

CHAPTER 5

Paediatric Renal Replacement Therapy

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

SECTION A: RRT PROVISION FOR PAEDIATRIC PATIENTS

This chapter presents data on paediatric patients less than 20 years of age receiving renal replacement therapy (RRT) from 2000 to 2009. The dialysis acceptance rate for the paediatric population in 2009 was 7 per million age-related population (pmarp). The number of new transplants had shown some encouraging increase over the last 5 years with about 20 new transplants yearly. The overall incidence rate for all RRT was 8 pmarp in 2009 and it had remained fairly stable over the last 8 years.

As expected, with increasing number of children on dialysis and improve survival; the number of prevalent patients continue to rise. At the end of 2009, 796 paediatric patients were receiving RRT in Malaysia. Of these, 605 children were on dialysis. The equivalent dialysis prevalence rate more than doubled over the last 10 years from 23 pmarp in 2000 to 52 pmarp in 2008. The prevalent HD population continued to expand at a higher rate than the PD population although the dialysis acceptance rate for new PD patients was higher, consistent with higher technique failure among PD patients.

Table 5.1: Stock and Flow of Paediatric Renal Replacement Therapy 2000-2009

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|------|------|------|------|------|------|------|------|------|------|
| New HD patients | 12 | 24 | 29 | 32 | 39 | 34 | 51 | 35 | 43 | 30 |
| New PD patients | 37 | 40 | 54 | 38 | 41 | 47 | 44 | 50 | 50 | 66 |
| New Transplants | 17 | 11 | 12 | 11 | 11 | 18 | 23 | 20 | 21 | 17 |
| HD deaths | 4 | 1 | 11 | 6 | 10 | 9 | 7 | 11 | 11 | 10 |
| PD deaths | 3 | 8 | 8 | 9 | 5 | 9 | 16 | 8 | 9 | 11 |
| Transplant deaths | 1 | 0 | 1 | 2 | 0 | 1 | 1 | 3 | 4 | 0 |
| On HD at 31 st December | 119 | 143 | 160 | 183 | 216 | 241 | 286 | 313 | 350 | 369 |
| On PD at 31 st December | 109 | 123 | 152 | 163 | 176 | 192 | 189 | 202 | 208 | 236 |
| Functioning transplant at 31 st December | 92 | 100 | 110 | 115 | 124 | 138 | 156 | 167 | 174 | 191 |

Figure 5.1 (a): Incidence cases of RRT by modality in children under 20 years old, 2000-2009

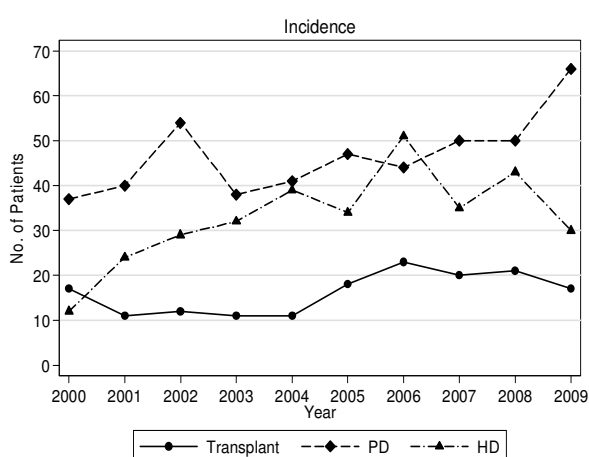


Figure 5.1 (b): Prevalence cases of RRT by modality in children under 20 years old, 2000-2009

