# CHAPTER 11

# PAEDIATRIC REPORT

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This year, as well as providing a summary of current trends in the frequency and causes of ESKD, the paediatric report will focus on current trends in the epidemiology and outcomes of paediatric transplantation.

# INCIDENCE AND PREVALENCE OF ESKD IN CHILDREN AND ADOLESCENTS 1991 - 2011

## GENERAL OVERVIEW

As shown in Figure 11.1, there is no clear long term trend in the incidence of children and adolescents developing ESKD and being treated with renal replacement therapy, although there are fluctuations from year to year. Prevalent numbers of treated ESKD have gradually increased across all age groups reflecting improved survival through increased duration of ESKD (Figure 11.2).

Figure 11.1

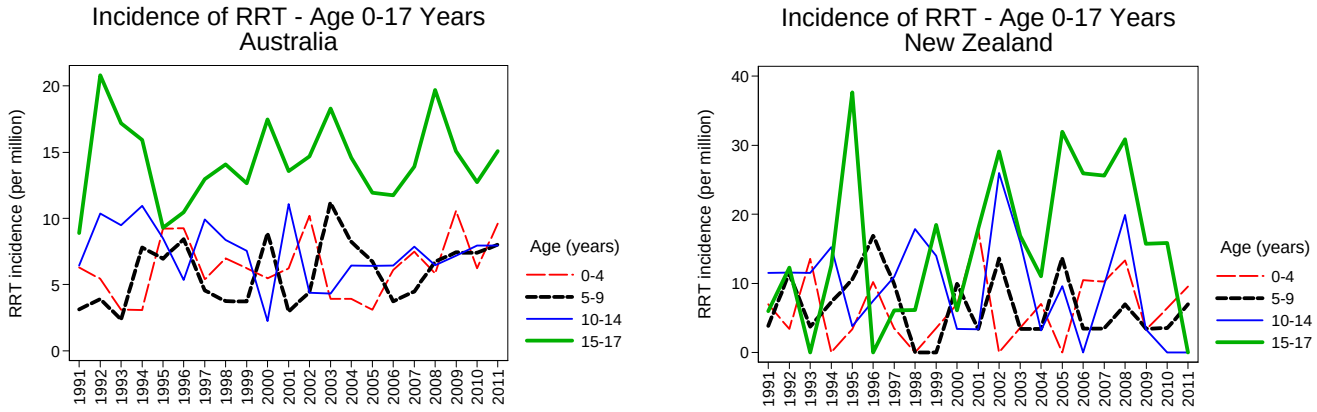
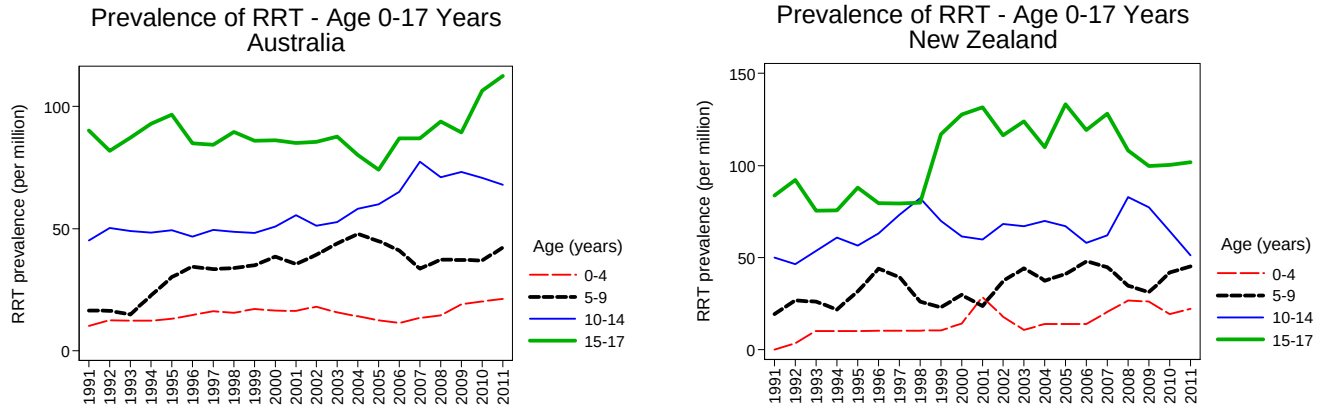



