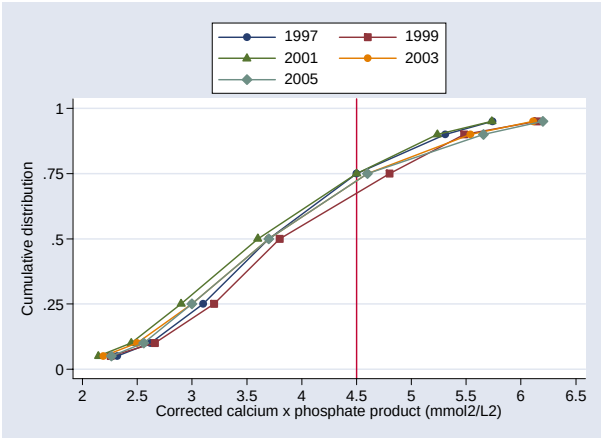


Table 9.2.6: Distribution of corrected calcium x phosphate product, CAPD patients 1997-2005

Year	No of Subjects	Mean	SD	Median	LQ	UQ	% patients <3.5 $mmol^2/L^2$	% patients ≥3.5 & <4 $mmol^2/L^2$	% patients ≥4 & <4.5 $mmol^2/L^2$	% patients ≥4.5 & <5 $mmol^2/L^2$	% patients ≥5 & <5.5 $mmol^2/L^2$	% patients ≥5.5 $mmol^2/L^2$
1997	468	3.9	1.1	3.7	3.1	4.5	40	20	15	10	6	7
1998	533	4	1.1	3.8	3.2	4.6	38	18	16	10	6	11
1999	580	4	1.2	3.8	3.2	4.8	36	20	13	12	9	10
2000	621	3.8	1.1	3.7	3.1	4.5	44	19	12	10	7	8
2001	723	3.8	1.1	3.6	2.9	4.5	46	18	12	10	8	7
2002	856	3.8	1.2	3.6	2.9	4.5	45	17	12	11	7	8
2003	1164	3.9	1.2	3.7	3	4.6	43	17	13	10	8	10
2004	1275	4	1.2	3.8	3	4.7	41	15	14	10	8	12
2005	1332	3.9	1.3	3.7	3	4.6	43	15	14	11	6	11

In 2005 the median corrected serum calcium level among HD patients from 212 centres ranged widely from as low as 1.8 to as high as 2.6 mmol/L in some centres. For CAPD patients all 18 centres had a median within the 2.2 to 2.6 mmol/L range (tables 9.2.7a and 9.2.8a).

Table 9.2.7: Variation in corrected serum calcium levels among HD centres, 2005
(a) Median serum calcium level among HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	2.1	2.2	2.3	2.3	2.4	2.5	2.5
1998	50	2	2.1	2.3	2.3	2.4	2.5	2.5
1999	69	1.5	2	2.3	2.3	2.4	2.5	2.6
2000	93	2	2.1	2.3	2.3	2.4	2.6	3.2
2001	116	2	2.1	2.3	2.4	2.4	2.5	2.6
2002	138	1.9	2.1	2.2	2.3	2.4	2.5	2.6
2003	164	2	2.1	2.2	2.3	2.4	2.5	2.5
2004	190	1.9	2.1	2.2	2.3	2.3	2.4	2.5
2005	212	1.8	2	2.2	2.3	2.4	2.4	2.6

Figure 9.2.7(a): Variation in median serum calcium level among HD patients, HD centres 2005

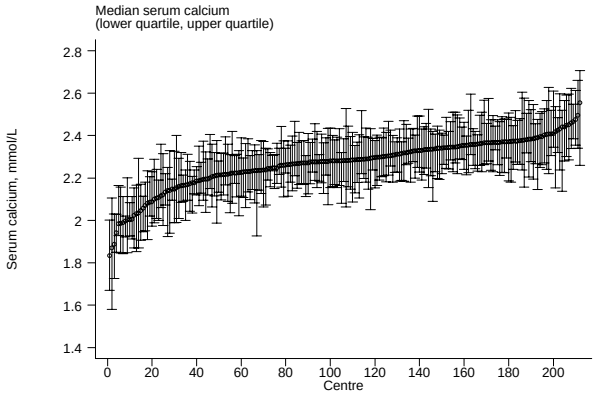
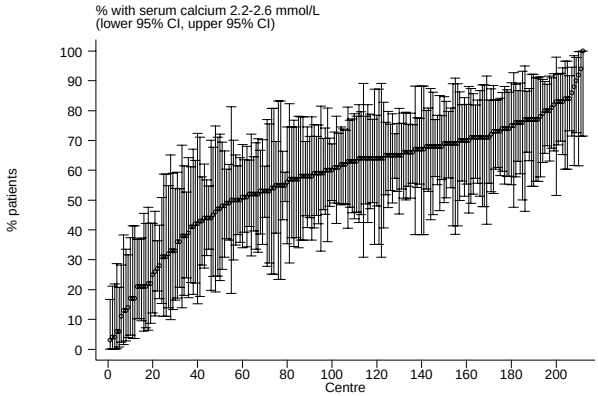


Figure 9.2.7(b): Variation in proportion of patients with serum calcium 2.2 to 2.6 mmol/L, HD centres 2005



We reviewed the proportion of patients with serum calcium range between 2.2 to 2.6 mmol/L from 1997 to 2005. The median was lower for HD centres (62.5%) (table 9.2.7b) compared to CAPD centres (64.5%) (table 9.2.8b) for the year 2005. In some HD centres less than 5% of their patients achieved a serum calcium of 2.2 to 2.6 mmol/L. The percentage of CAPD patients within a centre with serum calcium 2.2 to 2.6 mmol/L ranged from 38% to 75%.

(b) Proportion of patients with serum calcium 2.2 to 2.6 mmol/L

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	23	36	50	57.5	63	72	76
1998	50	22	30	51	63	71	82	94
1999	69	8	20	49	60	70	81	94
2000	93	0	25	52	62	69	79	100
2001	116	16	28	57	64	71	85	98
2002	138	0	25	49	62	70	81	92
2003	164	9	30	53.5	63	70.5	81	91
2004	190	5	25	50	63	73	83	91
2005	212	3	17	49	62.5	70	83	100

Table 9.2.8: Variation in corrected serum calcium levels among CAPD centres, 2005
(a) Median serum calcium level among CAPD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	2.1	2.1	2.4	2.4	2.5	2.6	2.6
1998	9	2.2	2.2	2.3	2.4	2.4	2.6	2.6
1999	10	2.4	2.4	2.4	2.5	2.6	2.6	2.6
2000	11	2.4	2.4	2.4	2.5	2.5	2.6	2.6
2001	12	2.3	2.3	2.4	2.5	2.5	2.6	2.6
2002	14	2.4	2.4	2.4	2.5	2.5	2.6	2.6
2003	18	2.3	2.3	2.4	2.4	2.5	2.6	2.6
2004	18	2.3	2.3	2.4	2.4	2.5	2.5	2.5
2005	18	2.2	2.2	2.3	2.4	2.5	2.6	2.6

Figure 9.2.8(a): Variation in median serum calcium level among CAPD patients, CAPD centres 2005

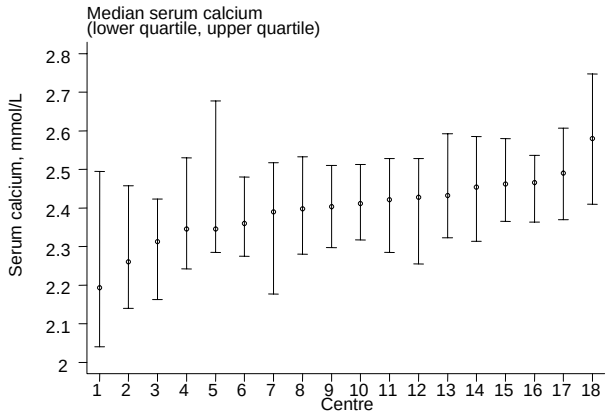
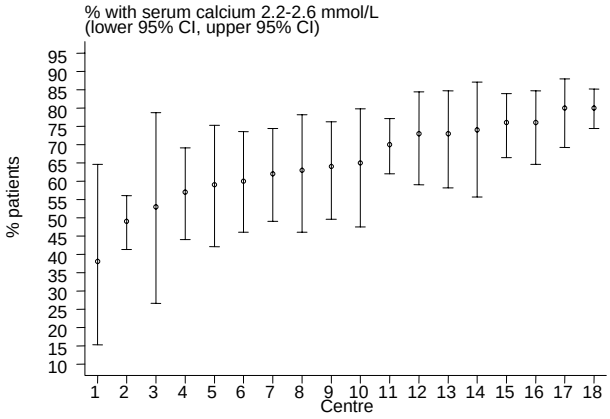


Figure 9.2.8(b): Variation in proportion of patients with serum calcium 2.2 to 2.6 mmol/L, CAPD centres 2005



(b) Proportion of patients with serum calcium 2.2 to 2.6 mmol/L

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	34	34	35	59	67	71	71
1998	9	43	43	47	55	60	78	78
1999	10	36	36	53	58	62	82	82
2000	11	45	45	48	57	70	83	83
2001	12	45	45	54	57.5	60.5	69	69
2002	14	50	50	56	68.5	71	73	73
2003	18	41	41	57	64	69	76	76
2004	18	45	45	61	68	75	80	80
2005	18	38	38	59	64.5	74	80	80

In reviewing the proportion of patients with a serum phosphate level below 1.6 mmol/L the CAPD centres have a higher median proportion of patients with serum phosphate level below 1.6 mmol/L (52.5%) compared to HD centres (37%) (tables 9.2.9a & 9.2.9b). However since 2002 the trend shows an increasing proportion of HD patients is achieving a serum phosphate of <1.6 mmol/L.

Table 9.2.9: Variation in serum phosphate levels among HD centres, 2005
(a) Median serum phosphate level among HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	1.3	1.5	1.8	1.9	2.1	2.3	2.8
1998	50	1.5	1.5	1.8	1.9	2.1	2.2	2.6
1999	71	1.1	1.6	1.8	1.9	2	2.1	2.1
2000	100	1.4	1.6	1.7	1.9	1.9	2.2	3.8
2001	117	1.3	1.5	1.7	1.8	1.9	2.1	2.3
2002	145	1.3	1.5	1.8	1.9	2	2.2	2.4
2003	169	.9	1.5	1.7	1.8	1.9	2.2	2.4
2004	191	1.4	1.5	1.7	1.8	1.9	2.1	2.2
2005	218	.9	1.4	1.6	1.8	1.9	2.1	2.2

Figure 9.2.9(a): Variation in median serum phosphate level among HD patients, HD centres 2005

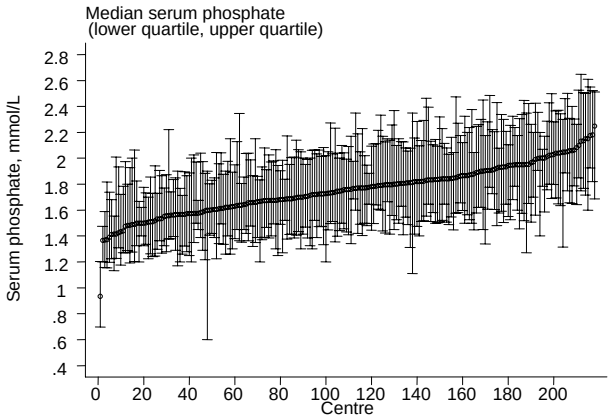
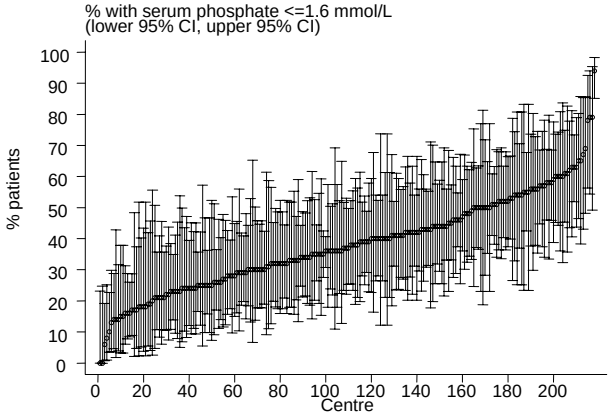


Figure 9.2.9(b): Variation in proportion of patients with



(b) Proportion of patients with serum phosphate ≤ 1.6 mmol/L

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	0	10	17	25.5	38	55	71
1998	50	0	7	17	22	30	54	59
1999	71	6	10	21	29	39	55	81
2000	100	0	13	21	31	38.5	50.5	66
2001	117	0	11	23	30	38	57	77
2002	145	0	8	21	28	36	58	76
2003	169	5	13	22	31	40	56	89
2004	191	0	11	23	33	44	60	95
2005	218	0	15	27	37	49	63	94

Table 9.2.10: Variation in serum phosphate levels among CAPD centres, 2005
(a) Median serum phosphate level among CAPD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	1.4	1.4	1.5	1.5	1.6	1.7	1.7
1998	9	1.4	1.4	1.5	1.6	1.6	1.8	1.8
1999	9	1.5	1.5	1.5	1.6	1.6	1.7	1.7
2000	11	1.3	1.3	1.4	1.5	1.6	1.8	1.8
2001	12	1.3	1.3	1.4	1.5	1.6	1.9	1.9
2002	14	1.4	1.4	1.4	1.5	1.6	2.1	2.1
2003	18	1.1	1.1	1.4	1.5	1.6	1.7	1.7
2004	18	1.4	1.4	1.4	1.5	1.6	1.8	1.8
2005	18	1.4	1.4	1.5	1.5	1.6	1.9	1.9

Figure 9.2.10(a): Variation in median serum phosphate level among CAPD patients, CAPD centres 2005

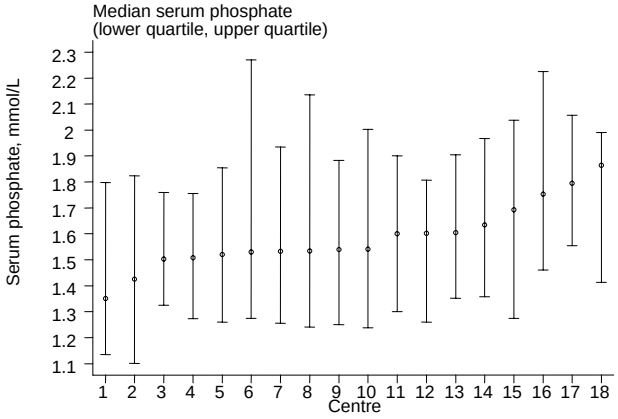
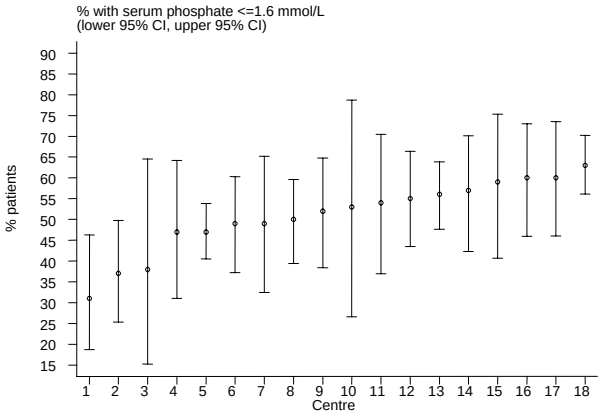


Figure 9.2.10(b): Variation in proportion of patients with serum phosphate ≤ 1.6 mmol/L, CAPD centres 2005



(b) Proportion of patients with serum phosphate ≤ 1.6 mmol/L

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	24	24	53	54	63	75	75
1998	9	37	37	49	53	54	67	67
1999	9	41	41	49	53	56	57	57
2000	11	29	29	48	54	66	73	73
2001	12	30	30	48	59	65	72	72
2002	14	36	36	51	55.5	61	72	72
2003	18	33	33	49	56.5	67	75	75
2004	18	34	34	44	55.5	61	76	76
2005	18	31	31	47	52.5	57	63	63

A higher number of CAPD centres have median calcium phosphate product less than 4.5 $mmol^2/L^2$ as compared to HD centres (73.5% versus 69%). In 2005 more than half of the CAPD patients in all the 18 CAPD centres were able to achieve a calcium phosphate product of <4.5 $mmol^2/L^2$. Nevertheless there is an increasing trend among HD centres achieving a corrected calcium phosphate product less than 4.5 $mmol^2/L^2$ (tables and figs 9.2.11 & 9.2.12). In some HD centres 90% of their patients achieved a calcium phosphate product of <4.5 $mmol^2/L^2$.