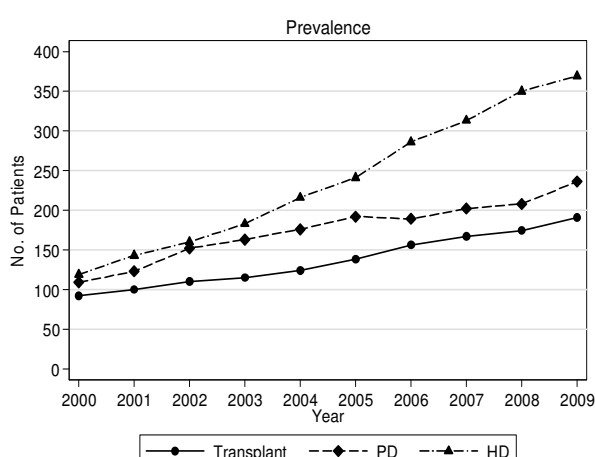
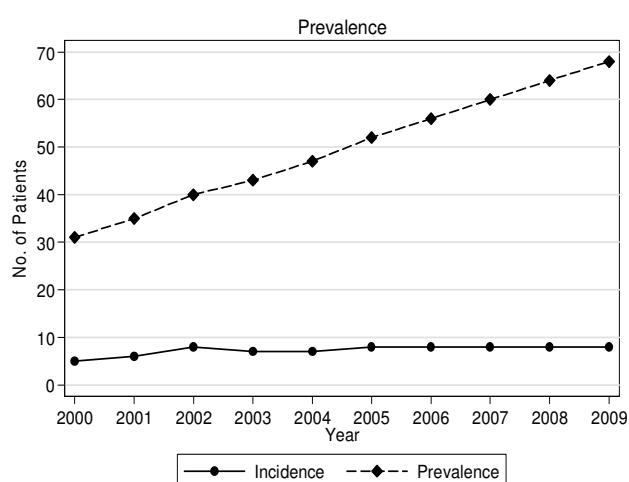


Table 5.2: Paediatric Dialysis and Transplant Rates per million age-group population 2000-2009

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|--|------|------|------|------|------|------|------|------|------|------|
| Incidence Rate | | | | | | | | | | |
| New HD | 1 | 2 | 3 | 3 | 4 | 3 | 5 | 3 | 4 | 3 |
| New PD | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 6 |
| New Transplant | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 |
| All RRT | 5 | 6 | 8 | 7 | 7 | 8 | 8 | 8 | 8 | 8 |
| Prevalence Rate at 31 st December | | | | | | | | | | |
| On HD | 12 | 14 | 15 | 17 | 20 | 22 | 26 | 28 | 30 | 32 |
| On PD | 11 | 12 | 14 | 15 | 16 | 17 | 17 | 18 | 18 | 20 |
| Functioning Graft | 9 | 10 | 10 | 11 | 11 | 12 | 14 | 15 | 15 | 16 |
| All RRT | 31 | 34 | 39 | 42 | 47 | 51 | 55 | 59 | 63 | 67 |

Figure 5.2: Incidence and prevalence rate per million age related population years old on RRT, 2000-2009



SECTION B: DISTRIBUTION OF PAEDIATRIC DIALYSIS PATIENTS

The treatment gap between the more economically developed states of West Malaysia and East Malaysia remained. However this gap is becoming less obvious over the years with the set up of new paediatric nephrology centres in these regions particularly in East Malaysia where the number of new dialysis patients had doubled over the last 5 years.

Table 5.3 (a): Dialysis Treatment Rate by State, per million state age group populations; 2000-2009

| State | 2000-2004 | 2005-2009 |
|----------------------|-----------|-----------|
| Pulau Pinang | 10 | 17 |
| Melaka | 12 | 12 |
| Johor | 11 | 11 |
| Perak | 7 | 10 |
| Selangor & Putrajaya | 7 | 9 |
| Kuala Lumpur | 13 | 13 |
| Negeri Sembilan | 9 | 13 |
| Kedah | 9 | 6 |
| Perlis | 16 | 10 |
| Terengganu | 9 | 11 |
| Pahang | 7 | 11 |
| Kelantan | 8 | 7 |
| Sarawak | 5 | 8 |
| Sabah & WP Labuan | 4 | 7 |