Figure 11.2



# CAUSES OF ESKD IN CHILDREN AND ADOLESCENTS 2006 - 2011

Overall, glomerulonephritis remains the most common cause of ESKD in children and adolescents (30%) but causes vary significantly with age. In young children renal hypoplasia/dysplasia is the most common cause while reflux nephropathy is a common cause of ESKD in adolescents.

Figure 11.3

Causes of End Stage Kidney Disease
In Children and Adolescents 2006 - 2011
Australia and New Zealand

| Primary Renal Disease | Age Groups (Years) | | | | Total |
|---|---|---|---|---|---|
| | 0-4 | 5-9 | 10-14 | 15-17 | |
| Glomerulonephritis | 13 (16%) | 17 (29%) | 23 (32%) | 38 (39%) | **91 (30%)** |
| Familial Glomerulonephritis | | | 1 (1%) | 3 (3%) | **4 (1%)** |
| Reflux Nephropathy | 3 (4%) | 3 (5%) | 5 (7%) | 11 (11%) | **22 (7%)** |
| Polycystic Kidney Disease | 8 (10%) | 3 (5%) | 1 (1%) | 1 (1%) | **13 (4%)** |
| Medullary Cystic Disease | | 1 (2%) | 3 (4%) | 4 (4%) | **8 (3%)** |
| Posterior Urethral Valve | 7 (9%) | 2 (3%) | 9 (13%) | 3 (3%) | **21 (7%)** |
| Haemolytic Uraemic Syndrome | 7 (9%) | 1 (2%) | 2 (3%) | 2 (2%) | **12 (4%)** |
| Hypoplasia / Dysplasia | 24 (30%) | 13 (22%) | 12 (17%) | 15 (15%) | **64 (21%)** |
| Diabetes | 2 (3%) | | 1 (1%) | | **3 (1%)** |
| Cortical Necrosis | 2 (3%) | 3 (5%) | 2 (3%) | 3 (3%) | **10 (3%)** |
| Interstitial Nephritis | | 1 (2%) | 1 (1%) | | **2 (1%)** |
| Cystinosis | | 1 (2%) | 1 (1%) | | **2 (1%)** |
| Uncertain | 1 (1%) | | | 6 (6%) | **7 (2%)** |
| Miscellaneous / Other | 13 (16%) | 14 (24%) | 10 (14%) | 12 (12%) | **49 (16%)** |
| **Total** | **80** | **59** | **71** | **98** | **308** |

# MODALITY OF TREATMENT 2006 - 2011

The modality of the first renal replacement treatment is shown in Figure 11.4. Although numbers are small and therefore fluctuate from year to year, around 20% of children and adolescents receive pre-emptive kidney transplants. Of the remainder, 37% commence renal replacement therapy with haemodialysis compared with 43% starting with peritoneal dialysis.

Figure 11.4

Modality of Initial Renal Replacement Therapy
By Year of First Treatment - Australia and New Zealand < 18 Years of Age at First Treatment

| Current Treatment | Year | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Total |
| Haemodialysis | 17 (41%) | 16 (31%) | 28 (46%) | 16 (30%) | 18 (38%) | 20 (37%) | **115 (37%)** |
| Peritoneal Dialysis | 16 (39%) | 26 (51%) | 23 (38%) | 29 (54%) | 19 (40%) | 23 (43%) | **136 (44%)** |
| Transplant | 8 (20%) | 9 (18%) | 10 (16%) | 9 (17%) | 10 (21%) | 11 (20%) | **57 (19%)** |
| **Total** | **41** | **51** | **61** | **54** | **47** | **54** | **308** |

For prevalent patients (Figure 11.5), a very different pattern is seen, with the great majority of children and adolescents with a functioning transplant. This reflects the relatively high rate of transplantation among children.