Table 9.2.11: Variation in corrected calcium x phosphate product among HD centres, 2005
(a) Median corrected calcium x phosphate product among HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	2.9	3.7	4.1	4.4	4.8	5.3	6.2
1998	50	3.2	3.3	4.1	4.5	4.7	5.3	5.3
1999	69	2.3	3.1	4	4.3	4.7	5.2	5.2
2000	91	3.1	3.7	4	4.3	4.6	5.2	6.2
2001	113	2.9	3.6	3.9	4.2	4.6	5	5.7
2002	138	2.9	3.5	3.9	4.3	4.6	5.2	6.2
2003	164	2.1	3.4	3.8	4.1	4.5	5	5.7
2004	189	2.9	3.3	3.8	4.1	4.3	5	5.5
2005	210	2.1	3.2	3.6	3.9	4.3	4.8	5.1

Figure 9.2.11(a): Variation in median corrected calcium x phosphate product among HD patients, HD centres

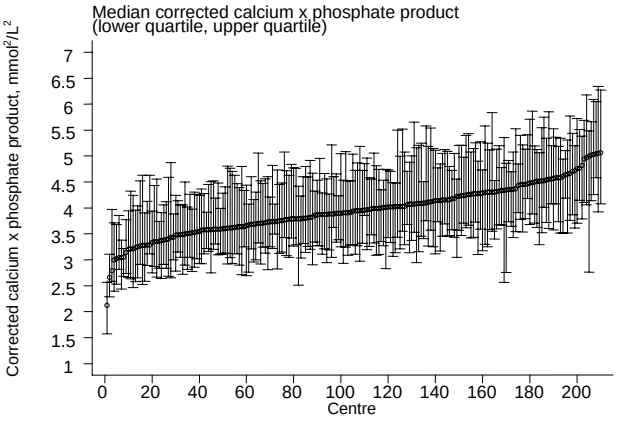
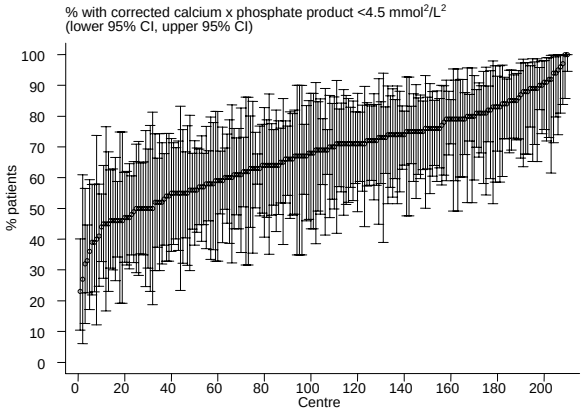


Figure 9.2.11(b): Variation in proportion of patients with corrected calcium x phosphate product < 4.5 $mmol^2/L^2$, HD centres 2005



(b) Proportion of patients with corrected calcium x phosphate product < 4.5 $mmol^2/L^2$

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	15	26	39	51.5	66	77	100
1998	50	20	27	40	52	64	83	91
1999	69	20	31	47	55	65	95	100
2000	91	12	33	48	58	67	80	88
2001	113	18	38	48	55	71	82	91
2002	138	14	31	48	57	69	88	100
2003	164	21	32	50	61.5	72.5	85	100
2004	189	21	36	54	64	74	89	100
2005	210	23	45	57	69	79	91	100

Table 9.2.12: Variation in corrected calcium x phosphate product among CAPD centres, 2005
(a) Median corrected calcium x phosphate product among CAPD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	3.5	3.5	3.6	3.7	3.8	3.9	3.9
1998	9	3.5	3.5	3.6	3.7	3.9	4	4
1999	9	3.6	3.6	3.7	3.9	4.1	4.2	4.2
2000	11	3.4	3.4	3.5	3.7	4	4.4	4.4
2001	12	3.1	3.1	3.4	3.7	4	4.3	4.3
2002	14	3.4	3.4	3.4	3.7	4	4.9	4.9
2003	18	2.7	2.7	3.4	3.6	3.9	4.1	4.1
2004	18	3.2	3.2	3.5	3.8	4	4.4	4.4
2005	18	3.3	3.3	3.5	3.7	3.9	4.2	4.2

Figure 9.2.12(a): Variation in median corrected calcium x phosphate product among CAPD patients, CAPD centres 2005

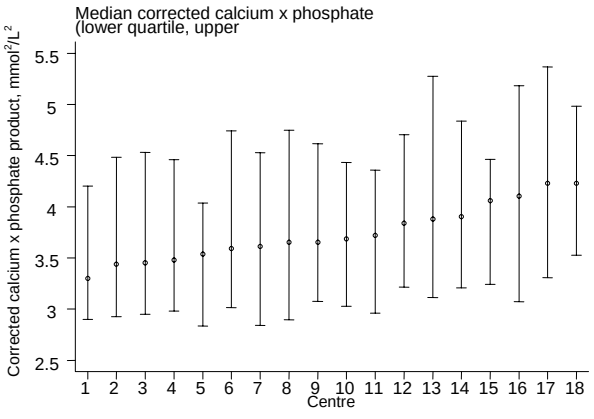
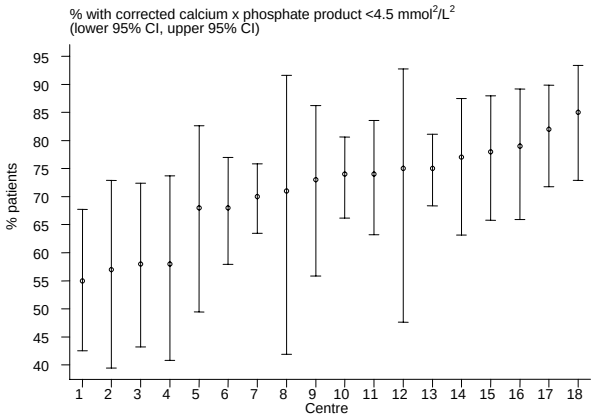


Figure 9.2.12(b): Variation in proportion of patients with corrected calcium x phosphate product < 4.5 mmol^2/L^2, CAPD centres 2005



(b) Proportion of patients with corrected calcium x phosphate product < 4.5 mmol^2/L^2

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	70	70	74	78	82	94	94
1998	9	66	66	71	73	79	91	91
1999	9	59	59	65	72	74	77	77
2000	11	59	59	70	73	81	85	85
2001	12	50	50	71.5	76	79	84	84
2002	14	43	43	65	74.5	82	88	88
2003	18	62	62	67	74	81	100	100
2004	18	56	56	66	72	78	91	91
2005	18	55	55	68	73.5	77	85	85

Conclusion

In 2005 calcium carbonate remains the major phosphate binder.in both HD and CAPD patients. Phosphate control continues to be better in the CAPD group. The target of calcium phosphate product of less than 4.5 $mmol^2/L^2$ is achieved more by CAPD patients than HD although there is an increasing trend among HD centres achieving a corrected calcium phosphate product less than 4.5 $mmol^2/L^2$. Continued differences in dialysis management have resulted in variation of outcome results in serum calcium, phosphate and calcium phosphate product.

The relationship of these factors to increased cardiovascular mortality in our patients has not been determined. It is hoped that in future reports this can be studied. It is also necessary to look at intact parathyroid hormone levels (iPTH) in the context of renal bone disease and cardiovascular disease. With the use of newer phosphate binders and vitamin D compounds in the coming years better control of bone disease is to be expected.

CHAPTER 10

HEPATITIS ON DIALYSIS

Teo Sue Mei
Claire Tan Hui Hong
Foo Sui Mei
Indralingam Vaithiligam

The prevalence of Hepatitis B infection has remained unchanged over the years, and was quite similar between HD and CAPD patients. Nosocomial transmission within the HD unit remained the main culprit for the much higher prevalence of HCV infection in HD as compared to CAPD patients. However with the effective and more stringent implementation of infection control measures, HCV prevalence showed a decreasing trend with a 9% decline in prevalence from 2001 onwards.

Table 10.1: Prevalence of positive HBsAg and positive Anti-HCV at annual survey, HD patients 1997-2005

Year	No. of subjects	Prevalence of HBsAg+ (%)	Prevalence of Anti-HCV+ (%)
1997	1694	6	23
1998	2139	6	22
1999	2991	6	23
2000	4386	6	25
2001	5187	6	23
2002	6106	5	20
2003	6999	5	19
2004	7618	5	17
2005	8757	4	14

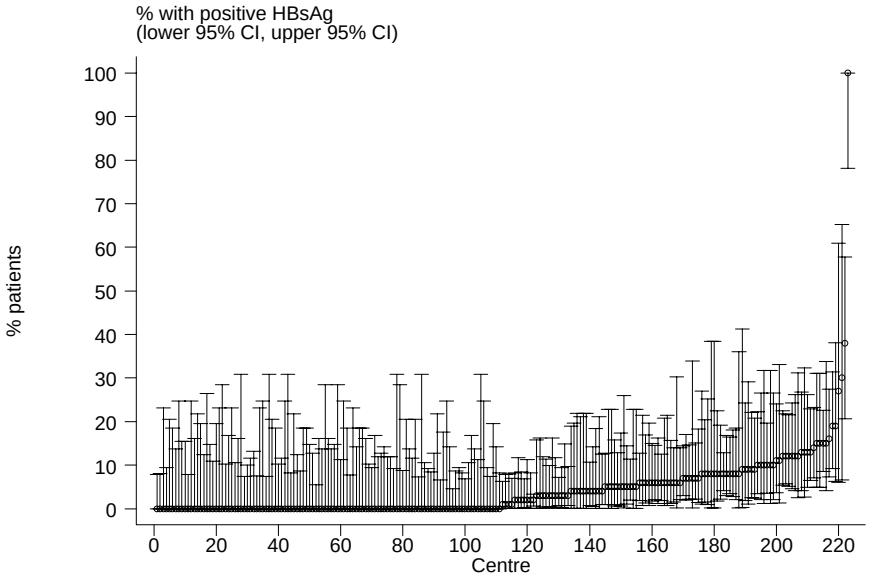
Table 10.2: Prevalence of positive HBsAg and positive Anti-HCV at annual survey, CAPD patients 1997-2005

Year	No. of subjects	Prevalence of HBsAg+ (%)	Prevalence of Anti-HCV+ (%)
1997	476	3	5
1998	541	3	6
1999	610	2	5
2000	662	2	5
2001	781	2	3
2002	891	3	4
2003	1229	3	4
2004	1201	4	5
2005	1317	4	5

Table 10.3: Variation in Proportion of patients with positive HBsAg at annual survey among HD centres, 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	0	0	1	5	9	17	19
1998	51	0	0	0	5	9	18	23
1999	76	0	0	0	4.5	9.5	19	30
2000	110	0	0	0	4	9	15	80
2001	125	0	0	0	5	9	14	90
2002	153	0	0	0	3	8	13	21
2003	173	0	0	0	3	7	15	64
2004	192	0	0	0	3	7	14	100
2005	223	0	0	0	1	6	14	100

Figure 10.3: Variation in Proportion of patients with positive HBsAg among HD centres, 2005



In general, the proportion of hepatitis B positive patients did not vary widely between centers. 111 centers (50%) had no hepatitis B positive patients (table and figure 10.3). This may be due to several reasons:

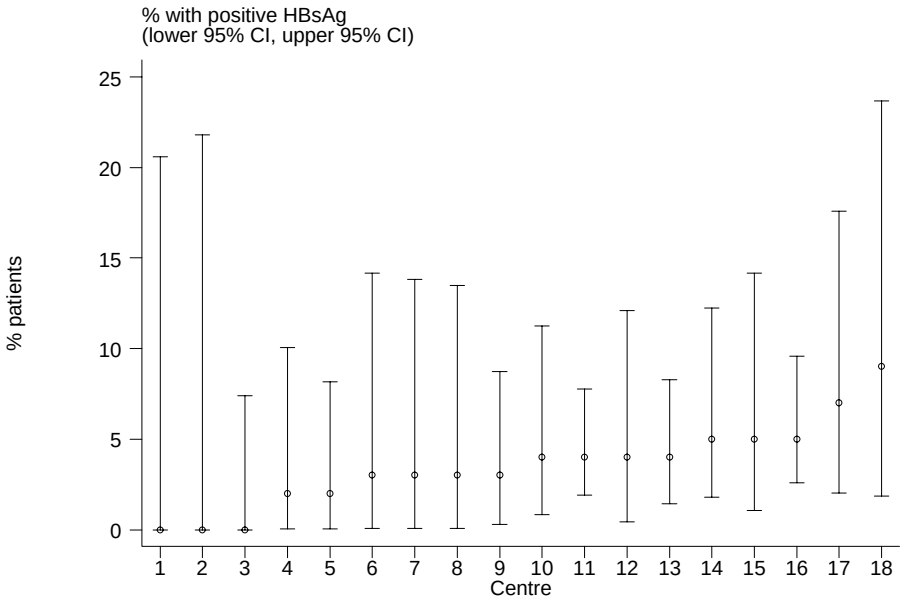
1. Some centers especially smaller ones practice the policy of not accepting Hepatitis B infected patients.
2. Early hepatitis B immunization in chronic kidney disease (CKD) patients resulted in lower rates of Hepatitis B infected patients starting dialysis.
3. Total segregation of Hepatitis B positive patients and routine vaccination of HD patients have further reduced the risk of acquiring the infection while on dialysis.

As the risk of cross infection is negligible in CAPD, the prevalence of Hepatitis B infection in CAPD patients was low with no significant variation among the various centres. (Table and figure 10.4)

Table 10.4: Variation in Proportion of patients with positive HBsAg at annual survey among CAPD centres, 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	0	0	0	2	3	8	8
1998	9	0	0	0	1	3	6	6
1999	10	0	0	0	2	2	4	4
2000	11	0	0	0	1	5	5	5
2001	12	0	0	0	2	3	9	9
2002	14	0	0	1	3	5	14	14
2003	18	0	0	2	3.5	6	8	8
2004	18	0	0	1	3	6	11	11
2005	18	0	0	2	3.5	5	9	9

Figure 10.4: Variation in Proportion of patients with positive HBsAg among CAPD centres, 2005

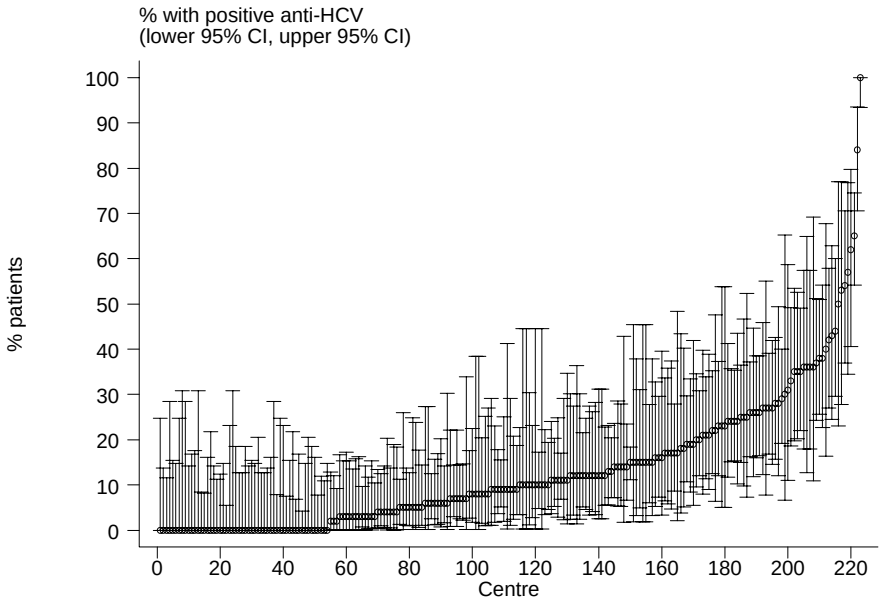


Between 1997 and 2005, the median proportion of HCV infected HD patients has decreased from 21% in 1997 to 9% in 2005. This was probably due to a greater awareness of the importance of stringent infection control measures to curb the nosocomial spread of HCV in the dialysis facility.

Table 10.5: Variation in Proportion of patients with positive anti-HCV at annual survey among HD centres, 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	46	0	0	13	21	29	56	64
1998	51	0	0	9	20	30	61	79
1999	76	0	0	6.5	18.5	30	58	81
2000	110	0	0	8	19	30	70	94
2001	125	0	0	7	18	30	64	92
2002	153	0	0	5	14	24	53	100
2003	173	0	0	5	13	24	49	98
2004	194	0	0	4	10.5	25	50	100
2005	223	0	0	2	9	19	40	100

Figure 10.5: Variation in Proportion of patients with positive anti-HCV among HD centres, 2005



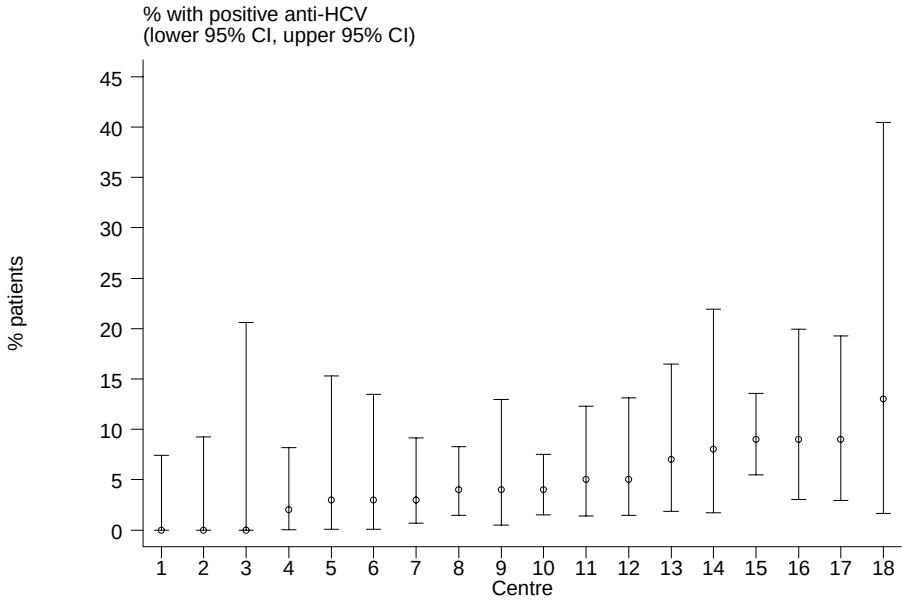
In 2005 the proportion of HCV infected patients varied widely between HD centers. Overall, centres with high HCV prevalence (>30%) were decreasing, with 24 centres (11%) in 2005 as compared to 28 centres (15%) in 2004. This may have contributed to a further 3% drop in the prevalence of Hepatitis C infection from 17% in 2004 to 14% in 2005.