Table 5.3 (b): New Dialysis Patients by State, 2000-2009

| State | 2000-2004 | 2005-2009 |
|----------------------|-----------|-----------|
| Pulau Pinang | 26 | 45 |
| Melaka | 18 | 18 |
| Johor | 67 | 70 |
| Perak | 31 | 46 |
| Selangor & Putrajaya | 62 | 90 |
| Kuala Lumpur | 35 | 39 |
| Negeri Sembilan | 18 | 25 |
| Kedah | 34 | 27 |
| Perlis | 8 | 5 |
| Terengganu | 22 | 28 |
| Pahang | 21 | 33 |
| Kelantan | 29 | 29 |
| Sarawak | 23 | 43 |
| Sabah & WP Labuan | 24 | 49 |

There had been consistently more males compared to females among the population of children on dialysis and this trend had persisted over the last 10 years suggesting this is most likely a reflection of the higher incidence of ESRD among the males. However this gender disparity appears more marked among the transplanted patients.

Table 5.4: Number of New Dialysis and Transplant Patients by Gender 2000-2009

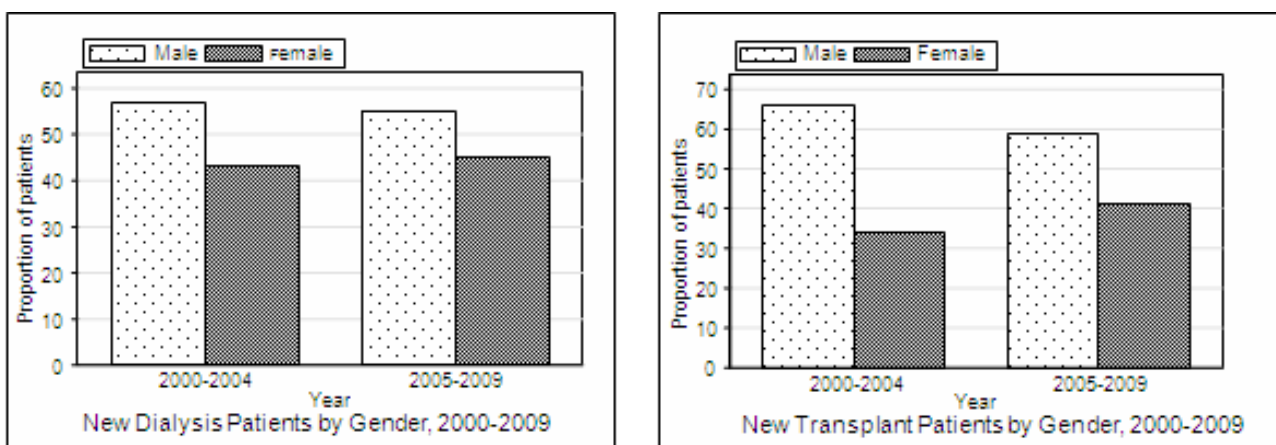
a) New Dialysis

| Year | Male | | Female | |
|-----------|------|----|--------|----|
| | No. | % | No. | % |
| 2000-2004 | 197 | 57 | 149 | 43 |
| 2005-2009 | 248 | 55 | 202 | 45 |

b) New Transplant

| Year | Male | | Female | |
|-----------|------|----|--------|----|
| | No. | % | No. | % |
| 2000-2004 | 41 | 66 | 21 | 34 |
| 2005-2009 | 58 | 59 | 41 | 41 |

Figure 5.4: Number of New Dialysis and Transplant Patients by gender 2000-2009

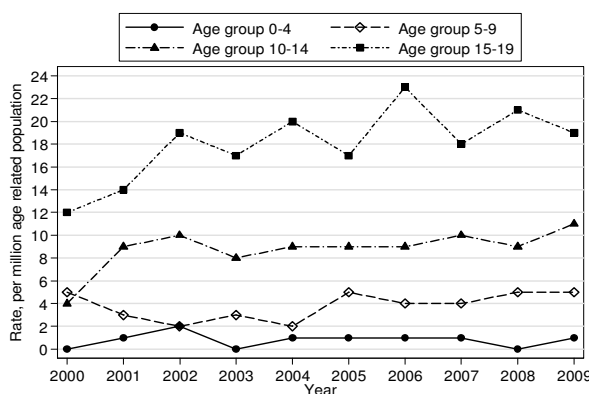


The dialysis treatment rate had leveled off over the last 7 years across the paediatric age spectrum. The treatment rate had remained consistently higher among the older age groups. The number of 0-4 year olds provided chronic dialysis treatment remained very low.