Figure 11.5

Modality of Treatment for all Patients in Australia and New Zealand
< 18 Years of Age at 31st December

| Current Treatment | Year | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Total |
| Haemodialysis | 23 (8%) | 24 (8%) | 35 (11%) | 29 (9%) | 30 (9%) | | **141 (7%)** |
| Peritoneal Dialysis | 35 (12%) | 55 (18%) | 54 (17%) | 57 (18%) | 50 (15%) | 81 (24%) | **332 (18%)** |
| Transplant | 236 (80%) | 230 (74%) | 225 (72%) | 229 (73%) | 245 (75%) | 253 (76%) | **1418 (75%)** |
| **Total** | **294** | **309** | **314** | **315** | **325** | **334** | **1891** |

# TRANSPLANT DEMOGRAPHICS

Figures 11.6-11.9 show the trends in paediatric transplantation over the 12- year period from 2000-2011. Live donor kidneys (living related and unrelated) mostly come from donors in the 35-44 year age group. In contrast, the proportion of deceased donors aged < 25 is higher than in living donors. There are no significant trends in the type of donor according to recipient age. The use of donor after cardiac death (DCD) kidneys in children and adolescents remains uncommon (~6%).

The time to first kidney transplant (Fig 11.8) has remained largely unchanged over this period.