Similar to Hepatitis B infection, the prevalence of HCV infection was low in CAPD patients and there was no great variation seen among centres**.**

Table 10.6: Variation in Proportion of patients with positive anti-HCV at annual survey among CAPD centres, 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	7	0	0	0	6	7	9	9
1998	9	0	0	3	3	8	11	11
1999	10	0	0	3	4	7	14	14
2000	11	0	0	0	3	8	10	10
2001	12	0	0	0	3	4	6	6
2002	14	0	0	2	3	7	11	11
2003	18	0	0	1	3	7	9	9
2004	18	0	0	0	4	7	10	10
2005	18	0	0	3	4	8	13	13

Figure 10.6: Variation in Proportion of patients with positive anti-HCV among CAPD centres, 2005



CHAPTER 11

HAEMODIALYSIS PRACTICES

Tan Chwee Choon
Shahnaz Shah Firdaus Khan

1.1: VASCULAR ACCESS AND ITS COMPLICATIONS

There was a progressive decline in the percentage of patients having native vascular access from 98% in 1997 to 92% in 2005. The ratio of brachiocephalic fistula (BCF) to arteriovenous fistula (AVF) has increased. In 2005, 25% of native vascular access was BCF. The proportion of patients with artificial graft remained at 2% while the use of permanent catheters has increased from 1% in 2004 to 2% in 2005. These developments may be due to the increased intake of diabetic and older patients. (Table 11.1.1)

Table 11.1.1: Vascular Access on Haemodialysis, 1997-2005

	1997		1998		1999		2000		2001	
Access types	No.	%	No.	%	No.	%	No.	%	No.	%
Wrist AVF	1427	85	1763	84	2406	81	3561	82	4049	79
BCF*	213	13	273	13	431	14	655	15	897	17
Venous graft	4	0	6	0	8	0	11	0	19	0
Artificial graft	13	1	20	1	34	1	31	1	64	1
Permanent CVC	4	0	8	0	17	1	19	0	25	0
Temporary CVC*	20	1	37	2	77	3	77	2	90	2
Temporary FVC*	0	0	0	0	0	0	0	0	0	0
TOTAL	1681	100	2107	100	2973	100	4354	100	5144	100

	2002		2003		2004		2005	
Access types	No.	%	No.	%	No.	%	No.	%
Wrist AVF	4680	78	5253	75	5891	73	6264	69
BCF*	1068	18	1360	19	1693	21	2119	23
Venous graft	14	0	23	0	41	1	27	0
Artificial graft	78	1	114	2	150	2	216	2
Permanent CVC	43	1	62	1	99	1	178	2
Temporary CVC*	138	2	180	3	233	3	263	3
Temporary FVC*	0	0	0	0	0	0	7	0
TOTAL	6021	100	6992	100	8107	100	9074	100

* BCF=Brachiocephalic fistula * FVC= Femoral venous catheter
* CVC= Central venous catheter

Table 11.1.2: Difficulties reported with Vascular Access, 1997-2005

Access difficulty	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
Difficulty with needle placement	55	47	82	4	133	5	146	4	217	5
Difficulty in obtaining desired blood flow rate	48	41	60	3	112	5	136	4	239	5
Other difficulties	12	10	30	2	55	2	32	1	39	1
No difficulties	1	1	1778	91	2155	88	3402	92	4276	90
TOTAL	116	100	1950	100	2455	100	3716	100	4771	100

Access difficulty	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
Difficulty with needle placement	215	4	217	3	255	3	318	4
Difficulty in obtaining desired blood flow rate	235	4	243	4	301	4	346	4
Other difficulties	57	1	60	1	67	1	59	1
No difficulties	5073	91	5975	92	6957	92	8146	92
TOTAL	5580	100	6495	100	7580	100	8869	100

Complication rates have remained similar despite an increase in intake of elderly and diabetic patients on dialysis in recent years. 12% had vascular access complications in 2005, of these 3% were due to thrombosis. (Table 11.1.3)

Table 11.1.3: Complications reported with Vascular Access, 1997-2005

Complication	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
Thrombosis	71	19	69	3	129	5	148	4	209	4
Bleed	23	6	37	2	23	1	30	1	62	1
Aneurysmal dilatation	121	33	134	6	159	6	208	5	212	4
Swollen limb	35	9	36	2	51	2	44	1	67	1
Access related infection, local/systemic	29	8	21	1	34	1	52	1	49	1
Distal limb ischaemia	4	1	12	1	9	0	26	1	22	0
Venous outflow obstruction	45	12	50	2	71	3	78	2	123	2
Carpal tunnel	23	6	19	1	35	1	42	1	41	1
Others	18	5	48	2	64	2	37	1	74	1
No complications	0	0	1636	79	2119	79	3237	83	4204	83
TOTAL	369	100	2062	100	2694	100	3902	100	5063	100

Complication	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
Thrombosis	202	3	220	3	284	4	284	3
Bleed	66	1	54	1	67	1	73	1
Aneurysmal dilatation	211	4	200	3	193	2	177	2
Swollen limb	56	1	55	1	77	1	82	1
Access related infection, local/systemic	52	1	43	1	70	1	63	1
Distal limb ischaemia	17	0	13	0	37	0	35	0
Venous outflow obstruction	101	2	119	2	151	2	166	2
Carpal tunnel	44	1	63	1	49	1	55	1
Others	118	2	118	2	133	2	108	1
No complications	4988	85	5967	87	6896	87	7917	88
TOTAL	5855	100	6852	100	7957	100	8960	100

11.2: HD PRESCRIPTION

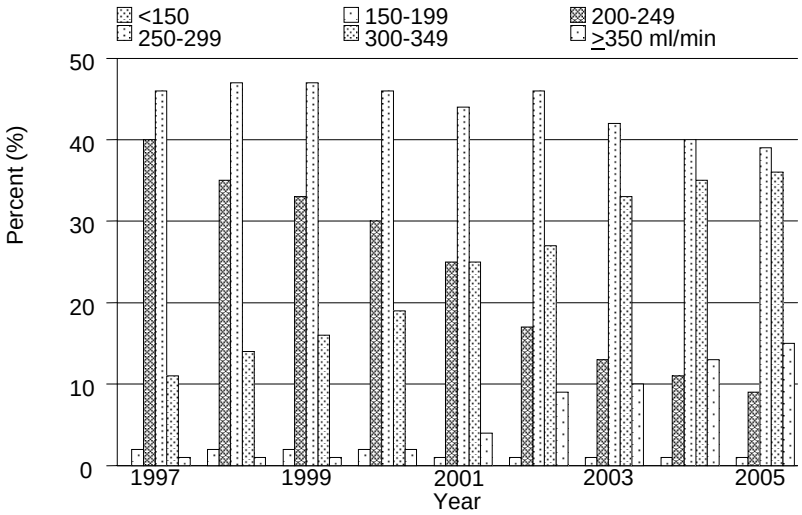
There was an increasing trend towards the use of higher blood flow rates from 1997 to 2005. The proportion of patients with blood flow of 300-349 ml/min had increased from 11% to 36% and those with blood flow ≥ 350 ml/min from 1% to 15%. In 2005, 51% had blood flow rates of ≥ 300 ml/min compared to only 12% in 1997. (Table 11.2.1 and Fig. 11.2.1)

Table 11.2.1: Blood Flow Rates in HD Units, 1997– 2005

Blood flow rates	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
<150 ml/min	2	0	4	0	6	0	9	0	7	0
150-199 ml/min	34	2	36	2	65	2	85	2	69	1
200-249 ml/min	649	40	735	35	962	33	1282	30	1233	25
250-299 ml/min	734	46	968	47	1367	47	1938	46	2229	44
300-349 ml/min	176	11	298	14	455	16	814	19	1276	25
>=350 ml/min	18	1	30	1	31	1	94	2	216	4
TOTAL	1613	100	2071	100	2886	100	4222	100	5030	100

Blood flow rates	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
<150 ml/min	9	0	4	0	11	0	7	0
150-199 ml/min	69	1	84	1	86	1	91	1
200-249 ml/min	973	17	882	13	879	11	761	9
250-299 ml/min	2692	46	2867	42	3112	40	3424	39
300-349 ml/min	1590	27	2242	33	2711	35	3186	36
>=350 ml/min	505	9	691	10	1020	13	1322	15
TOTAL	5838	100	6770	100	7819	100	8791	100

Figure 11.2.1: Blood Flow Rates in HD Units, 1997–2005



97% of patients were on 3 HD sessions per week. This has increased over the years from 92% in 2000 to 97% in 2005. Three percent were on 2 HD sessions per week. The small percentage of patients on 2 HD sessions per week is likely to be patients who are dialysing in private centres and who are unable to do 3 HD sessions per week because of financial or logistic reasons. (Table 11.2.2)

Table 11.2.2: Number of HD Sessions per week, 1997 – 2005

HD sessions per week	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
1	1	0	1	0	4	0	8	0	8	0
2	6	0	5	0	153	5	341	8	337	7
3	1664	99	2110	100	2811	95	3982	92	4761	92
4	9	1	2	0	3	0	10	0	50	1
TOTAL	1680	100	2118	100	2971	100	4341	100	5156	100

HD sessions per week	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
1	10	0	15	0	11	0	7	0
2	369	6	343	5	281	3	247	3
3	5603	93	6562	95	7709	96	8824	97
4	18	0	10	0	30	0	30	0
TOTAL	6000	100	6930	100	8031	100	9108	100

The majority of patients (98%) were on 4 hours HD session. Only a small percentage was more than 4 hours (1%) and ≤ 3 hours (1%). (Table 11.2.3)

Table 11.2.3: Duration of HD, 1997 – 2005

Duration of HD per session	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
≤3 hours	7	0	3	0	4	0	8	0	6	0
3.5 hours	3	0	18	1	9	0	12	0	33	1
4 hours	1594	95	1993	94	2735	92	4053	93	4956	96
4.5 hours	69	4	91	4	160	5	189	4	106	2
5 hours	8	0	8	0	61	2	77	2	59	1
≥5 hours	1	0	3	0	0	0	13	0	0	0
TOTAL	1682	100	2116	100	2969	100	4352	100	5160	100

Duration of HD per session	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
≤ 3 hours	19	0	20	0	87	1	98	1
3.5 hours	15	0	7	0	17	0	17	0
4 hours	5844	97	6757	98	7766	97	8899	98
4.5 hours	68	1	76	1	119	1	52	1
5 hours	48	1	66	1	47	1	40	0
≥5 hours	0	0	0	0	3	0	0	0
TOTAL	5994	100	6926	100	8039	100	9106	100

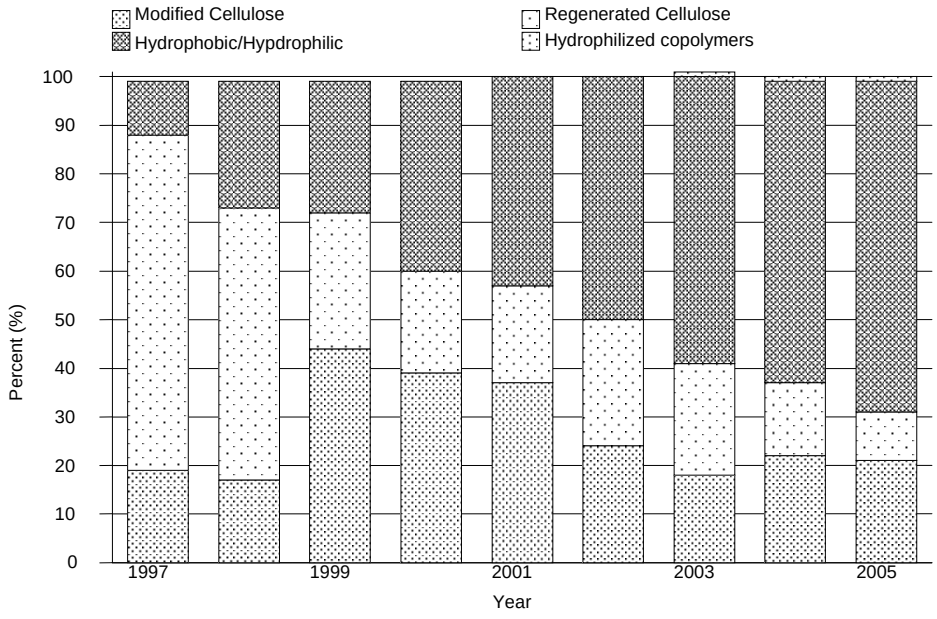
The use of synthetic membrane (hydrophobic/hydrophilic and hydrophilised copolymer) has increased from 11% in 1997 to 69% in 2005. Regenerated cellulose membrane usage has progressively declined from 67% in 1997 to 10% in 2005. The use of modified cellulose membrane remained at about 21%. (Table 11.2.4 and fig. 11.2.4)

Table 11.2.4: Dialyser membrane types in HD Units, 1997 – 2005

Dialyser membrane	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
Modified Cellulose	317	19	338	17	1216	44	1602	39	1666	37
Regenerated Cellulose	1136	69	1114	56	777	28	871	21	890	20
Hydrophobic/Hypdrophilic	184	11	524	26	754	27	1586	39	1944	43
Hydrophilized copolymers	1	0	2	0	1	0	0	0	0	0
TOTAL	1638	100	1978	100	2748	100	4059	100	4500	100

Dialyser membrane	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
Modified Cellulose	1376	24	1129	18	1719	22	1782	21
Regenerated Cellulose	1470	26	1480	23	1149	15	878	10
Hydrophobic/Hypdrophilic	2828	50	3758	59	4836	62	5802	68
Hydrophilized copolymers	1	0	35	1	74	1	110	1
TOTAL	5675	100	6402	100	7778	100	8572	100

Figure 11.2.4: Dialyser membrane types in HD Units, 1997 – 2005



Reuse of dialysers is a common practice in Malaysia whereby 96% reuse the dialyser. The frequency of reuse depends on the type of dialyser membrane. One of the common reuse frequencies is 6 times (11%) for modified cellulose and regenerated cellulose. The other common frequencies are 10, 12 and >13 times with 15%, 26% and 30% respectively for synthetic membrane. In 2005, 71% of patients reused their dialysers 10 times or more. Four percent of patients were on single use in 2005 and the trend has not changed in recent years. The latter are likely to be patients who have hepatitis B or C and whose centres do not reuse such dialysers. (Table 11.2.5)

Table 11.2.5: Dialyser Reuse Frequency in HD Units, 1997- 2005

Dialyser reuse frequency	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
1*	21	1	16	1	65	2	116	3	152	3
2	9	1	5	0	13	0	17	0	15	0
3	996	63	215	11	191	7	205	5	232	5
4	174	11	113	6	250	9	477	12	416	9
5	194	12	137	7	264	10	312	8	357	7
6	154	10	1072	55	1414	51	1730	43	1413	29
7	2	0	37	2	46	2	69	2	85	2
8	4	0	66	3	122	4	357	9	793	16
9	30	2	109	6	179	6	101	2	132	3
10	0	0	84	4	96	3	246	6	400	8
11	0	0	23	1	6	0	4	0	43	1
12	0	0	64	3	118	4	333	8	470	10
≥ 13	0	0	0	0	0	0	91	2	331	7
TOTAL	1584	100	1941	100	2764	100	4058	100	4839	100

Dialyser reuse frequency	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
1*	197	4	251	4	319	4	181	4
2	41	1	19	0	42	1	1	0
3	316	6	350	5	194	3	78	2
4	337	6	339	5	192	3	77	2
5	318	6	267	4	192	3	98	2
6	1216	22	916	14	806	11	543	11
7	124	2	71	1	89	1	44	1
8	866	16	852	13	809	11	396	8
9	59	1	87	1	50	1	45	1
10	538	10	880	14	1160	16	769	15
11	36	1	25	0	42	1	12	0
12	879	16	1512	24	1916	26	1330	26
≥ 13	644	12	820	13	1644	22	1533	30
TOTAL	5571	100	6389	100	7455	100	5107	100

1* is single use i.e. no reuse

99% of patients were on bicarbonate dialysate buffer in 2005 compared to 67% in 1997. In 2005 there were still 58 patients who were using acetate as a buffer. (Table 11.2.6)

Table 11.2.6: Dialysate Buffer used in HD Units, 1997 – 2005

Dialysate buffer	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
Acetate	551	33	627	30	552	19	393	9	240	5
Bicarbonate	1123	67	1492	70	2429	81	3969	91	4920	95
TOTAL	1674	100	2119	100	2981	100	4362	100	5160	100

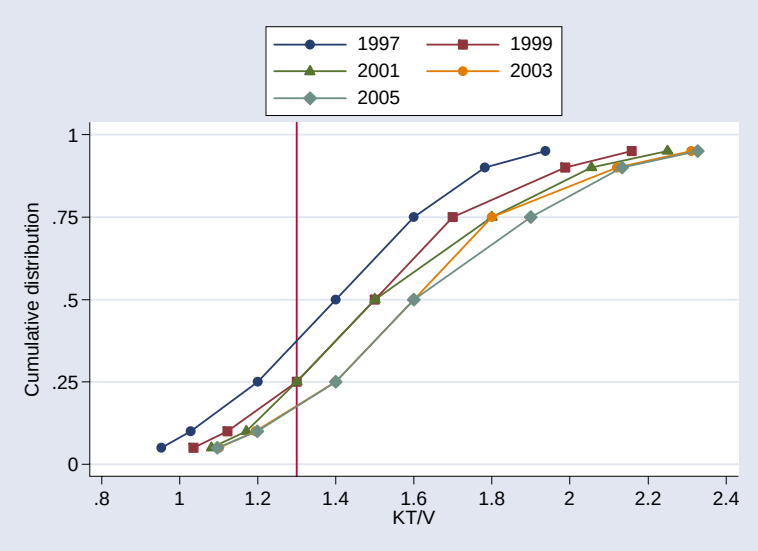
Dialysate buffer	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
Acetate	138	2	77	1	33	0	58	1
Bicarbonate	5880	98	6819	99	7957	100	9061	99
TOTAL	6018	100	6896	100	7990	100	9119	100

The median prescribed KT/V was 1.6. The percentage of patients with Kt/V $\geq$ 1.3 has increased from 60% in 1997 to 82% in 2005. Since 2002, the median KT/V and the percentage of patients with KT/V $\geq$ 1.3 has plateaued. (Table 11.2.7)

Table 11.2.7: Distribution of prescribed KT/V, HD patients 1997-2005

Year	No. of subjects	Mean	SD	Median	LQ	UQ	% patients $\geq$1.3
1997	1558	1.4	.3	1.4	1.2	1.6	60
1998	2022	1.5	.3	1.4	1.2	1.6	68
1999	2831	1.5	.3	1.5	1.3	1.7	73
2000	4087	1.6	.4	1.5	1.3	1.8	75
2001	4908	1.6	.4	1.5	1.3	1.8	78
2002	5496	1.6	.4	1.6	1.4	1.8	81
2003	6520	1.6	.4	1.6	1.4	1.8	82
2004	7453	1.6	.4	1.6	1.4	1.8	81
2005	8555	1.6	.4	1.6	1.4	1.9	82