Table 5.5: New RRT Rate, Per Million Age Related Population by Age Group 2000-2009

| Year | New RRT rate, pmp | | | |
|------|-------------------|-----|-------|-------|
| | Age group (years) | | | |
| | 0-4 | 5-9 | 10-14 | 15-19 |
| 2000 | 0 | 5 | 4 | 12 |
| 2001 | 1 | 3 | 9 | 14 |
| 2002 | 2 | 2 | 10 | 19 |
| 2003 | 0 | 3 | 8 | 17 |
| 2004 | 1 | 2 | 9 | 20 |
| 2005 | 1 | 5 | 9 | 17 |
| 2006 | 1 | 4 | 9 | 23 |
| 2007 | 1 | 4 | 10 | 18 |
| 2008 | 0 | 5 | 9 | 21 |
| 2009 | 1 | 5 | 11 | 19 |

Figure 5.5: New RRT Rate by Age group 2000-2009

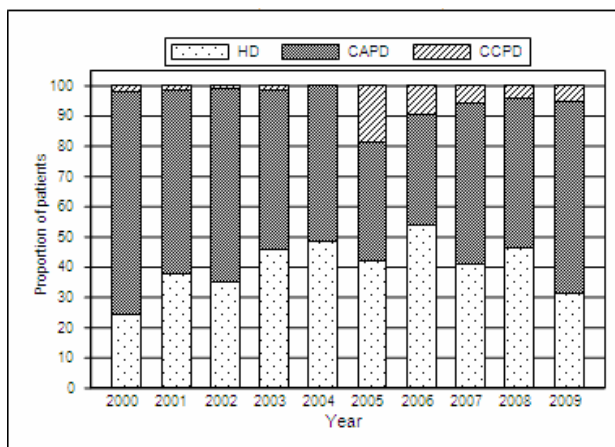


PD was the first modality of dialysis in more than two thirds (69%) of patients. A significant proportion of children were started on automated PD (CCPD) as the first mode of dialysis in 2005 when CCPD was first made widely available to the paediatric population. However since 2009 the policy had changed back to CAPD first and the numbers on CCPD are expected to show a decreasing trend.

Table 5.6: New Dialysis by treatment modality 2000-2009

| Year | HD | | CAPD | | CCPD | |
|------|-----|----|------|----|------|----|
| | No. | % | No. | % | No. | % |
| 2000 | 12 | 24 | 36 | 73 | 1 | 2 |
| 2001 | 24 | 38 | 39 | 61 | 1 | 2 |
| 2002 | 29 | 35 | 53 | 64 | 1 | 1 |
| 2003 | 32 | 46 | 37 | 53 | 1 | 1 |
| 2004 | 39 | 49 | 41 | 51 | 0 | 0 |
| 2005 | 34 | 42 | 32 | 40 | 15 | 19 |
| 2006 | 51 | 54 | 35 | 37 | 9 | 9 |
| 2007 | 35 | 41 | 45 | 53 | 5 | 6 |
| 2008 | 43 | 46 | 46 | 49 | 4 | 4 |
| 2009 | 30 | 31 | 61 | 64 | 5 | 5 |

Figure 5.6: New Dialysis by treatment modality 2000-2009

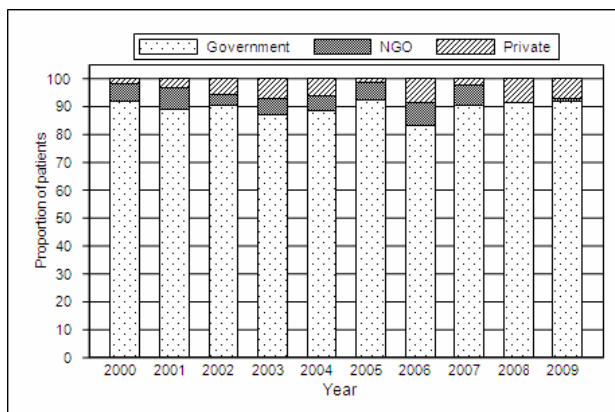


Most of the children (up to 90%) received their dialysis treatment from government centres and hence were government funded. This figure had not changed over the last 10 years.