Figure 11.6

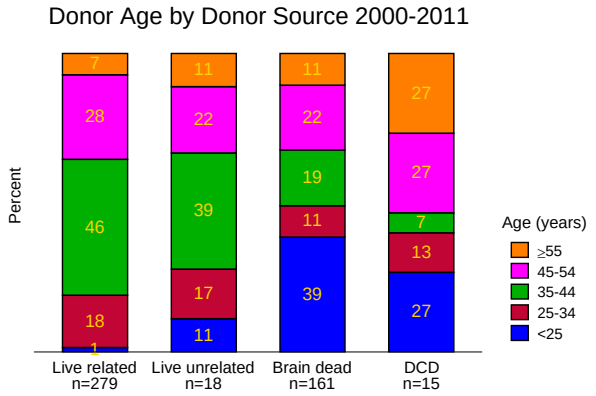



Figure 11.7

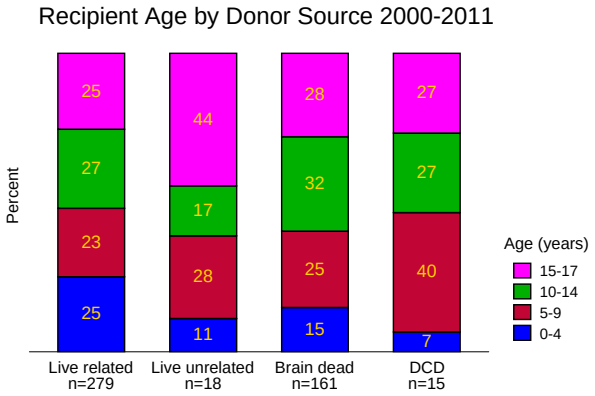



Figure 11.8

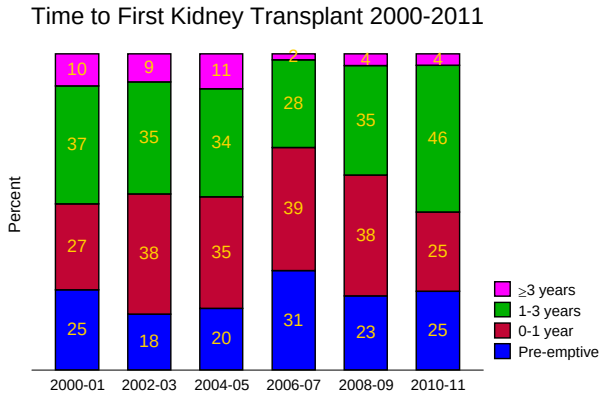



Figure 11.9

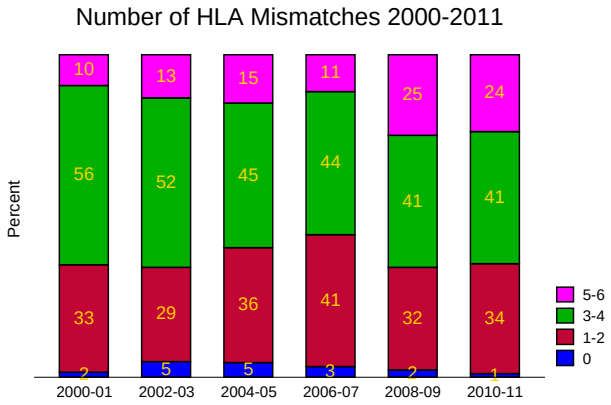


Figure 11.10

Graft numbers 2002 - 2011
Australia and New Zealand Recipients <18 Years of Age

| Graft numbers | Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
| 1 | 34 | 45 | 35 | 47 | 26 | 28 | 45 | 36 | 40 | 44 |
| 2 | 3 | 1 | 4 | 1 | 4 | 3 | 4 | 3 | 3 | 2 |

Figure 11.11

Donor Source by Year 2002 - 2011
Australia and New Zealand
Number (%) of Total Transplants in Recipients <18 Years of Age

| Donor Source | Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
| LD pre-emptive | 5 (14%) | 7 (15%) | 5 (13%) | 10 (21%) | 7 (23%) | 8 (26%) | 9 (18%) | 9 (23%) | 10 (23%) | 10 (22%) |
| LD not pre-emptive | 16 (43%) | 23 (50%) | 19 (49%) | 20 (42%) | 15 (50%) | 13 (42%) | 24 (49%) | 16 (41%) | 19 (44%) | 10 (22%) |
| DBD | 16 (43%) | 16 (35%) | 15 (38%) | 17 (35%) | 8 (27%) | 9 (29%) | 13 (27%) | 12 (31%) | 11 (26%) | 21 (46%) |
| DCD | 0 (0%) | 0 (0%) | 0 (0%) | 1 (2%) | 0 (0%) | 1 (3%) | 3 (6%) | 2 (5%) | 3 (7%) | 5 (11%) |
| **Total** | **37** | **46** | **39** | **48** | **30** | **31** | **49** | **39** | **43** | **46** |

Figure 11.12

Antibody Use for Induction Immunosuppression
Australia and New Zealand 2002 - 2011 Number of Transplant Recipients
Age <18 Years Receiving Each Agent By Year (% Total New Transplants)

| Agent | Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
| Muromonab-CD3 | 1 (3%) | - | - | - | - | - | - | - | - | - |
| Intravenous immunoglobulin | - | - | - | - | - | - | - | 1 (3%) | - | 2 (4%) |
| Anti-CD25 | 17 (46%) | 26 (57%) | 26 (67%) | 32 (67%) | 20 (67%) | 19 (61%) | 43 (88%) | 33 (85%) | 36 (84%) | 41 (89%) |
| Rituximab | - | - | - | - | - | - | 1 (2%) | - | 1 (2%) | - |
| T cell depleting polyclonal Ab | 3 (8%) | 2 (4%) | - | 1 (2%) | - | - | - | 1 (3%) | 2 (5%) | 2 (4%) |
| **Total new transplants** | **37** | **46** | **39** | **48** | **30** | **31** | **49** | **39** | **43** | **46** |

# IMMUNOSUPPRESSION

Tacrolimus continues to be the most commonly used calcineurin inhibitor (CNI) at induction and one year post-transplant. The proportion of patients on cyclosporin is higher in the five and ten year cohorts and reflects historical use of this agent. Within the 2005 cohort, 50% of patients were commenced on tacrolimus compared with 64% on tacrolimus at five years.