Figure 11.2.7: Cumulative distribution of prescribed KT/V, HD patients 1997-2005



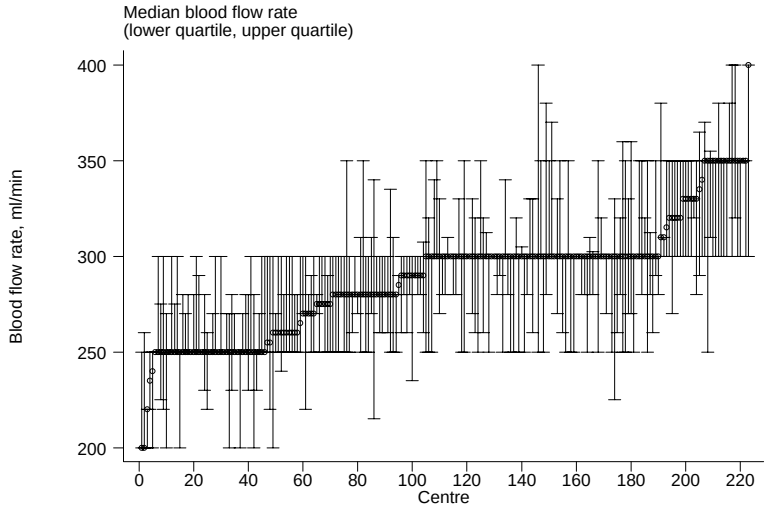
The median blood flow rates among centres had increased from 250ml/min in 1997 to 300mls/min in 2005. There is still a wide variation in practice among centers. The median blood flow rates among centres ranged from 200ml/min to 400ml/min. (Table 11.2.8 (a) and Fig. 11.2.8 (a))

Table 11.2.8: Variation in HD prescription among HD centres 2005

(a) Median blood flow rates in HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	45	200	200	220	250	250	280	300
1998	46	200	200	230	250	250	300	300
1999	67	200	200	230	250	250	300	300
2000	100	200	200	240	250	275	300	300
2001	116	200	220	250	252.5	300	300	350
2002	137	200	230	250	280	300	300	350
2003	155	200	240	250	280	300	325	350
2004	184	220	250	257.5	287.5	300	350	400
2005	223	200	250	260	300	300	350	400

Figure 11.2.8(a): Variation in median blood flow rates in HD patients among HD centres 2005



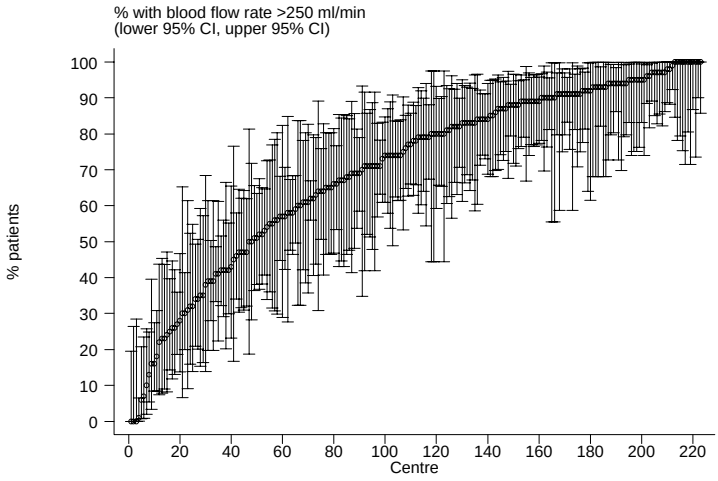
There is an increase in the proportion of patients with blood flow rates of > 250 ml/min. In 2005, 50% of centers had 78% of their patients with blood flow rate of >250mls/min. This represents a marked improvement when compared with 1997 when it was only13%. (Table 11.2.8 (b))

(b) Proportion of patients with blood flow rates > 250 ml/min

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	45	0	0	4	13	27	60	64
1998	46	0	2	9	20.5	38	79	100
1999	67	0	2	8	28	49	85	100
2000	100	0	0	10.5	31.5	59.5	85.5	91
2001	116	0	0	22.5	49.5	73.5	92	100
2002	137	0	2	36	61	82	95	100
2003	155	0	4	42	70	85	98	100
2004	184	0	17	50	73	86	96	100
2005	223	0	22	55	78	91	99	100

In 2005 as in 2004, there was still a wide variation in the proportion of patients with blood flow rates >250mils/ min among HD centres. This is clearly reflected in fig. 11.2.8 (b). Three centres had no patients with blood flow rate of > 250mls/min. A small number of centres reported 100% of their patients with blood flow rates of > 250 ml/min.

Figure 11.2.8(b): Variation in Proportion of patients with blood flow rates > 250 ml/min among HD centres 2005

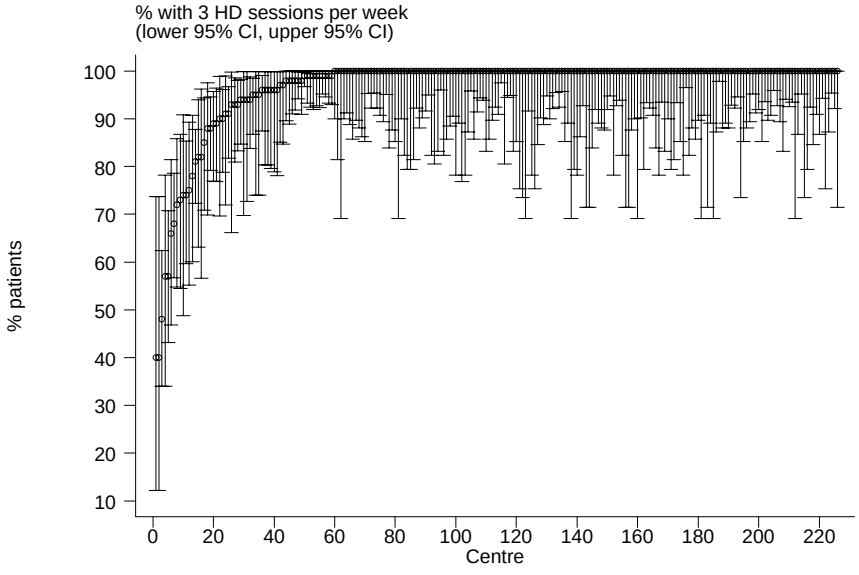


The majority of centres had 100% of their patients with 3 HD sessions per week. There were still a number of HD centres with a significant proportion of their patients with less than 3 HD sessions per week. In 2005, 3 HD centers had less than 50% of their patients with 3 HD sessions per week. (Table 11.2.8 (c) and figure 11.2.8 (c))

(c) Proportion of patients with 3 HD sessions per week

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	47	80	92	99	100	100	100	100
1998	46	80	98	100	100	100	100	100
1999	69	17	45	97	100	100	100	100
2000	100	25	44.5	90.5	100	100	100	100
2001	118	23	50	92	100	100	100	100
2002	137	28	48	94	99	100	100	100
2003	160	36	55	97	100	100	100	100
2004	188	37	70	98	100	100	100	100
2005	226	40	75	99	100	100	100	100

Figure 11.2.8(c): Variation in proportion of patients with 3 HD sessions per week among HD centres 2005



The median prescribed KT/V in HD patients was 1.6 in 2005. The minimum prescribed KT/V was 1.3 and the maximum prescribed KT/V was 2.0. The variation of prescribed KT/V among centres (fig. 11.2.8.d) was less marked than the variation in proportion of patients with blood flow rates of > 250 ml/ min (fig. 11.2.8 b.).

(d) Median prescribed KT/V in HD patients

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	44	1.2	1.2	1.3	1.4	1.4	1.5	1.8
1998	45	1.1	1.3	1.4	1.4	1.5	1.6	1.7
1999	67	1.2	1.3	1.4	1.5	1.6	1.7	1.8
2000	99	1.2	1.3	1.4	1.5	1.6	1.8	2.8
2001	114	1.2	1.3	1.5	1.5	1.7	1.8	1.9
2002	132	1.2	1.4	1.5	1.6	1.7	1.8	2.1
2003	150	1.2	1.4	1.5	1.6	1.7	1.9	2.1
2004	181	1.2	1.4	1.5	1.6	1.7	1.9	2.2
2005	219	1.3	1.4	1.5	1.6	1.7	1.9	2

Figure 11.2.8(d): Variation in median prescribed KT/ V in HD patients among HD centres 2005

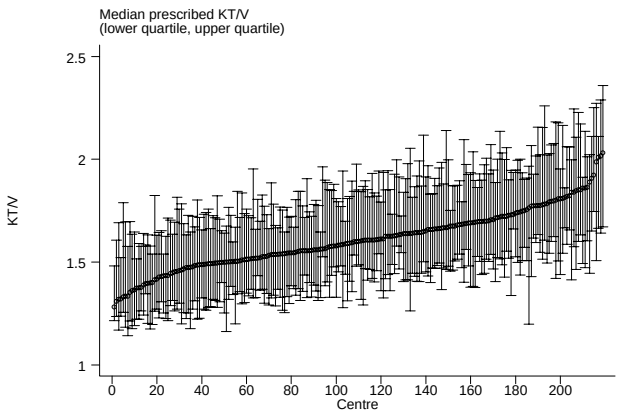
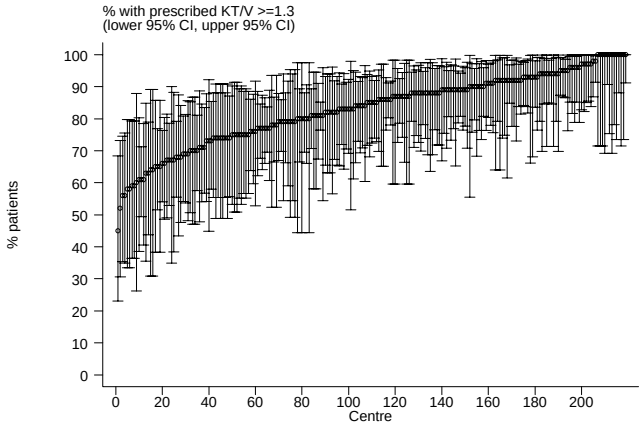


Figure 11.2.8(e): Variation in proportion of patients with prescribed KT/V ≥1.3 among HD centres 2005



In 2005, half the centres had 85% of their patients with a prescribed KT/V ≥ 1.3. This is an improvement compared to 1997 when half the centres had only 60% of their patients with KT/V of ≥ 1.3. However, there is still a wide variation in the proportion of patients with KT/V ≥1.3 among HD centres ranging from below 45% to 100 %.(table 11.2.8e, fig 11.2.8 e).

(e) Proportion of patients with prescribed KT/V ≥1.3

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
1997	44	32	44	51.5	60	70	90	100
1998	45	0	46	60	67	74	85	96
1999	67	36	50	67	74	83	94	100
2000	99	26	47	67	79	86	94	100
2001	114	42	50	71	81.5	88	96	100
2002	132	35	58	74.5	82	90	97	100
2003	150	30	57	77	83.5	91	96	100
2004	181	28	61	74	83	91	100	100
2005	219	45	61	75	85	92	100	100

11.3: TECHNIQUE SURVIVAL ON DIALYSIS

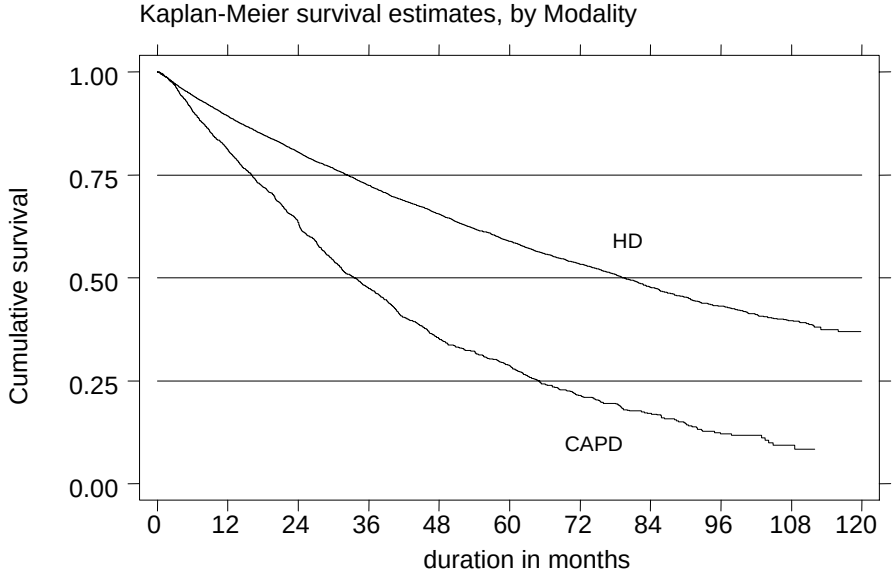
The unadjusted HD technique survival at 1 year, 5 years and 10 years was 89%, 59% and 37%. CAPD unadjusted technique survival was 81% at 1 year and 29% at 5 years. The CAPD technique survival was negligible at 10 years. (Table 11.3.1 and Fig. 11.3.1)

Table 11.3.1: Unadjusted technique survival by Dialysis modality, 1996-2005

Dialysis modality	CAPD			HD			All Dialysis		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	2374	90	1	15266	94	0	17640	94	0
12	1980	81	1	13066	89	0	15046	88	0
24	1300	63	1	9515	81	0	10813	78	0
36	769	47	1	6881	72	0	7650	69	0
48	439	35	1	4822	65	0	5261	61	0
60	267	29	1	3303	59	1	3569	55	0
72	147	21	1	2188	53	1	2335	49	1
84	89	17	1	1330	48	1	1417	43	1
96	39	12	1	716	43	1	754	39	1
108	13	9	1	278	40	1	290	35	1
120	-	-	-	17	37	1	17	33	1

* No. = Number at risk SE=standard error

Figure11.3.1: Unadjusted technique survival by Dialysis modality, 1996-2005



There was no apparent difference in the unadjusted HD technique survival by year of starting dialysis for the years 1996 to 2005. (Table 11.3.2 and fig 11.3.2)

Table 11.3.2: Unadjusted technique survival by year of entry, 1996-2005

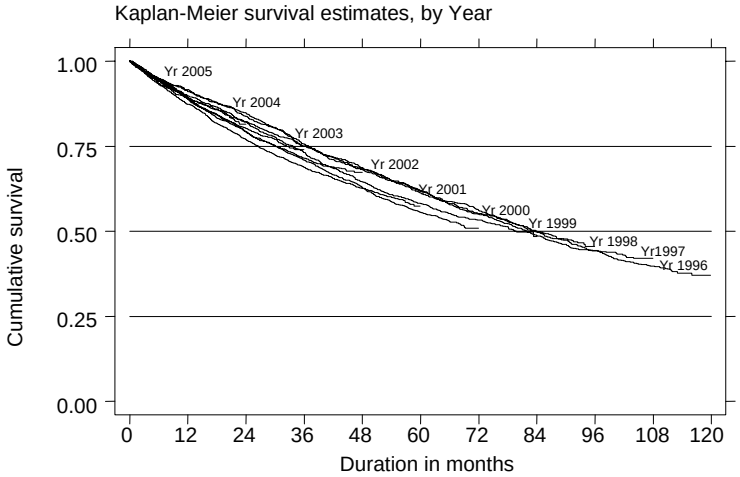
Year	1996			1997			1998			1999		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	735	94	1	946	94	1	1098	95	1	1320	95	1
12	692	91	1	892	89	1	1048	92	1	1238	90	1
24	630	85	1	811	82	1	940	84	1	1101	82	1
36	552	75	2	736	75	1	836	76	1	964	73	1
48	500	69	2	661	69	1	741	68	1	842	65	1
60	445	62	2	589	62	2	661	61	1	751	58	1
72	395	55	2	515	55	2	599	56	2	684	53	1
84	352	50	2	452	49	2	528	50	2	-	-	-
96	310	44	2	407	44	2	-	-	-	-	-	-
108	278	40	2	-	-	-	-	-	-	-	-	-
120	17	37	2	-	-	-	-	-	-	-	-	-

Year	2000			2001			2002			2003		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	1597	95	1	1757	93	1	1998	94	1	2131	94	0
12	1476	89	1	1610	87	1	1872	89	1	1975	89	1
24	1272	79	1	1396	77	1	1614	79	1	1750	80	1
36	1119	71	1	1228	69	1	1445	72	1	-	-	-
48	979	63	1	1104	63	1	-	-	-	-	-	-
60	859	56	1	-	-	-	-	-	-	-	-	-

Year	2004			2005		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE
6	2441	95	0	1250	94	1
12	2267	89	1	-	-	-

* No. = Number at risk SE=standard error

Figure 11.3.2: Unadjusted technique survival by year of entry, 1996-2005



As expected unadjusted HD technique survival showed better technique survival in the younger age groups than the older age groups. Ten year unadjusted HD technique survival in the age groups of 25-34, 35-44, 45-54, 55-64 and > 65 was 68%, 59%, 38%, 21% and 14% respectively. (Table 11.3.3 and fig 11.3.3)

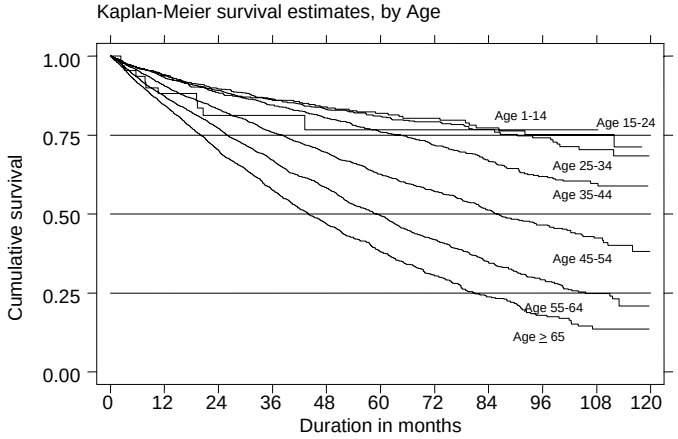
Table 11.3.3: Unadjusted technique survival by age, 1996-2005

Age group (years)	≤ 14			15-24			25-34			35-44		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	55	94	0	611	96	1	1307	96	1	2247	96	0
12	46	88	0	526	94	1	1145	94	1	1990	93	1
24	33	81	1	384	88	1	893	90	1	1574	89	1
36	25	81	1	302	87	1	712	86	1	1244	85	1
48	16	77	1	228	84	2	536	83	1	965	80	1
60	13	77	1	173	82	2	425	81	1	721	76	1
72	11	77	1	126	80	2	307	79	1	507	72	1
84	6	77	1	85	77	3	206	77	2	335	67	1
96	4	77	1	53	75	3	123	74	2	188	62	2
108	2	77	1	23	75	3	53	70	2	79	60	2
120	-	-	-	-	-	-	3	68	3	4	59	2