Table 5.7: New Dialysis by sector 2000-2009

| Year | Government | | NGO | | Private | |
|------|------------|----|-----|---|---------|---|
| | No. | % | No. | % | No. | % |
| 2000 | 45 | 92 | 3 | 6 | 1 | 2 |
| 2001 | 57 | 89 | 5 | 8 | 2 | 3 |
| 2002 | 75 | 90 | 3 | 4 | 5 | 6 |
| 2003 | 61 | 87 | 4 | 6 | 5 | 7 |
| 2004 | 71 | 89 | 4 | 5 | 5 | 6 |
| 2005 | 75 | 93 | 5 | 6 | 1 | 1 |
| 2006 | 79 | 83 | 8 | 8 | 8 | 8 |
| 2007 | 77 | 91 | 6 | 7 | 2 | 2 |
| 2008 | 85 | 91 | 0 | 0 | 8 | 9 |
| 2009 | 88 | 92 | 1 | 1 | 7 | 7 |

Figure 5.7: New Dialysis by sector 2000-2009



SECTION C: PRIMARY RENAL DISEASE

The most common primary renal disease identified was glomerulonephritis, which accounted for about 22% of the patients. FSGS on its own accounted for almost 8% of the ESRD population. The number of children presenting with ESRD of unknown aetiology was still high at 35%.

Table 5.8: Primary renal disease by sex, 2000-2009

| Primary Renal Disease | Male | | Female | | All | |
|-----------------------|------|----|--------|----|-----|----|
| | No. | % | No. | % | No. | % |
| Glomerulonephritis | 107 | 24 | 75 | 21 | 182 | 22 |
| FSGS | 31 | 7 | 32 | 9 | 63 | 8 |
| Refux nephropathy | 25 | 6 | 8 | 2 | 33 | 4 |
| SLE | 9 | 2 | 44 | 12 | 53 | 7 |
| Obstructive uropathy | 42 | 9 | 19 | 5 | 61 | 8 |
| Renal dysplasia | 14 | 3 | 10 | 3 | 24 | 3 |
| Hereditary nephritis | 11 | 2 | 3 | 1 | 14 | 2 |
| Cystic kidney disease | 3 | 1 | 5 | 1 | 8 | 1 |
| Metabolic | 5 | 1 | 3 | 1 | 8 | 1 |
| Others | 36 | 8 | 42 | 12 | 78 | 10 |
| Unknown | 170 | 38 | 115 | 32 | 285 | 35 |

SECTION D: TYPES OF RENAL TRANSPLANTATION

Living related renal transplant used to be the commonest type of transplantation done among children. However the trend has changed particularly over the last 5 years in that cadaveric renal transplant is now the most common transplantation done accounting for about 48% compared to 35% for living related renal transplant. About 17% of renal transplant were done overseas mainly from commercial cadaveric programme.

Table 5.9: Types of Renal Transplantation, 2000-2009

| Year | 2000-2004 | | 2005-2009 | |
|----------------------------|-----------|-----|-----------|-----|
| | No. | % | No. | % |
| Commercial cadaver | 16 | 26 | 15 | 15 |
| Commercial living donor | 3 | 5 | 2 | 2 |
| Living related donor | 19 | 31 | 34 | 35 |
| Cadaver | 23 | 38 | 47 | 48 |
| Living emotionally related | 0 | 0 | 0 | 0 |
| TOTAL | 61 | 100 | 98 | 100 |

SECTION E: SURVIVAL ANALYSIS

Renal transplantation had the best patient survival with 93% survival at 5 years and 91% at 9 years. HD patients showed a slightly better survival over PD patients with 85% and 80% survival respectively at 5 years. When censored for change of dialysis modality; the survival rate was still better among HD patients (Figure 5.10b)