Mycophenolate is the most commonly used antimetabolite at induction and long term use has increased over time, with only a small proportion of patients treated with azathioprine aside from the five and ten year cohorts.

The proportion of prednisolone-free patients at induction has returned to zero, reflecting a trend since 2005 for virtually universal use of prednisolone at induction. Similarly, there are appears to be a trend since 2005 for a decreasing proportion of steroid-free use in longer term transplants.

Figure 11.13

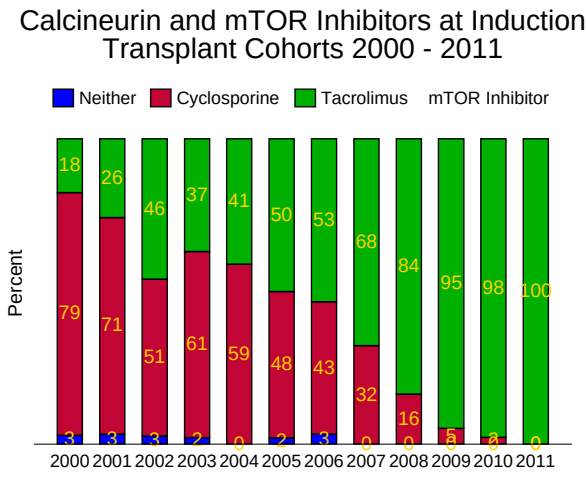



Figure 11.14

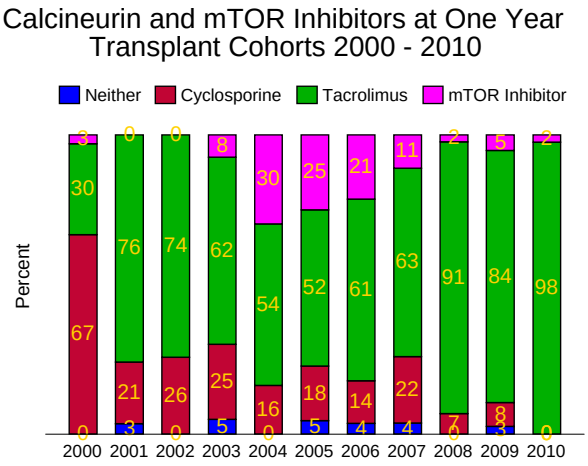



Figure 11.15

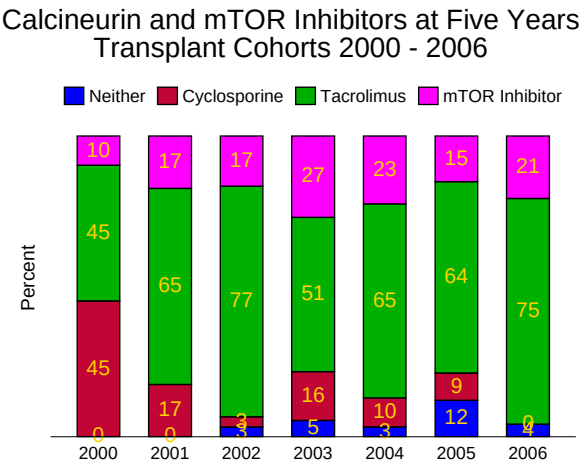
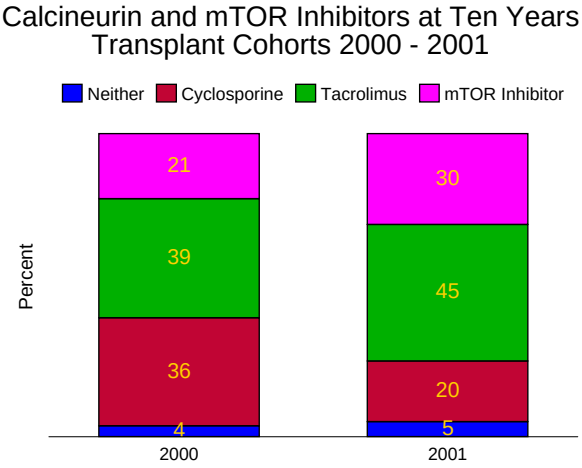