Age group (years)	45-54			55-64			≥ 65		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	3928	96	0	4181	93	0	2939	91	0
12	3369	91	0	3558	87	1	2436	84	1
24	2502	83	1	2548	77	1	1586	70	1
36	1846	76	1	1764	67	1	992	58	1
48	1310	69	1	1180	58	1	593	47	1
60	905	63	1	742	49	1	329	38	1
72	598	57	1	462	42	1	184	30	1
84	351	51	1	256	35	1	97	24	1
96	183	47	1	131	29	1	40	18	2
108	73	42	2	42	25	2	13	14	2
120	7	38	3	3	21	2	2	14	2

* No. = Number at risk SE=standard error

Figure 11.3.3: Unadjusted technique survival by age, 1996-2005

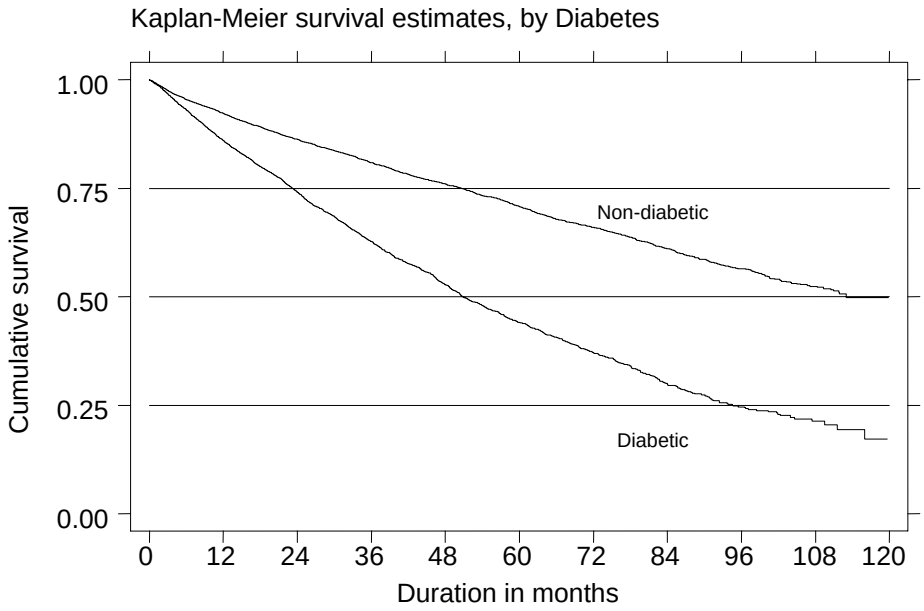


Unadjusted HD technique survival in the non diabetic patients at 1 year, 5 years and 10 years was 92%, 71% and 50% respectively. In contrast unadjusted HD technique survival in diabetic patients was worse at 86%, 44% and 17% respectively. More than 50% of diabetic patients have HD technique failure at 5 years. (Table 11.3.4 and fig 11.3.4)

Table 11.3.4: Unadjusted technique survival by Diabetes status, 1996-2005

Diabetes status	Non-Diabetic			Diabetic		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE
6	8076	95	0	7190	93	0
12	7077	92	0	5989	86	0
24	5488	86	0	4027	74	1
36	4255	81	0	2626	63	1
48	3192	76	1	1630	53	1
60	2321	71	1	983	44	1
72	1617	66	1	573	37	1
84	1027	61	1	304	30	1
96	595	56	1	122	25	1
108	243	52	1	36	21	1
120	14	50	1	4	17	3

Figure 11.3.4: Unadjusted technique survival by Diabetes status, 1996-2005



CHAPTER 12

CHRONIC PERITONEAL DIALYSIS PRACTICES

Sunita Bavanandan
Anita Bhajan Manocha

12.1: PERITONEAL DIALYSIS PRACTICES

12.1: Mode of Peritoneal Dialysis (Tables 12.1.1 to 12.1.4)

In 2005, CAPD remained the commonest mode of peritoneal dialysis (PD) (93%). However, there was increased utilization of automated peritoneal dialysis (APD) or continuous cycling peritoneal dialysis (CCPD) regimes from ≤1% in earlier years to 4% in 2005. This trend was likely related to an increased number of paediatric patients on APD with special reduction in cost of APD for children. Most patients (90%) were on the Baxter disconnect system. The majority of patients (94%) were on 4 exchanges per day but there is a trend for an increased percentage of patients on 3 exchanges a day from 1% to 2%. This may be a reflection of more aggressive management of advanced chronic kidney disease, with earlier initiation of dialysis allowing for the practice of incremental dialysis. Most patients (90%) use a fill volume of 2L.

Table 12.1.1: Chronic Peritoneal Dialysis Regimes, 1997-2005

PD regime	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
Standard CAPD	440	94	492	93	577	96	633	97	755	98
DAPD	26	6	32	6	16	3	16	2	17	2
Automated PD/ CCPD	4	1	6	1	6	1	5	1	2	0
TOTAL	470	100	530	100	599	100	654	100	774	100

PD regime	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
Standard CAPD	837	97	1155	97	1212	96	1271	93
DAPD	24	3	33	3	39	3	45	3
Automated PD/ CCPD	3	0	5	0	13	1	50	4
TOTAL	864	100	1193	100	1264	100	1366	100

Table 12.1.2: CAPD Connectology, 1997-2005

CAPD Connectology	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
UVXD	27	5	10	2	3	1	0	0	0	0
Baxter disconnect	461	93	511	95	347	58	235	39	436	57
B Braun disconnect	10	2	18	3	248	41	370	61	324	43
Fresenius disconnect	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0
TOTAL	498	100	539	100	598	100	605	100	760	100

CAPD Connectology	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
UVXD	0	0	0	0	0	0	0	0
Baxter disconnect	719	87	1040	87	1144	88	1252	90
B Braun disconnect	93	11	7	1	14	1	0	0
Fresenius disconnect	11	1	154	13	145	11	111	8
Others	0	0	1	0	0	0	28	2
TOTAL	823	100	1202	100	1303	100	1391	100

Table 12.1.3: CAPD Number of Exchanges per day, 1997-2005

No. of Exchanges/ day	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
2	0	0	2	0	0	0	2	0	1	0
3	3	1	4	1	4	1	1	0	5	1
4	454	97	508	96	579	97	624	96	735	95
5	12	3	16	3	13	2	23	4	31	4
TOTAL	469	100	530	100	596	100	650	100	772	100

No. of Exchanges/ day	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
2	0	0	4	0	6	0	3	0
3	11	1	14	1	12	1	25	2
4	834	96	1138	96	1225	95	1279	94
5	28	3	32	3	53	4	48	4
TOTAL	873	100	1188	100	1296	100	1355	100

Table 12.1.4: CAPD Volume per Exchange, 1997– 2005

Volume per Exchange (L)	1997		1998		1999		2000		2001	
	No.	%	No.	%	No.	%	No.	%	No.	%
1	24	5	25	5	19	3	25	4	32	4
2	444	95	496	95	557	96	595	95	711	95
3	0	0	0	0	2	0	7	1	9	1
TOTAL	468	100	521	100	578	100	627	100	752	100

Volume per Exchange (L)	2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%
1	37	4	40	3	42	3	52	4
2	793	94	1090	94	1154	92	1192	90
3	14	2	31	3	63	5	86	6
TOTAL	844	100	1161	100	1259	100	1330	100

12.2: ACHIEVEMENT OF SOLUTE CLEARANCE AND PERITONEAL TRANSPORT

The median delivered weekly Kt/V has remained unchanged at 2.1 since 2003, with 58% of patients achieving K/DOQI recommended Kt/V of more than or equal to 2.0. Compared to 2004 there has been a widening in the gap between the highest and lowest performing centers with more than 8-fold variation in terms of the percentage of patients in each center achieving a Kt/V of > 2.0 per week. Half of the centers were able to have up to 53.5% of their patients achieving the K/DOQI target although this percentage has been declining since 2003. This may reflect changes in practice due to results of the ADEMEX trial and indeed 75% of patients achieved the lower target proposed by ADEMEX which was 1.8 (Tables and figures 12.2.1 and 12.2.2)

Table 12.2.1: Distribution of delivered KT/V, CAPD patients 2003-2005

Year	No of Subjects	Mean	SD	Median	LQ	UQ	% patients ≥2.0 per week
2003	790	3.7	19.9	2.1	1.8	2.5	59
2004	1069	2.8	9.9	2.1	1.8	2.5	61
2005	1124	3.3	13.7	2.1	1.8	2.5	58

Figure 12.2.1: Cumulative distribution of delivered KT/V, CAPD patients 2003-2005

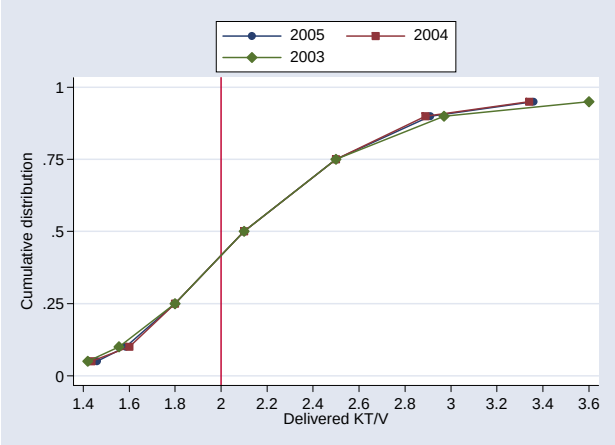


Figure 12.2.2: Variation in proportion of patients with KT/V ≥ 2.0 per week among CAPD centres 2005

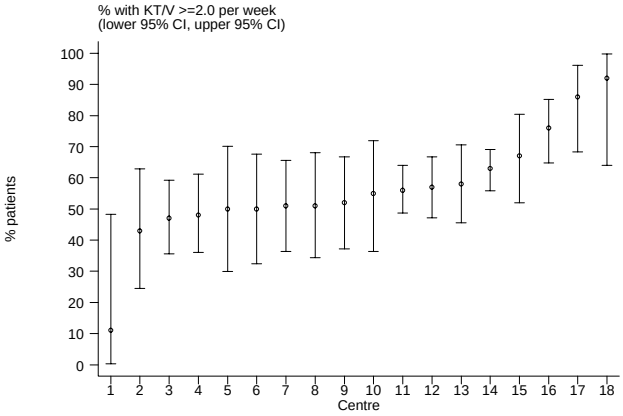


Table 12.2.2: Variation in proportion of patients with KT/V ≥2.0 per week among CAPD centres 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
2003	14	0	0	51	59	62	73	73
2004	17	43	43	53	56	67	85	85
2005	18	11	11	50	53.5	63	92	92

Low average transport status was commonest (41%) among incident PD patients followed by high average transport status (37%). This pattern of distribution of peritoneal transport status remains unchanged amongst the prevalent PD patients. However, high PET status becomes more common in prevalent compared to new PD patients (13% versus 10%).

Table 12.2.3: Peritoneal transport status by PET D/P creatinine at 4 hours, new PD patients 2003-2005

PET	2003		2004		2005	
	No.	%	No.	%	No.	%
Low	10	6	67	15	69	12
Low average	85	51	187	41	246	41
High average	62	37	176	38	223	37
High	11	7	29	6	62	10
TOTAL	168	100	459	100	600	100

* New PD patients=patients commencing dialysis since 2003

Table 12.2.4: Peritoneal transport status by PET D/P creatinine at 4 hours, prevalent PD patients 2003-2005

PET	2003		2004		2005	
	No.	%	No.	%	No.	%
Low	10	3	40	9	44	13
Low average	175	44	180	42	130	39
High average	172	43	168	39	118	35
High	39	10	41	10	42	13
TOTAL	396	100	429	100	334	100

*Prevalent PD patients=patients commencing dialysis before 2003

12.3: TECHNIQUE SURVIVAL ON PD

CAPD fared worse compared with haemodialysis in terms of technique survival with Kaplan-Meir cumulative survival curves diverging as early as 6 months. One- and two- year technique survival for CAPD was 81% and 63% respectively as compared to haemodialysis (89% and 81%). Median technique survival was less than 36 months. Overall these trends in technique survival remain unchanged by year of entry (Tables and figures 12.3.1 and 12.3.2).

The best technique survival rate is seen in the youngest age group between 1-14 years and the worst in the oldest age group aged >65years (Table and figure 12.3.3). Diabetics have a poorer technique survival than the non-diabetics (Table and figure 12.3.4). However, there is no gender difference (Table and figure 12.3.5).

Table 12.3.1: Unadjusted technique survival by Dialysis modality, 1996-2005

Dialysis modality	CAPD			HD			All Dialysis		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	2374	90	1	15266	94	0	17640	94	0
12	1980	81	1	13066	89	0	15046	88	0
24	1300	63	1	9515	81	0	10813	78	0
36	769	47	1	6881	72	0	7650	69	0
48	439	35	1	4822	65	0	5261	61	0
60	267	29	1	3303	59	1	3569	55	0
72	147	21	1	2188	53	1	2335	49	1
84	89	17	1	1330	48	1	1417	43	1
96	39	12	1	716	43	1	754	39	1
108	13	9	1	278	40	1	290	35	1
120	-	-	-	17	37	1	17	33	1

* No. = Number at risk SE=standard error

Figure 12.3.1: Unadjusted technique survival by Dialysis modality, 1996-2005

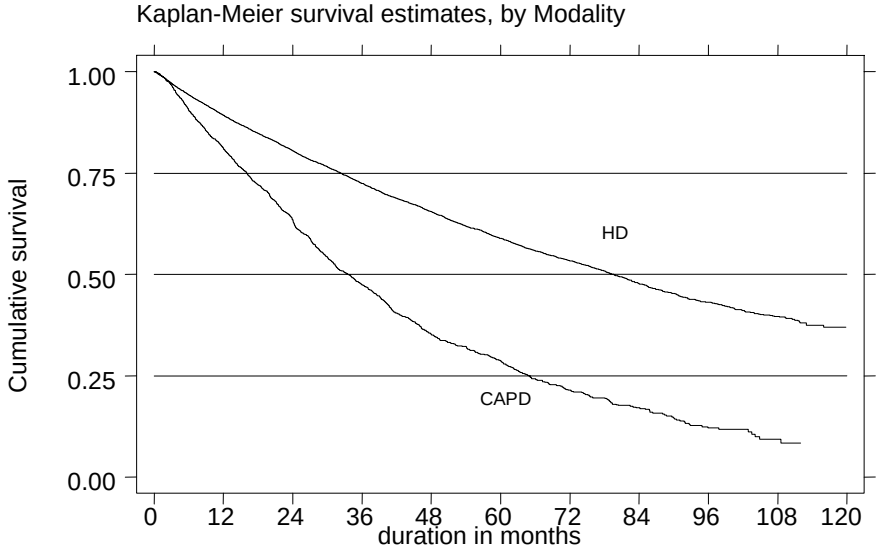


Table 12.3.2: Unadjusted technique survival by year of entry, 1996-2005

Year	1996			1997			1998			1999		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	200	91	2	187	94	2	144	92	2	188	89	2
12	178	81	3	170	88	2	127	83	3	174	84	3
24	139	67	3	141	74	3	96	65	4	116	57	3
36	105	51	3	101	55	4	75	51	4	77	38	3
48	68	35	3	76	42	4	59	41	4	56	28	3
60	53	28	3	57	32	3	45	32	4	49	25	3
72	35	18	3	44	25	3	35	25	4	36	18	3
84	27	15	3	32	18	3	31	25	4	-	-	-
96	16	9	2	24	14	3	-	-	-	-	-	-
108	13	7	2	-	-	-	-	-	-	-	-	-

Year	2000			2001			2002			2003		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	206	91	2	303	90	2	341	92	1	369	89	2
12	185	81	3	264	80	2	292	80	2	332	80	2
24	138	63	3	197	61	3	227	63	3	253	63	2
36	101	46	3	151	47	3	164	47	3	-	-	-
48	78	36	3	106	34	3	-	-	-	-	-	-
60	67	31	3	-	-	-	-	-	-	-	-	-

Year	2004			2005		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE
6	299	89	2	146	90	2
12	265	80	2	-	-	-

* No. = Number at risk SE=standard error

Figure 12.3.2: Unadjusted technique survival by year of entry, 1996-2005

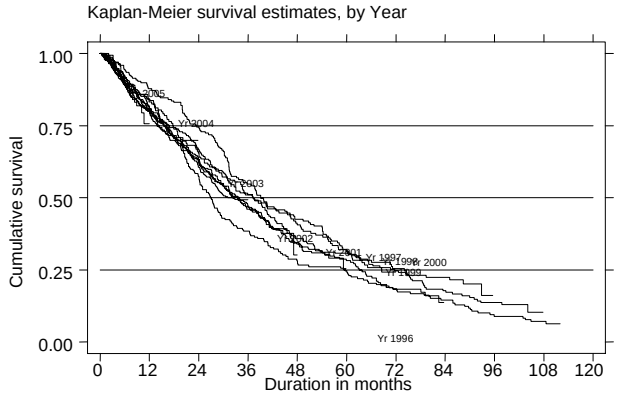


Figure 12.3.3: Unadjusted technique survival by age, 1996-2005

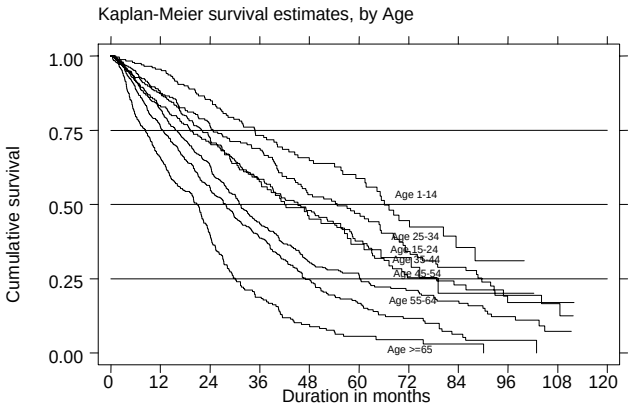


Table 12.3.3: Unadjusted technique survival by age, 1996-2005

Age group (years)	<=14			15-24			25-34			35-44		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	220	97	1	222	92	2	234	93	2	346	95	1
12	195	96	1	182	83	2	209	87	2	294	87	2
24	144	85	3	117	71	3	156	76	3	208	72	2
36	104	73	3	70	58	4	115	69	3	140	59	3
48	66	65	4	36	45	4	77	53	4	82	48	3
60	44	59	4	20	37	5	54	47	4	49	38	3
72	22	45	5	11	32	5	34	34	4	25	25	4
84	10	35	6	5	20	7	27	29	4	16	23	4
96	4	31	7	3	20	7	12	19	4	9	17	4
108	-	-	-	-	-	-	7	17	4	5	17	4
120	-	-	-	-	-	-	-	-	-	-	-	-