Table 5.10 (a): Patient survival by dialysis modality analysis (not censored with change of modality)

| Modality Interval (months) | Transplant | | | PD | | | HD | | |
|----------------------------|------------|------------|----|-----|------------|----|-----|------------|----|
| | No. | % survival | SE | No. | % survival | SE | No. | % survival | SE |
| 0 | 232 | 100 | - | 609 | 100 | - | 460 | 100 | - |
| 6 | 221 | 99 | 1 | 554 | 97 | 1 | 427 | 96 | 1 |
| 12 | 210 | 98 | 1 | 507 | 94 | 1 | 403 | 95 | 1 |
| 24 | 188 | 96 | 1 | 426 | 88 | 1 | 348 | 91 | 1 |
| 36 | 166 | 95 | 2 | 366 | 85 | 2 | 303 | 88 | 2 |
| 48 | 145 | 95 | 2 | 319 | 82 | 2 | 255 | 86 | 2 |
| 60 | 126 | 93 | 2 | 276 | 80 | 2 | 225 | 85 | 2 |
| 72 | 117 | 92 | 2 | 234 | 77 | 2 | 189 | 84 | 2 |
| 84 | 109 | 92 | 2 | 201 | 74 | 2 | 162 | 82 | 2 |
| 96 | 100 | 92 | 2 | 156 | 72 | 2 | 139 | 81 | 2 |
| 108 | 93 | 91 | 2 | 123 | 69 | 3 | 119 | 79 | 2 |
| 120 | 78 | 88 | 3 | 93 | 66 | 3 | 110 | 79 | 2 |

Figure 5.10 (a): Patient survival by dialysis modality analysis (not censored with change of modality)

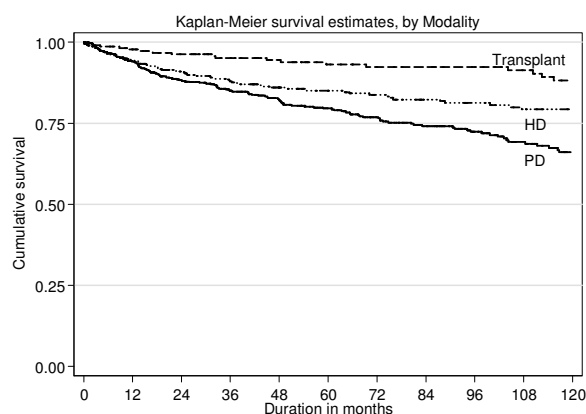


Figure 5.10 (b): Patient survival by dialysis modality analysis (censored with change of modality)

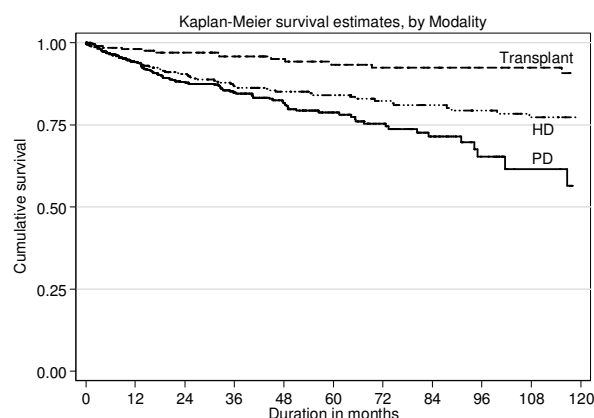


Table 5.10 (b): Patient survival by dialysis modality analysis (censored with change of modality)