Figure 11.16



# IMMUNOSUPPRESSION

Figure 11.17

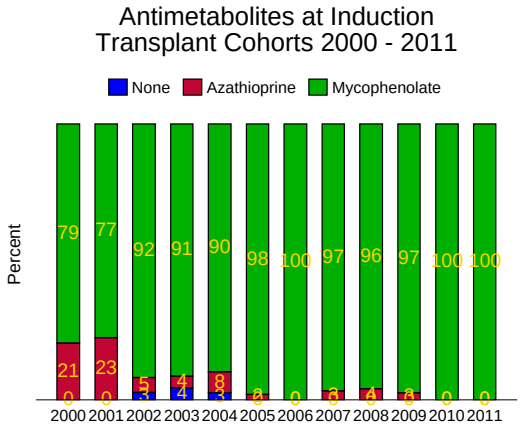



Figure 11.18

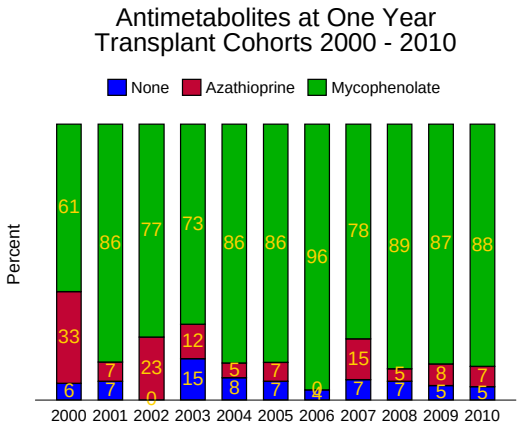



Figure 11.19

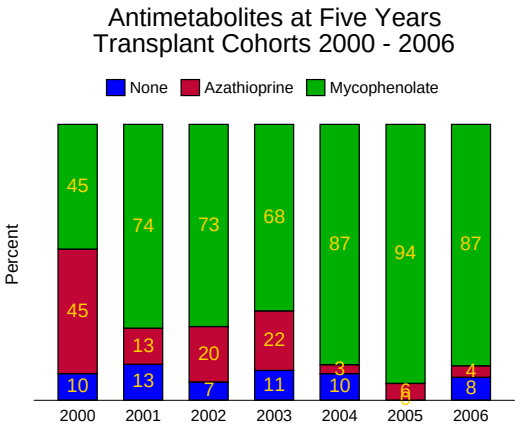



Figure 11.20

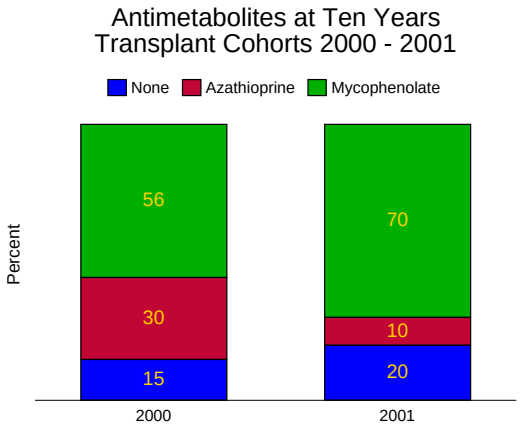
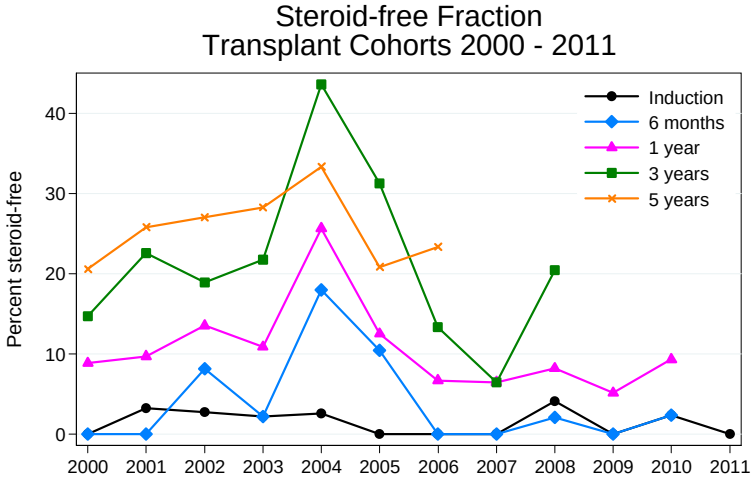