Age group (years)	45-54			55-64			>=65		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	573	92	1	503	89	1	282	80	2
12	481	82	2	403	76	2	221	66	3
24	315	63	2	259	56	2	108	40	3
36	169	44	2	139	39	2	40	19	2
48	98	31	2	68	25	2	16	10	2
60	66	26	2	32	17	2	8	6	2
72	38	21	2	18	12	2	5	5	2
84	25	17	2	8	6	2	3	3	2
96	13	12	2	3	4	2	-	-	-
108	3	7	3	-	-	-	-	-	-
120	-	-	-	-	-	-	-	-	-

* No. = Number at risk SE=standard error

Table 12.3.4: Unadjusted technique survival by Diabetes status, 1996-2005

Diabetes status	Non-Diabetic			Diabetic		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE
6	1443	93	1	933	86	1
12	1243	87	1	737	73	1
24	876	74	1	424	49	2
36	583	61	1	186	29	2
48	344	47	2	96	19	1
60	213	39	2	56	14	1
72	126	30	2	22	9	1
84	79	25	2	11	6	1
96	36	18	2	4	4	1
108	12	14	2	2	2	2
120	-	-	-	-	-	-

* No. = Number at risk SE=standard error

Figure 12.3.4: Unadjusted technique survival by Diabetes status, 1996-2005

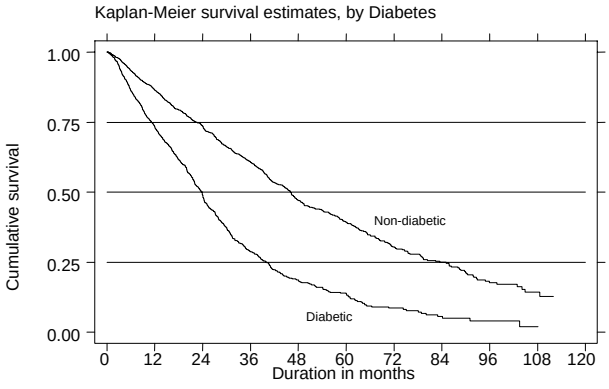


Figure 12.3.5: Unadjusted technique survival by Gender, 1996-2005

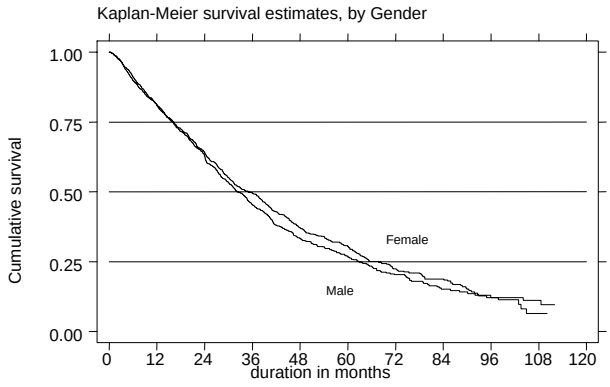


Table 12.3.5: Unadjusted technique survival by Gender, 1996-2005

Gender	Male			Female		
Interval (months)	No.	% Survival	SE	No.	% Survival	SE
6	1198	91	1	1179	90	1
12	987	81	1	994	81	1
24	650	63	1	653	64	1
36	364	45	2	407	49	2
48	199	33	2	240	37	2
60	122	27	2	146	31	2
72	67	20	2	81	22	2
84	36	15	2	54	19	2
96	17	12	2	23	12	2
108	3	7	2	11	11	2
120	-	-	-	-	-	-

* No. = Number at risk SE=standard error

12.4: PD PERITONITIS

The median peritonitis rate is 35 patient-months per episode which is in keeping with the continuing trend for improvement seen over the preceding years. There was however an almost 3-fold variation between centres with the highest and lowest peritonitis rates i.e. 23.3 vs 64.8 patient-months/episode. Gram-negative organisms accounted for 35% of peritonitis episodes while 32% were due to gram positive organisms. The culture–negative rate remained relatively unchanged at 30% (Table 12.4.2). There is a trend for increased peritonitis rates with increasing age and diabetic status but gender does not appear to have any influence.

Table 12.4.1: Variation in peritonitis rate (pt-month/epi) among CAPD centres 2005

Year	No. of centres	Min	5th Centile	LQ	Median	UQ	95th Centile	Max
2000	12	10.9	10.9	17.8	21.7	26.9	1019.7	1019.7
2001	11	13.4	13.4	19.3	23	30.9	53.1	53.1
2002	13	15.1	15.1	20.2	25.3	36.2	47.6	47.6
2003	13	12.5	12.5	22.8	30.1	40.3	253	253
2004	15	0	0	23.2	32	41.7	47.4	47.4
2005	15	23.3	23.3	26.8	35	46.6	64.8	64.8

* Criteria for combination of centres with less than 10 subjects not applied

Figure 12.4.1: Variation in peritonitis rate (pt-month/ epi) among CAPD centres 2005

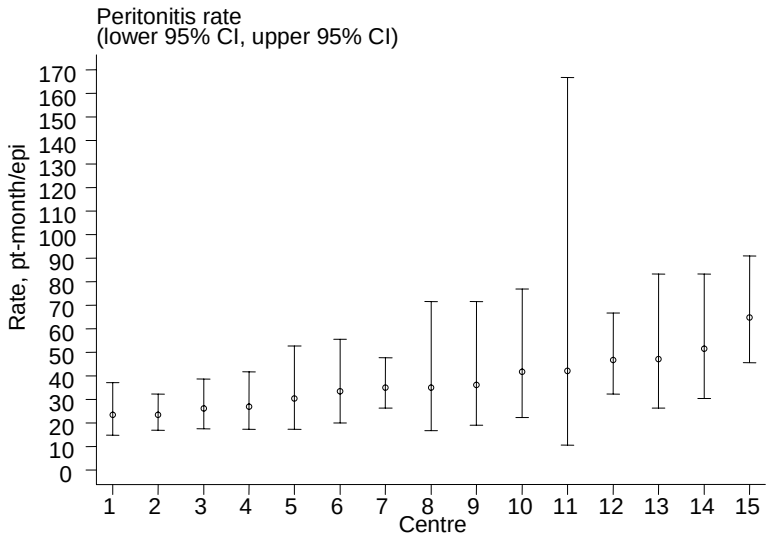


Table 12.4.2: Causative organism in PD peritonitis, 2000-2005

Microorganism	2000		2001		2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
(A) Gram Positives												
Staph. Aureus	35	11	41	13	62	17	45	12	51	14	42	13
Staph Coagulase Neg.	39	13	34	11	41	11	52	14	43	12	47	15
Strep	12	4	13	4	9	2	11	3	11	3	6	2
Others	4	1	6	2	7	2	15	4	4	1	8	2
(B) Gram Negatives												
Pseudomonas	19	6	14	4	22	6	20	5	28	8	27	8
Others	45	15	56	18	67	19	75	21	83	22	86	27
(C) Polymicrobial	9	3	10	3	8	2	3	1	2	1	0	0
(D) Others												
Fungal	19	6	21	7	12	3	12	3	15	4	7	2
Mycobacterium	6	2	4	1	1	0	3	1	4	1	2	1
Others	2	1	14	4	14	4	13	4	8	2	3	1
(E) No growth	119	39	99	32	118	33	115	32	123	33	96	30
TOTAL	309	100	312	100	361	100	364	100	372	100	324	100

Table 12.4.3: Factors influencing peritonitis rate, 2000-2005

Factors	N (No. at risk)	Annualised rate: Epi/ pt-year	(95% CI)	
Age (years):				
<=14	68	0.424	(0.343,	0.523)
15-24	38	0.451	(0.339,	0.6)
25-34	82	0.437	(0.368,	0.52)
35-44	94	0.467	(0.392,	0.555)
45-54	143	0.53	(0.46,	0.61)
55-64	120	0.577	(0.493,	0.675)
>=65	50	0.718	(0.562,	0.918)
Gender:				
Male	281	0.504	(0.455,	0.56)
Female	314	0.5	(0.456,	0.548)
Diabetes:				
No	412	0.471	(0.435,	0.511)
Yes	183	0.603	(0.529,	0.687)

CHAPTER 13

RENAL TRANSPLANTATION

Goh Bak Leong
Fan Kin Sing

13.1. STOCK AND FLOW

New renal transplant patients showed a modest increase from 151 transplants per year in 1996 to 185 per year in 2004. By 2005, the number of functioning renal transplants has increased to 1657 (Table 13.1.1).

Table 13.1.1: Stock and Flow of Renal Transplantation, 1996-2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New transplant patients	151	126	104	127	143	161	168	158	185	133
Died	31	29	23	25	27	35	31	36	37	37
Graft failure	28	38	48	36	32	40	38	41	44	14
Lost to follow up	1	0	2	4	10	2	7	9	20	5
Functioning graft at 31st December	1024	1083	1114	1176	1250	1334	1426	1498	1582	1659

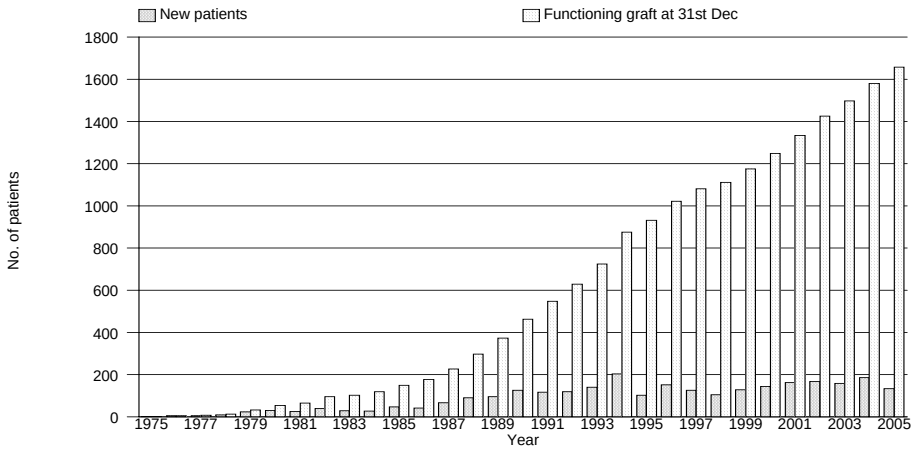


Figure 13.1.1: Stock and Flow of Renal Transplantation, 1975-2005

Incident rate for renal transplantation stabilised at a modest rate of 5-7 per million population (pmp) for the last decade (Table 13.1.2), while the transplant prevalence rate maintained at 48 -63 per million population for the last 10 years (Table 13.1.3).

Table 13.1.2: New transplant rate per million population (pmp), 1996-2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New transplant patients	151	126	104	127	143	161	168	158	185	133
New transplant rate, pmp	7	6	5	6	6	7	7	6	7	5

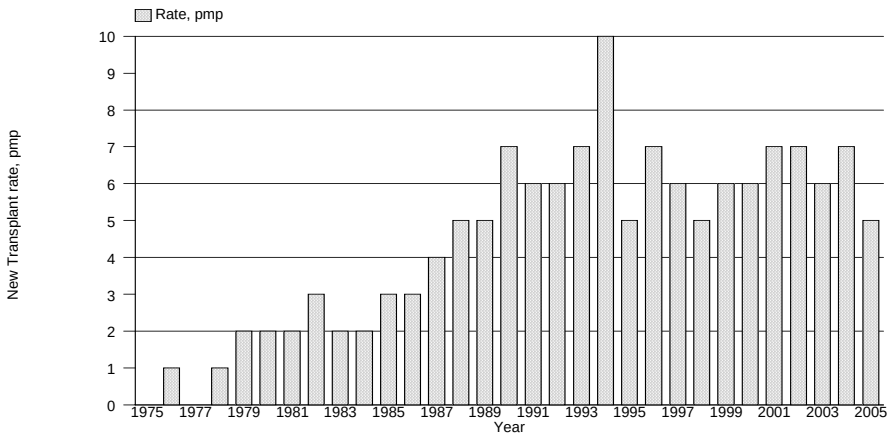
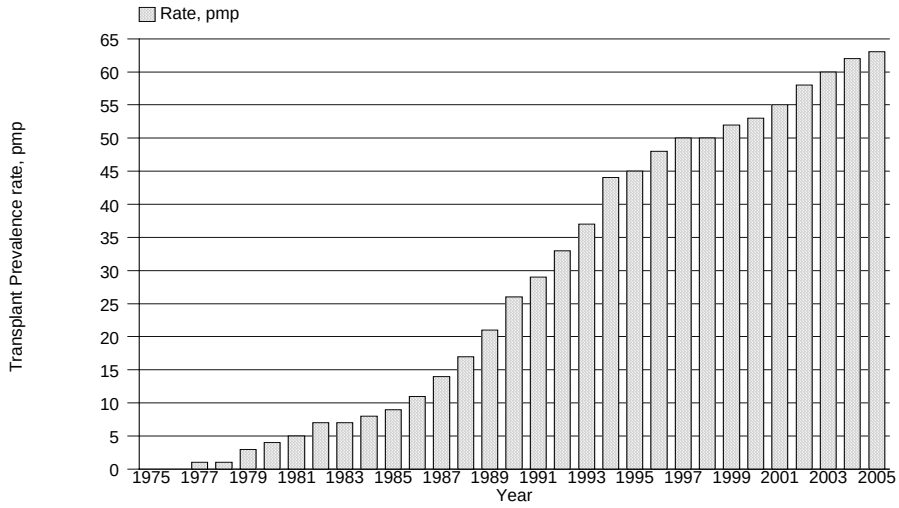


Figure 13.1.2: New transplant rate, 1975-2005

Table 13.1.3: Transplant prevalence rate per million population (pmp), 1996-2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Functioning graft at 31st December	1024	1083	1114	1176	1250	1334	1426	1498	1582	1659
Transplant prevalence rate, pmp	48	50	50	52	53	55	58	60	62	63

Figure 13.1.3: Transplant prevalence rate, 1975-2005



13.2. RECIPIENTS' CHARACTERISTICS

The mean age for new transplant recipients was between 36±6 years to 42±13 years over the last 10 years (Table 13.2.1). Men was still in the majority among renal transplant recipients and they made up 71% of all recipients in the year 2005. Over the last 10 years, the proportion of diabetic transplant recipients has increased, from 9% in1996 to more than 20% for the last 3 years.

In 2005, 4% were HbsAg positive and 3% had anti-HCV antibodies at the time of transplantation. The proportion of HbsAg positivity had reduced from 10-20% in the period 1985-1994 to 5-10% for the last 10 years while the number of recipients with anti-HCV antibodies at the time of transplantation had also reduced from 20-30% in the early 1990's to 8-15% for the last 8 years since the screening test was introduced in 1989. For those transplanted prior to the screening test, anti-HCV antibodies were found in 40-60%.

Table 13.2.1: Renal Transplant Recipients' Characteristics, 1996-2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
New Transplant Patients	151	126	104	127	143	161	168	158	185	133
Age at transplant (years), Mean	39	36	37	37	40	41	41	42	41	39
Age at transplant (years), SD	11	12	11	13	13	13	13	13	13	14
% Male	57	63	59	61	64	63	57	66	62	71
% Diabetic (co-morbid/ primary renal disease)	9	11	9	10	14	19	15	22	21	20
% HBsAg positive	13	6	6	4	5	4	7	8	6	4
% Anti-HCV positive	20	7	18	11	8	15	9	10	8	3

Chronic glomerulonephritis was the primary cause of ESRF in 25-34% for the last 5 years (Table 13.2.2). As expected, patients with diabetes mellitus had become increasingly frequent renal transplant recipients, from 7% in 1996 to 18% in 2005.The majority of renal transplant recipients still presented late with unknown primary renal disease, contributing to 29-50% of all the recipients for the last decade.

Table 13.2.2: Primary causes of end stage renal failure, 1996-2005

Year	1996		1997		1998		1999		2000		2001		2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
New transplant patients	151	100	126	100	104	100	127	100	143	100	161	100	168	100	158	100	185	100	133	100
Glomerulonephritis	47	31	29	23	28	27	41	32	49	34	41	25	53	32	53	34	62	34	37	28
Diabetes Mellitus	10	7	9	7	5	5	10	8	16	11	23	14	16	10	26	16	31	17	24	18
Hypertension	7	5	4	3	5	5	7	6	18	13	17	11	24	14	26	16	50	27	34	26
Obstructive uropathy	2	1	3	2	4	4	4	3	3	2	3	2	2	1	2	1	3	2	2	2
ADPKD	4	3	2	2	1	1	1	1	3	2	1	1	3	2	5	3	4	2	3	2
Drugs/ toxic nephropathy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	1	0	0
Hereditary nephritis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Unknown	76	50	64	51	55	53	62	49	54	38	61	38	68	40	57	36	80	43	38	29
Others	11	7	18	14	10	10	6	5	12	8	22	14	15	9	12	8	27	15	13	10

13.3. TRANSPLANT PRACTICES

In 2005, commercial transplants from China constituted 69% of all new renal transplantation, while live donor transplantation made up 26% and local cadaveric transplants contributed only 3% of all new renal transplantation (Table 13.3.1).