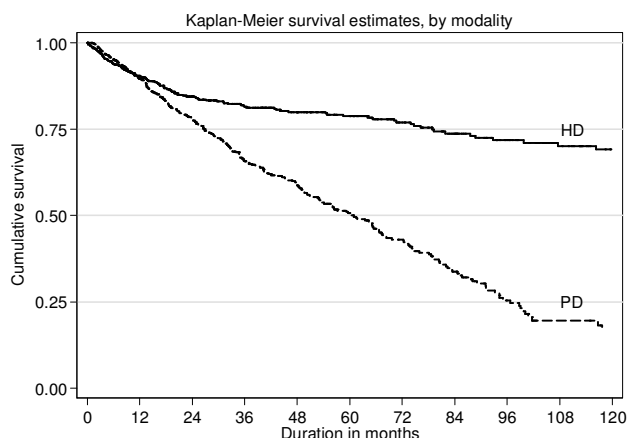
| Modality Interval (months) | Transplant | | | PD | | | HD | | |
|----------------------------|------------|------------|----|-----|------------|----|-----|------------|----|
| | No. | % survival | SE | No. | % survival | SE | No. | % survival | SE |
| 0 | 232 | 100 | - | 609 | 100 | - | 460 | 100 | - |
| 6 | 205 | 99 | 1 | 541 | 97 | 1 | 408 | 96 | 1 |
| 12 | 195 | 98 | 1 | 465 | 94 | 1 | 361 | 94 | 1 |
| 24 | 171 | 97 | 1 | 335 | 88 | 1 | 289 | 91 | 1 |
| 36 | 149 | 96 | 1 | 239 | 85 | 2 | 238 | 87 | 2 |
| 48 | 123 | 95 | 2 | 184 | 82 | 2 | 191 | 85 | 2 |
| 60 | 106 | 93 | 2 | 132 | 79 | 2 | 160 | 84 | 2 |
| 72 | 95 | 92 | 2 | 97 | 75 | 3 | 129 | 82 | 2 |
| 84 | 82 | 92 | 2 | 58 | 72 | 3 | 106 | 81 | 2 |
| 96 | 71 | 92 | 2 | 30 | 65 | 4 | 89 | 79 | 3 |
| 108 | 65 | 92 | 2 | 14 | 62 | 6 | 74 | 77 | 3 |
| 120 | 55 | 91 | 3 | 9 | 56 | 7 | 63 | 77 | 3 |

After the first year; dialysis technique failure rate was much higher amongst PD patients with progressive widening of the technique survival curve with increasing years on dialysis. Technique survival at 5 years was only 51% for PD compared to 79% for HD.

Table 5.11: Dialysis Technique Survival by Modality, 2000-2009

| Modality Interval (months) | PD | | | HD | | |
|-------------------------------|-----|------------|----|-----|------------|----|
| | No. | % survival | SE | No. | % survival | SE |
| 0 | 652 | 100 | - | 609 | 100 | - |
| 6 | 580 | 95 | 1 | 537 | 94 | 1 |
| 12 | 500 | 90 | 1 | 474 | 90 | 1 |
| 24 | 359 | 78 | 2 | 368 | 85 | 2 |
| 36 | 256 | 66 | 2 | 300 | 81 | 2 |
| 48 | 197 | 59 | 2 | 237 | 80 | 2 |
| 60 | 141 | 51 | 3 | 198 | 79 | 2 |
| 72 | 105 | 43 | 3 | 156 | 77 | 2 |
| 84 | 65 | 34 | 3 | 128 | 74 | 2 |
| 96 | 35 | 25 | 3 | 102 | 72 | 3 |
| 108 | 16 | 20 | 3 | 81 | 70 | 3 |
| 120 | 11 | 17 | 3 | 65 | 69 | 3 |

Figure 5.11: Dialysis Technique Survival by Modality, 2000-2009



The graft survival for paediatric transplants was 91% at 1 year, 78% at 5 years and 61% at 10 years.

Table 5.12: Transplant Graft Survival, 2000-2009

| Interval (month) | No. | % survival | SE |
|------------------|-----|------------|----|
| 0 | 237 | 100 | - |
| 6 | 209 | 91 | 2 |
| 12 | 199 | 91 | 2 |
| 24 | 175 | 87 | 2 |
| 36 | 153 | 84 | 2 |
| 48 | 127 | 80 | 3 |
| 60 | 110 | 78 | 3 |
| 72 | 98 | 75 | 3 |
| 84 | 84 | 70 | 4 |
| 96 | 72 | 68 | 4 |
| 108 | 65 | 65 | 4 |
| 120 | 55 | 61 | 4 |

Figure 5.12: Transplant Graft Survival, 2000-2009