Figure 11.21



# TRANSPLANT OUTCOMES

Graft and patient survival for grafts performed in Australia and New Zealand on recipients aged < 18 years, calculated by the Kaplan-Meier method, is shown in Figure 11.22. Unadjusted one, three and five year survival have remained stable over the past ten years.

Figure 11.22

Recipient and Graft Survival
Recipients Aged <18 Years 2002 - 2011
% [95% Confidence Interval]

| Year | Survival | | | |
|---|---|---|---|---|
| | 6 months | 1 year | 3 years | 5 years |
| **Recipient Survival** | | | | |
| 2002-03 (n=83) | 93 [85-97] | 93 [85-97] | 92 [83-96] | 92 [83-96] |
| 2004-05 (n=87) | 100 | 99 [92-100] | 98 [91-99] | 96 [89-99] |
| 2006-07 (n=61) | 100 | 100 | 98 [89-100] | 98 [89-100] |
| 2008-09 (n=88) | 100 | 100 | 100 | - |
| 2010-11 (n=89) | 100 | 98 [87-100] | - | - |
| **Graft Survival** | | | | |
| 2002-03 (n=83) | 92 [83-96] | 90 [82-95] | 88 [79-93] | 81 [70-88] |
| 2004-05 (n=87) | 97 [90-99] | 95 [88-98] | 88 [79-94] | 76 [66-84] |
| 2006-07 (n=61) | 93 [83-97] | 90 [79-95] | 82 [70-90] | 80 [68-88] |
| 2008-09 (n=88) | 94 [87-98] | 94 [87-98] | 86 [76-92] | - |
| 2010-11 (n=89) | 100 | 96 [86-99] | - | - |

Figure 11.23

Causes of Graft Failure 2002 - 2011
By Age at Transplant

| Reason for Failure | Age Groups (Years) | | | | Total |
|---|---|---|---|---|---|
| | 0-4 | 5-9 | 10-14 | 15-17 | |
| Rejection - Acute | 1 (11%) | 2 (15%) | 2 (9%) | 5 (15%) | **10 (13%)** |
| Rejection - CAN | 1 (11%) | 4 (31%) | 12 (52%) | 11 (32%) | **28 (35%)** |
| Vascular rejection | - | 3 (23%) | - | 2 (6%) | **5 (6%)** |
| Technical reasons | 3 (33%) | - | 4 (17%) | 4 (12%) | **11 (14%)** |
| Recurrent disease | - | 3 (23%) | 3 (13%) | 1 (3%) | **7 (9%)** |
| Non-compliance | 1 (11%) | - | - | 5 (15%) | **6 (8%)** |
| Death with function | 2 (22%) | 1 (8%) | - | 3 (9%) | **6 (8%)** |
| Other | 1 (11%) | - | 2 (9%) | 3 (9%) | **6 (8%)** |
| **Total** | **9** | **13** | **23** | **34** | **79** |