Table 13.3.1: Type of Renal Transplantation, 1996-2005

Year	1996		1997		1998		1999		2000		2001		2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Commercial Cadaver	106	72	80	66	51	52	61	51	79	55	82	51	102	61	109	69	136	75	87	69
Commercial Live Donor	4	3	7	6	4	4	4	3	10	7	6	4	11	7	3	2	5	3	3	2
Live Donor (genetically related)	36	24	27	22	27	27	40	33	21	15	32	20	30	18	25	16	21	12	30	24
Live Donor (emotionally related)	0	0	0	0	2	2	5	4	6	4	4	2	3	2	5	3	2	1	3	2
Cadaver	2	1	8	7	15	15	10	8	27	19	37	23	22	13	15	10	17	9	4	3
Total	148	100	122	100	99	100	120	100	143	100	161	100	168	100	157	100	181	100	127	100

* Commercial Cadaver (China, India, other oversea) * Commercial live donor (living unrelated) * Cadaver (local)

Table13.3.2: Biochemical data and Vital signs, 2004-2005

Biochemical parameters	Summary	2004	2005
Creatinine, umol/L	N	1557	1623
	Mean	132	133.7
	SD	63.6	65.4
	Median	120	120
	Minimum	38	35
	Maximum	817	763
Hb, g/dL	N	1557	1623
	Mean	12.9	12.9
	SD	1.9	1.9
	Median	12.9	12.9
	Minimum	4.9	5.5
	Maximum	19.7	20.6
Albumin, g/L	N	1557	1623
	Mean	39.3	39.3
	SD	1	0.5
	Median	39.3	39.3
	Minimum	22	34
	Maximum	50	46
Calcium, mmol/L	N	1557	1623
	Mean	2.4	2.3
	SD	0.2	0.2
	Median	2.3	2.3
	Minimum	1.1	1.2
	Maximum	3.3	3.3
Phosphate, mmol/L	N	1557	1623
	Mean	1.1	1.1
	SD	0.2	0.2
	Median	1.1	1.1
	Minimum	0.3	0.3
	Maximum	2.7	3.3
Alkaline Phosphate (ALP), U/L	N	1557	1623
	Mean	79.4	78.6
	SD	46.4	43.7
	Median	73	73
	Minimum	8	18
	Maximum	994	831
ALT, U/L	N	1557	1623
	Mean	31.4	30.7
	SD	32.6	29.9
	Median	25	24
	Minimum	4	4
	Maximum	563	613

Biochemical parameters	Summary	2004	2005
Total cholesterol, mmol/L	N	1557	1623
	Mean	5.5	5.4
	SD	1.1	1
	Median	5.4	5.4
	Minimum	2.6	2.1
	Maximum	20	13.1
LDL cholesterol, mmol/L	N	1557	1623
	Mean	3.1	3
	SD	0.7	0.8
	Median	3.1	3.1
	Minimum	1	0.9
	Maximum	8.5	9.2
HDL cholesterol, mmol/L	N	1557	1623
	Mean	1.6	1.6
	SD	0.4	0.5
	Median	1.6	1.6
	Minimum	0.2	0.2
	Maximum	4.3	5.6
Systolic Blood Pressure, mmHg	N	1557	1623
	Mean	132.3	133.4
	SD	15.9	17
	Median	130	130
	Minimum	80	56
	Maximum	200	220
Diastolic Blood Pressure, mmHg	N	1557	1623
	Mean	80.4	80.6
	SD	9.6	9.2
	Median	80	80
	Minimum	40	45.7
	Maximum	121	127
Weight (kg)	N	1557	1623
	Mean	64.3	64.5
	SD	13.5	14.2
	Median	64.4	64.4
	Minimum	15.1	18.4
	Maximum	116	130

Cyclosporine/prednisolone based triple therapy has remained the backbone of maintenance immunosuppressive therapy. In year 2004-2005, 78% of renal transplant recipients were on Cyclosporine while 97% were on prednisolone. Only 14% were on tacrolimus. However, 41% of the recipients were on MMF as opposed to 40% on azathioprine

Table 13.3.3: Medication data, 2004-2005

Medication data	Single drug treatment		Drug treatment	
	No.	%	No.	%
All patients	3180	100	3180	100
(i) Immunosuppressive drug(s)				
Prednisolone	27	1	3082	97
Azathioprine	1	0	1260	40
Cyclosporin A	9	0	2493	78
Tacrolimus (FK506)	0	0	435	14
Mycophenolate Mofetil (MMF)	1	0	1290	41
Rapamycin	0	0	14	0
Others	1	0	26	1
(ii) Non-Immunosuppressive drug(s)				
Beta blocker	222	7	1380	43
Calcium channel blocker	400	13	1704	54
ACE inhibitor	100	3	637	20
AIIRB	34	1	260	8
Anti-lipid	145	5	1234	39
Other anti-hypertensive	11	0	317	10

13.4. TRANSPLANT OUTCOMES

13.4.1 Post-transplant complications

64% of the recipients had hypertension as a co-morbidity before transplantation while another 26% developed hypertension post transplantation (Table 13.4.1). Among these patients, only 29% were on monotherapy while the rest were on multiple drug treatment. For those on combination therapy, majority was on calcium channel blockers (54%) and beta blockers (43%). Only 20% were on ACE inhibitors while another 8% were on angiotensin II receptor blockers (AIIRB).
It is also interesting to note while 13% of the prevalent renal transplant recipients had diabetes mellitus before transplantation (either as primary renal disease or co-morbidity), another 8% of them developed diabetes mellitus post transplantation (PTDM).

Table 13.4.1: Post transplant complications, 2004-2005

Post transplant complications	Complication developed before transplant (regardless of complication after transplantation)		Complication developed only after transplantation	
	No.	%	No.	%
All patients	3180	100	3180	100
Diabetes (either as Primary Renal Disease or co-morbid)	401	13	252	8
Cancer	5	0	36	1
Cardiovascular disease + cerebrovascular disorder	161	5	128	4
Hypertension	2047	64	832	26

* Hypertension: BP systolic> 140 and BP diastolic>90
OR have either Beta blocker/ Calcium channel blocker/ ACE inhibitor/ AIIRB/ Other anti-hypertensive

13.4.2 Deaths and Graft losses

In 2004, 37 (2%) of transplant recipients died and 44 (3%) lost their grafts. These rates of transplant death and graft loss have remained constant for the last 10 years (Table 13.4.2). Infection, cardiovascular disease and death at home were among the commonest causes of death for the last decade and in 2004; they accounted for 25%, 10% and 15% of the causes of death respectively (Table 13.4.3). However, death secondary to cancer has become more common over the last 5 years and in 2004, cancer death accounted for 18% of all causes of death. Renal allograft rejection accounted for 50-60% of graft loss for the last 10 years (Table 13.4.4).

Table13.4.2: Transplant Patients Death Rate and Graft Loss, 1996-2005

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
No. at risk	977	1052	1097	1143	1211	1290	1378	1460	1538	1619
Transplant death	31	29	23	25	27	35	31	36	37	37
Transplant death rate %	3	3	2	2	2	3	2	2	2	2
Graft loss	28	38	48	36	32	40	38	41	44	14
Graft loss rate %	3	4	4	3	3	3	3	3	3	1
Acute rejection	0	0	0	0	0	0	0	3	18	13
Acute rejection rate %	0	0	0	0	0	0	0	0	1	1
All losses	59	67	71	61	59	75	69	80	99	64
All losses rate %	6	6	6	5	5	6	5	5	6	4

* Graft loss=graft failure
* All losses=death/graft loss (Acute rejection happened concurrently with graft failure/ death)

Figure 13.4.2(a): Transplant Recipient Death Rate, 1975-2005

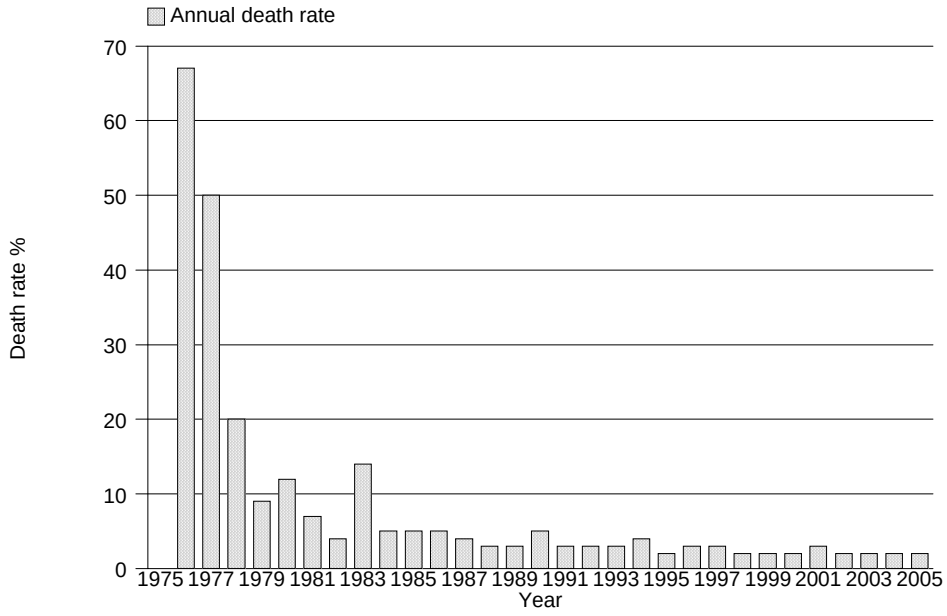


Figure 13.4.2(b): Transplant Recipient Graft Loss Rate, 1975-2005

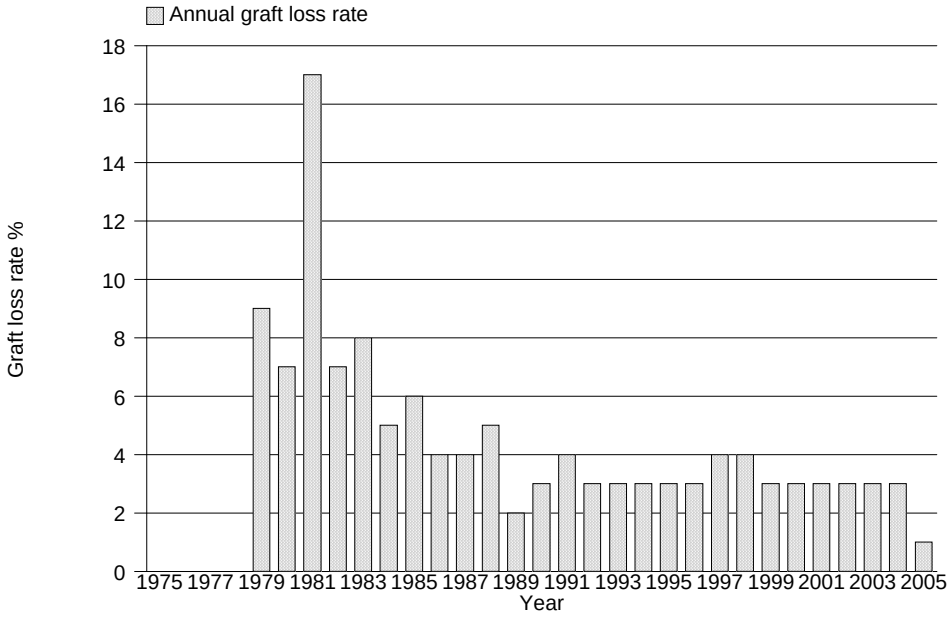


Table13.4.3: Causes of Death in Transplant Recipients, 1996-2005

Year	1996		1997		1998		1999		2000		2001		2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Cardiovascular	4	13	3	10	3	13	4	13	10	32	6	15	5	16	9	23	4	10	4	11
Died at home	3	9	2	7	4	17	6	19	1	3	5	12	5	16	5	13	6	15	4	11
Infection	18	56	14	48	9	38	7	23	11	35	19	46	9	29	10	26	10	25	20	54
Graft failure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cancer	2	6	0	0	3	13	3	10	2	6	6	15	4	13	6	15	7	18	2	5
Liver disease	3	9	2	7	2	8	3	10	1	3	1	2	3	10	2	5	3	8	2	5
Accidental death	0	0	0	0	0	0	1	3	1	3	1	2	1	3	0	0	0	0	0	0
Others	1	3	4	14	0	0	5	16	3	10	2	5	2	6	5	13	9	23	3	8
Unknown	1	3	4	14	3	13	2	6	2	6	1	2	2	6	2	5	1	3	2	5
TOTAL	32	100	29	100	24	100	31	100	31	100	41	100	31	100	39	100	40	100	37	100

Table 13.4.4: Causes of Graft Failure, 1996-2005

Year	1996		1997		1998		1999		2000		2001		2002		2003		2004		2005	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Rejection	14	50	21	54	27	52	23	64	19	59	25	61	22	55	22	50	33	70	14	78
Calcineurin toxicity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other drug toxicity	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0
Ureteric obstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Infection	0	0	0	0	1	2	0	0	1	3	2	5	0	0	2	5	1	2	1	6
Vascular causes	1	4	4	10	3	6	1	3	3	9	1	2	0	0	3	7	4	9	1	6
Recurrent/ de novo renal disease	2	7	1	3	1	2	0	0	0	0	2	5	2	5	1	2	1	2	0	0
Others	0	0	5	13	5	10	0	0	2	6	0	0	4	10	1	2	0	0	1	6
Unknown	11	39	7	18	15	29	12	33	7	22	11	27	12	30	15	34	7	15	1	6
TOTAL	28	100	39	100	52	100	36	100	32	100	41	100	40	100	44	100	47	100	18	102

13.5. Patient and Graft Survival

The overall transplant patient survival rate from 1993 to 2005 was 95%, 92%, 88% and 81% at 1 year, 3 years, 5 years and 10 years respectively, while the overall graft survival rate was 92%, 85%, 79% and 63% respectively.

Table 13.5.1: Patient survival, 1993-2005

Interval (years)	No.	% survival	SE
1	1616	95	1
3	1208	92	1
5	848	88	1
10	257	81	1
12	72	75	2

* No.=Number at risk SE=standard error

Figure 13.5.1: Patient survival, 1993-2005

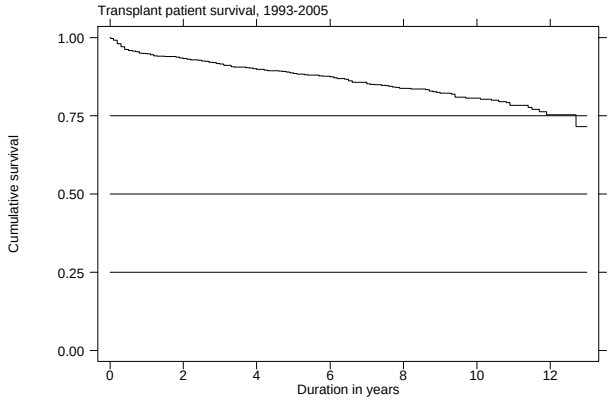
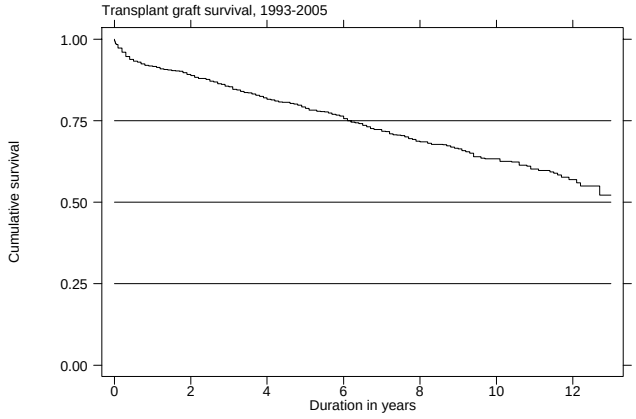


Table 13.5.2: Graft survival, 1993-2005

Interval (years)	No.	% survival	SE
1	1616	92	1
3	1208	85	1
5	848	79	1
10	257	63	2
12	72	57	2

* No.=Number at risk SE=standard error

Figure 13.5.2: Graft survival, 1993-2005



Outcomes of renal transplantation from the four donor groups are shown in Figures 13.5.3 and 13.5.4 and demonstrate substantially different patient & graft survival rates. Living donor grafts maintained the best patient and graft survival rates. The 1, 3, 5 and 10 year patient survival rate for recipients of living donor grafts were 96%, 95%, 94% and 89% respectively. The graft survival rates also differed between these 4 groups; living and commercial cadaver donor graft had the best outcomes.

Table 13.5.3: Patient survival by type of transplant, 1993-2005

Type of Transplant	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
1	822	96	1	279	96	1	362	96	1	121	83	3
3	562	93	1	239	91	2	298	95	1	88	79	3
5	360	89	1	201	87	2	219	94	1	50	75	4
10	53	85	2	125	73	3	74	89	2	3	69	6
12	9	85	2	39	66	4	22	89	2	2	34	25

* No.=Number at risk SE=standard error

Figure 13.5.3: Patient survival by type of transplant, 1993-2005

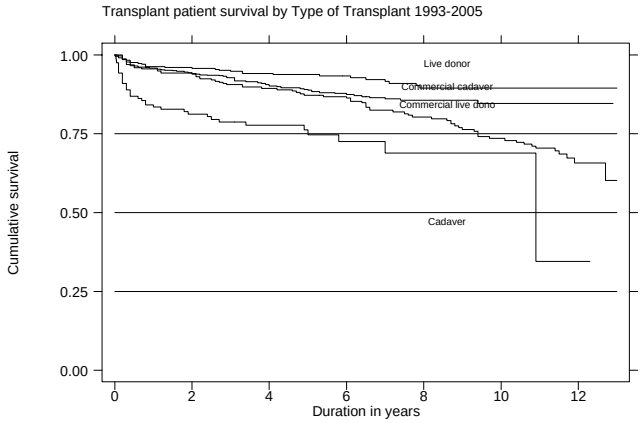


Figure 13.5.4: Graft survival by type of transplant, 1993-2005

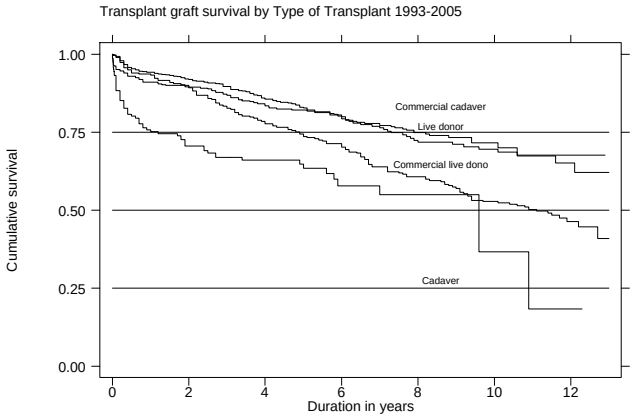


Table 13.5.4: Graft survival by type of transplant, 1993-2005

Type of Transplant	Commercial Cadaver			Commercial Live Donor			Live Donor			Cadaver		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
1	822	94	1	279	93	1	362	91	1	121	75	3
3	562	90	1	239	83	2	298	87	2	88	67	4
5	360	83	1	201	74	3	219	82	2	50	63	4
10	53	72	2	125	53	3	74	70	3	3	37	15
12	9	68	4	39	46	3	22	65	4	2	18	15

* No.=Number at risk SE=standard error

We compare the patient and graft survival rates for 1993-1998 cohort and 1999-2005 cohort.
We found that patient survival rate for living related donor renal transplants has remained excellent and unchanged for these two cohorts (Figure 13.5.5)

Table 13.5.5: Patient survival by year of transplant (Living related transplant, 1993-2005)

Year of Transplant	1993-1998			1999-2005		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE
1	181	97	1	182	96	1
3	168	95	2	131	94	2
5	158	93	2	62	94	2
7	146	91	2	1	94	2

* No.=Number at risk SE=standard error

Figure 13.5.5: Patient survival by year of transplant (Living related transplant, 1993-2005)

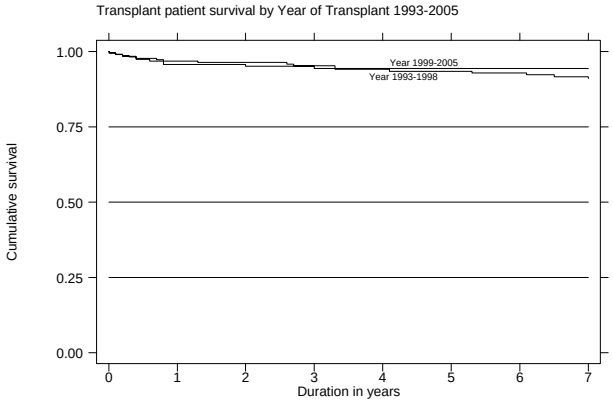
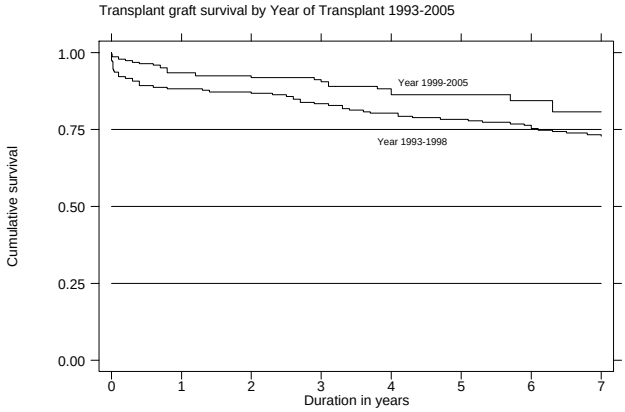


Figure 13.5.6: Graft survival by year of transplant (Living related transplant, 1993-2005)



Interestingly, the risk of graft failure for living related donor renal transplantation improved for the 1999-2004 cohort compared to the 1993-1998 cohort (Table & Figure 13.5.6). One possible explanation, among others, is the increasing use of newer immunosuppressive agents such as MMF and FK506 in recent years.

Table13.5.6: Graft survival by year of transplant (Living related transplant, 1993-2005)

Year of Transplant	1993-1998			1999-2005		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE
1	181	88	2	182	93	2
3	168	83	3	131	90	2
5	158	78	3	62	86	3
7	146	73	3	1	81	5

* No.=Number at risk SE=standard error

Interestingly, our data showed that commercial cadaveric transplants have excellent patient and graft survival rates, which are comparable to living related donor transplants for both 1993-1998 and 1999-2004 cohorts (Figure 13.5.7 and 13.5.8).

Table 13.5.7: Patient survival by year of transplant (Commercial cadaver transplant, 1993-2005)

Year of Transplant	1993-1998			1999-2005		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE
1	287	94	1	536	96	1
3	274	92	2	288	93	1
5	247	87	2	113	90	2
7	225	84	2	-	-	-

* No.=Number at risk SE=standard error

Figure 13.5.7: Patient survival by year of transplant (Commercial cadaver transplant, 1993-2005)

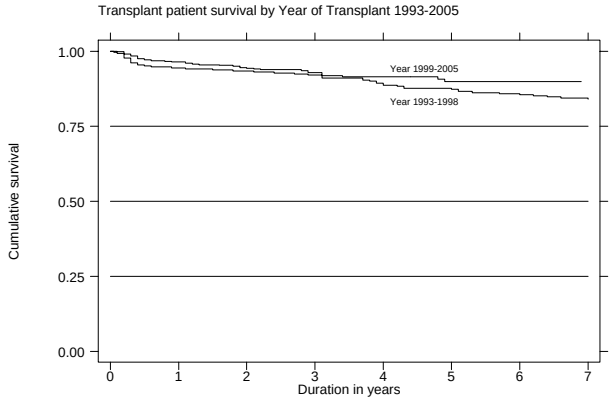


Figure 13.5.8: Graft survival by year of transplant (Commercial cadaver transplant, 1993-2005)

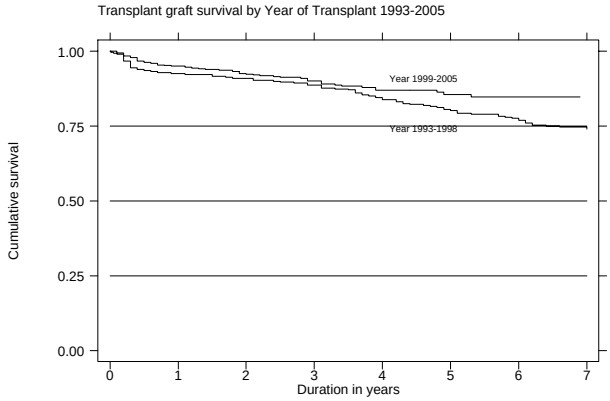


Table 13.5.8: Graft survival by year of transplant (Commercial cadaver transplant, 1993-2005)

Year of Transplant	1993-1998			1999-2005		
Interval (years)	No.	% Survival	SE	No.	% Survival	SE
1	287	93	1	536	95	1
3	274	89	2	288	90	1
5	247	80	2	113	86	2
7	225	74	3	-	-	-

* No.=Number at risk SE=standard error

APPENDIX 1: DATA MANAGEMENT

Introduction

Data integrity of a register begins from the data source, data collection tools, data verification and data entry process. Registry data is never as perfect as the clinical trail data. Caution should be used when interpreting the results.

Data source

The initial phase of the data collected in the Register covered all Renal Replacement Therapy (RRT) patients in the Ministry of Health program since its inception in the early 1970s. The Register subsequently received the data from other sector of RRT providers like the private, non-government organization (NGO), armed forces and the university.

The Register continues to actively ascertain new RRT centres in the country. The mechanism of ascertainment is through feedback from the dialysis related company, current Source Data Provider (SDP) and public propagandas. This will gradually and eventually result in a complete RRT centre database. The identified RRT centre is invited to participate in data collection. Participation in NRR is voluntary. Those RRT centres which have expressed interest in participating will be recruited as SDP.

There were 4 haemodialysis centres which ceased operation in the year 2005. The NRR currently receives data from 474 SDP comprising 351 HD centers, 22 CAPD centers and 44 centers that provide follow-up care for post transplant patients. This represents an estimated coverage of 88.0% of potential SDP as shown in the table below. Of these, about 16.1% of the SDP did not submit the annual returns on the treatment parameters and Work Related Rehabilitation & Quality of Life Survey.

	Known dialysis centre (N)	Submitting data in 2005 (N)	Submitting annual returns (N)	submitted any data (%)
Haemodialysis	384	351	291	91.4
Peritoneal Dialysis	26	22	22	84.6
Transplant	64	44	37	57.8
All modality	**474**	**417**	**350**	**88.0**

Data collection

The data collection tools are designed to mimic the data capture format in the patient case notes to facilitate the data transcription and minimise transcription error. All the SDPs are provided with instructions on data collection and submission to the Register.

The Register collects the RRT patients' demographic details, clinical data, dialysis treatment data, transplant data, peritonitis data and outcome data. The Register holds individual patient's identifiable data that allow complete follow-up despite patient transfers from one centre to another or change of modality which are especially common among the RRT patients. These patients are monitored and tracked through from the time they were registered and commenced their RRT treatment till their death. For those patients who were lost to follow-up, the Register will verify their final outcome with the National Vital Registration System. Patient Profiles are submitted to the Register throughout the year. The identity of patients in the database is not released publicly or in the registry reports.

Centre-specific reports are generated and forwarded to SDP on a quarterly basis. This has generated increased feedback from SDP and improved the patient ascertainment rate and the accuracy of the data transmitted to the Registry.

At the end of each year, the Register conducts a survey on the Staff and Facility Profile. The survey questionnaire provides summary information about the number of patients on various treatments. This acts as the basis to calculate the patient ascertainment rate.

Database System

The Register initial database was created in DBASE IV in a single computer environment. It was then upgraded to Microsoft Access as a client server application. Currently the NRR data system is a Pentium Xeon 2.4 with dual processors, with a total of 1GB RAM memory and 72GB of RAID-5 (Redundant Array of Independent Disks, level 5). In view of capacity ability, performance and security issues of Microsoft Access, it was subsequently migrated to SQL Server 2000 in the year 2004.

Data management personnel

The data management personnel in the Register office are trained base on the standard operating procedures (SOP). The data entry process is also designed to enhance data quality. Quality assurance procedures are in place at all stages to ensure the quality of data.

Visual review, Data entry and de-duplication verification, Data Editing

On receiving the CRF submitted by SDP, visual review is performed to check for obvious error or missing data in the compulsory fields. Data entry will not be performed if a critical variable on the CRF is missing or ambiguous. The CRF is returned to the SDP for verification.

After passing the duplicate check, the data is than entered and coded where required. Edit checks are performed against pre-specified validation rules to detect missing values, out of range values or inconsistent values. Any data discrepancy found is verified against the source CRF and resolved within the Register office where possible. Otherwise the specific data query report will be generated and forwarded to the SDP to clarify and resolve the data discrepancy.

Data coding, data cleaning / data analysis

Most of the data fields have auto data coding. Those data in text fields will be manually coded by the Register manager. A final edit check run is performed to ensure that data is clean. All queries are resolved before database is locked to ensure data quality and integrity. Data is subsequently exported to the statistician for analysis

Limitation:

The majority of the RRT centres in this country are still paper based. Currently there is no satisfactory active electronic patient information system in the various centres. Computer literacy among staff is still low.

The data submission to the Register is totally voluntary and is done manually using the standard data collection tools. The process is tedious and time consuming for the SDP and the Register office. Some SDP have difficulty submitting data on time for inclusion in the yearly report. This inevitably results in slight differences when the existing data is been reported in subsequent year. Work to improve the timely data submission is ongoing.

Data release and publication policy

One of the primary objectives of the Registry is to make data available to the renal community. There are published data in the registry's annual report in the website: http://www.msn.org.my/nrr. This report is copyrighted. However it may be freely reproduced without the permission of the National Renal Registry. Acknowledgment would be appreciated. Suggested citation is: YN Lim, TO Lim (Eds). Thirteenth Report of the Malaysian Dialysis and Transplant Registry 2005. Kuala Lumpur 2006

A distinction is made between use of NRR results (as presented in NRR published report) and use of NRR data in a publication. The former is ordinary citation of published work. NRR, of course encourages such citation whether in the form of presentation or other write-ups. The latter constitutes original research publication. NRR position is as follows:

- The NRR does not envisage independent individual publication based entirely on NRR published results, without further analyses or additional data collection.
- NRR however agrees that investigator shall have the right to publish any information or material arising in part out of NRR work. In other words, there must be additional original contribution by the investigator in the work intended for publication.
- NRR encourages the use of its data for research purpose. Any proposed publication or presentation (e.g. manuscript, abstract or poster) for submission to journal or scientific meeting that is based in part or entirely on NRR data should be sent to the NRR prior to submission. NRR will undertake to comment on such documents within 4 weeks. Acknowledgement of the source of the data would also be appreciated.
- Any formal publication of a research based in part or entirely on NRR data in which the input of NRR exceeded that of conventional data management and provision will be considered as a joint publication by investigator and the appropriate NRR personnel.

Any party who wish to request data for a specific purpose that requires computer-run should make such requests in writing (by e-mail, fax, or classic mail) accompanied by a Data Release Application Form and signed Data Release Agreement Form. Such request will require approval by the Advisory Board before the data can be released.

Distribution of report

The MSN has made a grant towards the cost of running the registry and the report printing to allow distribution to all members of the association and the source data producers. The report will also be distributed to relevant Health Authorities and international registries.

Further copies of the report can be made available with donation of RM60.00 to defray the cost of printing. The full report is also available in the registry web site: http://www.msn.org.my/nrr

APPENDIX II:
ANALYSIS SETS, STATISTICAL METHODS AND DEFINITIONS

Analysis sets

This refers to the sets of cases whose data are to be included in the analysis.
Six analysis sets were defined:

1. Dialysis patients notification between 1996 and 2005
   This analysis set consists of patients commencing dialysis between 1996 and 2005. This analysis set was used for the analysis in Chapter 1, 2 and 3.

2. Dialysis patients notification between 1990 and 2005
   This analysis set consists of patients with age commencing dialysis less than 20 years old between 1990 and 2005. This analysis set was used for the analysis in Chapter 5.

3. Dialysis patients between 1997 and 2005
   Since 1993, the NRR conducted an annual survey on all dialysis patients to collect data on dialysis and drug treatment, clinical and laboratory measurements. All available data were used to describe the trends in these characteristics.
   However, in the early years, the data collected from annual survey were relatively incomplete. Hence, for any analyses in relation to these characteristics, we used only data from 1997 onwards when the data were more complete. Remaining missing data in this analysis set was imputed using first available observation carried backward or last observation carried forward. This analysis set was used for the analysis in Chapters 6 to 12.

4. Rehabilitation outcomes
   Analysis is confined to the relevant population. Hence we exclude the following groups.
   1. Age less than or equal to 21 years
   2. Age more than or equal to 55 years
   3. Homemaker
   4. Full time student
   5. Retired

   This analysis set was used for the analysis in Chapter 4.

5. Centre Survey data
   Section 2.2 in the report was based on annual centre survey data between 1980 to 2005 rather than individual patient data reported to the Registry.

6. Peritonitis data
   Analysis was confined to CAPD patients who were on peritoneal dialysis from 31st Dec 1999. This analysis set was used for the analysis in Section 12.4.

Statistical methods

Population treatment rates (new treatment or prevalence rates)
Treatment rate is calculated by the ratio of the count of number of new patients or prevalent patients in a given year to the mid-year population of Malaysia in that year, and expressed in per million-population. Results on distribution of treatment rates by state are also expressed in per million-population since states obviously vary in their population sizes.

Death rate calculation
Annual death rates were calculated by dividing the number of deaths in a year by the estimated mid-year patient population.

Odds ratio
The odds of an event is the probability of having the event divided by the probability of not having it. The odds ratio is used for comparing the odds of 2 groups. If the odds in group 1 is O1 and group 2 is O2, then odds ratio is O1/O2. Thus the odds ratio expresses the relative probability that an event will occur when 2 groups are compared.

With multiple factors, logistic regression model was used to estimate the independent effect of each factor, expressed as odds ratio, on the event of interest.

Survival analysis
The unadjusted survival probabilities were calculated using the Kaplan-Meier method, in which the probability of surviving more than a given time can be estimated for members of a cohort of patients without accounting for the characteristics of the members of that cohort.

In order to estimate the difference in survival of different subgroups of patients within the cohort, a stratified proportional hazards model (Cox) was used where appropriate. The results from Cox model are interpreted using a hazard ratio. Adjusted survival probabilities are with age, gender, primary diagnosis and time on RRT used as adjusting risk factors. For diabetics compared with non-diabetics, for example, the hazard ratio is the ratio of the estimated hazards for diabetics relative to non-diabetics, where the hazard is the risk of dying at time t given that the individual has survival until this time. The underlying assumption of a proportional hazards model is that the ratio remains constant throughout the period under consideration.

Technique failure is defined as occurrence of death or transfer to another modality of dialysis. Similarly, graft failure is defined as occurrence of death or returned to dialysis.

Analysis of trend of intermediate results
For summarizing intermediate results like continuous laboratory data, we have calculated summary statistics like mean, standard deviation, median, lower quartile, upper quartile and the cumulative frequency distribution graph is plotted over year. Cumulative distribution plot shows a listing of the sample values of a variable on the X axis and the proportion of the observations less than or greater than each value on the Y axis. An accompanying table gives the Median (50% of values are above or below it), upper quartile (UQ, 25% of values above and 75% below it), lower quartile (LQ, 75% of values above and 25% below it). Other percentiles can be read directly off the cumulative distribution plot. The table also shows percent of observations above or below a target value, or with an interval of values; the target value or interval obviously vary with the type of laboratory data. For example, interval of values for prescribed KT/V is >1.3 and that for haemoglobin is <10, 10-11 and >11 g/l. The choice of target value is guided by published clinical practice guidelines, for example, the DOQI guideline; or otherwise they represent consensus of the local dialysis community.

Centre survey data

In contrast to other results reported in this report, Section 2.2 was based on centre survey data rather than individual patient data reported to the Registry. This is to provide an up-to-date information on patient and centre census in the country and thus overcome the inevitable time lag between processing individual patient data and subsequent reporting of results. The survey was conducted in the month of December 2005. Centre response rate to survey was 100%. 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 2005 census 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 states estimates. However, we minimize the bias by combining states (Selangor and Wilayah Persekutuan, Kedah and Perlis) based on geographical considerations. 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 number of centre HD patient is a useful measure of utilization of available capacity.

Centre variation

To compare the variation of the intermediate results between centres, graph describing intermediate results in each centre are presented. The 95% confidence intervals have been calculated using the normal approximation of the Poisson to show the variation of proportion in centres. Lower quartile and upper quartile are instead plotted in comparison of variation in median among centres. In the analysis, centres with less than ten patients were combined in a pooled centre. An accompanying table gives the summary statistics like minimum, 5th percentile, lower quartile, median, upper quartile, 95th percentile and maximum value among centres over year.

Centres with intermediate results for <10 patients were combined into one composite centre.

Peritonitis rate

The occurrence of peritonitis is expressed as number of episode per patient-month of observation; peritonitis rate in short. Relapse peritonitis is defined as peritonitis caused by the same organism occurring within 6 weeks of diagnosis of previous peritonitis.