Figure 11.24

Causes of Graft Failure 2002 - 2011
By Age at Failure

| Reason for Failure | Age Groups (Years) | | | | Total |
|---|---|---|---|---|---|
| | 0-4 | 5-9 | 10-14 | 15-17 | |
| Rejection - Acute | - | 3 (21%) | - | - | **3 (4%)** |
| Rejection - CAN | - | 4 (29%) | 13 (43%) | 18 (56%) | **35 (44%)** |
| Vascular rejection | - | 2 (14%) | 2 (7%) | 2 (6%) | **6 (8%)** |
| Technical reasons | 3 (75%) | - | 4 (13%) | 4 (13%) | **11 (14%)** |
| Recurrent disease | - | 1 (7%) | 5 (17%) | - | **6 (8%)** |
| Non-compliance | - | 1 (7%) | 1 (3%) | 3 (9%) | **5 (6%)** |
| Death with function | 1 (25%) | 2 (14%) | 2 (7%) | 2 (6%) | **7 (9%)** |
| Other | - | 1 (7%) | 3 (10%) | 3 (9%) | **7 (9%)** |
| **Total** | **4** | **14** | **30** | **32** | **80** |

# REJECTION

The proportions of patients experiencing at least one episode of acute rejection (biopsy proven or clinically diagnosed) in the first six months post-transplant, and between 6-24 months post transplant, have remained largely unchanged over the past five years (Figures 11.25 and 11.26). The majority of rejection episodes are either cellular or not biopsied (Figure 11.27).

Figure 11.25

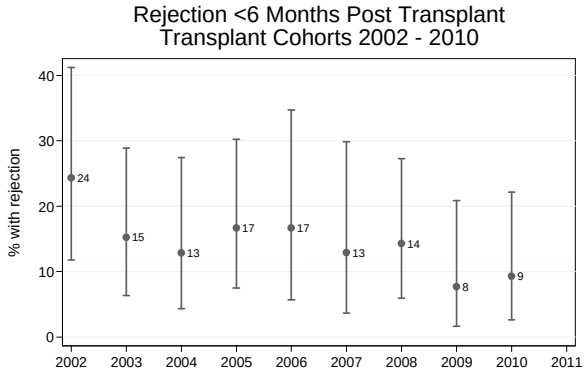



Figure 11.26

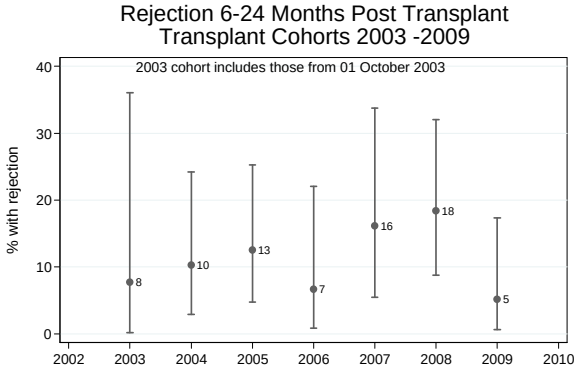



Figure 11.27

Type of Rejection 2002 - 2010

| Rejection <6 months Post Transplant | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| No biopsy | 1 | 1 | 3 | 5 | 6 | 2 | . | 1 | 3 |
| Cellular | 8 | 9 | 5 | 6 | 2 | 4 | 6 | 2 | 3 |
| ABMR | 1 | . | . | . | . | . | . | . | 1 |
| Cellular + ABMR | . | . | . | 1 | . | . | 1 | . | . |
| **Rejection 6-24 months Post Transplant** | * | * | | | | | | | |
| No biopsy | - | - | 2 | 3 | 1 | . | 1 | . | - |
| Cellular | - | - | 2 | 5 | 1 | 4 | 12 | 3 | - |
| ABMR | - | - | . | . | . | 1 | . | . | - |
| Cellular + ABMR | - | - | . | . | . | . | 1 | . | - |

* NOTE: Not collected until Oct 2003. ABMR - antibody-mediated rejection