

## CHAPTER 3

### DEATHS

Stephen McDonald  
Leonie Excell  
Brian Livingston



## INTRODUCTION

The format of the deaths chapter has been substantially revised for this report.

Observed survival for non-indigenous patients who started in the period 2000-2009 is shown in Figure 3.1. This data is censored at transplantation-survival after transplantation is covered in subsequent chapters, as is survival of indigenous people.

Crude unadjusted death rates for dialysis and transplantation are shown in Figure 3.2 for various groups and comparisons in 3.3. Rates are generally higher with older age, diabetes and coronary artery disease. The comparison between indigenous rates (and some other comparisons) will be subject to several confounders.

The evolution of death rates by year of starting dialysis is illustrated in Figure 3.4-3.7. Across both dialysis and transplantation, there are suggestions of a slight reduction in mortality rates among those who commenced dialysis in more recent years. Expected survival is a crucial part of counseling patients, but these “averages” must be interpreted in the context of individual patients .

Figure 3.1

Survival for People who Commenced Dialysis 2000—2009 (Non-Indigenous) % (95% CI)			
Age at Start	Time Period (Years)	Proportion Surviving Aust (95 % CI)	Proportion Surviving NZ (95 % CI)
0–24	1	97 (95–98)	96 (90–98)
	2	93 (89–96)	94 (86–98)
	5	89 (83–92)	81 (58–92)
25–44	1	97 (96–97)	98 (95–99)
	2	91 (90–98)	94 (89–96)
	5	79 (76–82)	70 (61–78)
45–64	1	91 (90–92)	90 (88–92)
	2	84 (82–85)	79 (76–82)
	5	59 (57–61)	49 (44–54)
65–74	1	85 (84–86)	84 (81–87)
	2	71 (70–73)	72 (68–75)
	5	39 (37–41)	34 (29–39)
75–84	1	79 (78–85)	73 (68–78)
	2	61 (60–63)	52 (46–58)
	5	24 (22–26)	20 (15–26)
85 +	1	67 (62–72)	61 (41–76)
	2	48 (42–54)	43 (25–60)
	5	15 (10–22)	16 (5–32)

Figure 3.2

Death Rates During Renal Replacement Therapy  
All Patients Included who Received Treatment During 2009

Group	Dialysis Mortality Rate (per 100 patient years, 95% CI)	Dialysis Number of Deaths Included in Analysis	Transplant Mortality Rate (per 100 patient years, 95% CI)	Transplant Number of Deaths Included in Analysis
<b>OVERALL</b>	15.4 (14.7–16.2)	1641	1.23 (1.08–1.40)	221
Australia	15.3 (14.5–16.2)	1340	1.20 (1.04–1.40)	182
New Zealand	18.8 (14.3–18.0)	301	1.36 (1.00–1.87)	39
<b>AGES (YEARS)</b>				
< 25	3.3 (1.5–7.3)	6	0.35 (0.17–0.74)	7
25–44	6.2 (5.0–7.9)	72	0.53 (0.37–0.74)	33
45–64	10.2 (9.3–11.2)	418	1.62 (1.36–1.92)	130
65–84	20.5 (19.3–21.8)	998	3.11 (2.36–4.09)	51
≥ 85	43.9 (37.4–51.7)	147	-	0
<b>DIABETES (AT RRT START)</b>				
Non-diabetic	13.0 (12.1–14.0)	758	0.98 (0.83–1.15)	150
Type 1	15.8 (11.7–21.3)	43	1.32 (0.86–2.06)	20
Type 2	18.5 (17.2–19.7)	840	4.35 (3.30–5.72)	51
<b>CORONARY ARTERY DISEASE (AT RRT START)</b>				
No	11.2 (10.4–12.0)	741	1.00 (0.86–1.17)	166
Yes	22.5 (21.1–24.0)	900	3.98 (3.06–5.19)	55
<b>INDIGENOUS</b>				
Non-Indigenous (Australia)	15.6 (14.8–16.6)	1170	1.13 (0.97–1.32)	165
Non-Indigenous (New Zealand)	17.3 (14.7–20.3)	145	1.36 (0.97–1.92)	33
Aboriginal /Torres Strait Islanders	14.3 (12.2–16.9)	147	5.17 (3.17–8.44)	16
Maori (in New Zealand)	17.5 (14.5–21.1)	111	2.26 (1.01–5.03)	6
Pacific People (in New Zealand)	11.2 (8.4–15.0)	48	Not calculated	0

Figure 3.3

Age Specific Mortality Rates for Patients Treated with Dialysis or Transplantation Relative to the Australian Population 2009

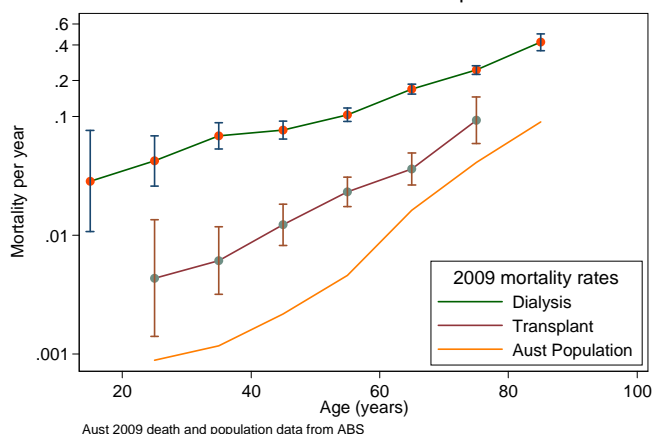
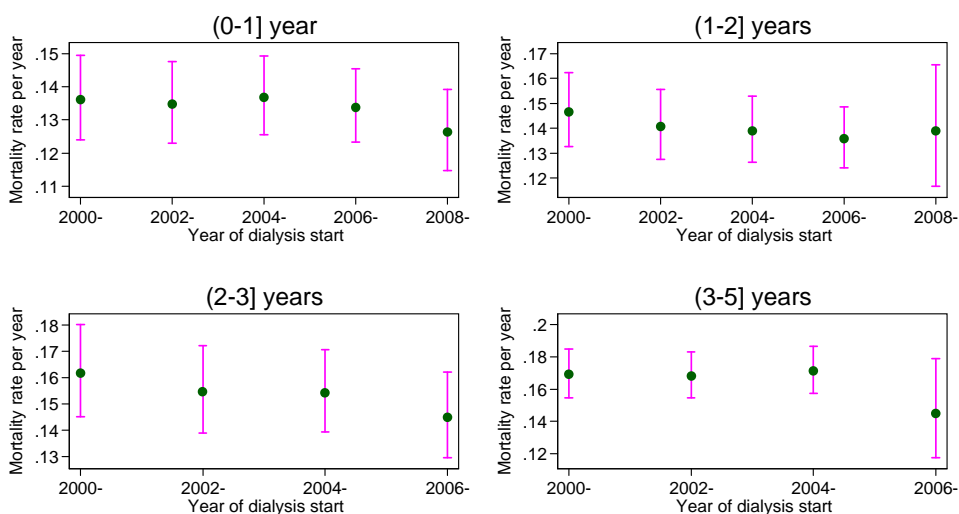




Figure 3.4

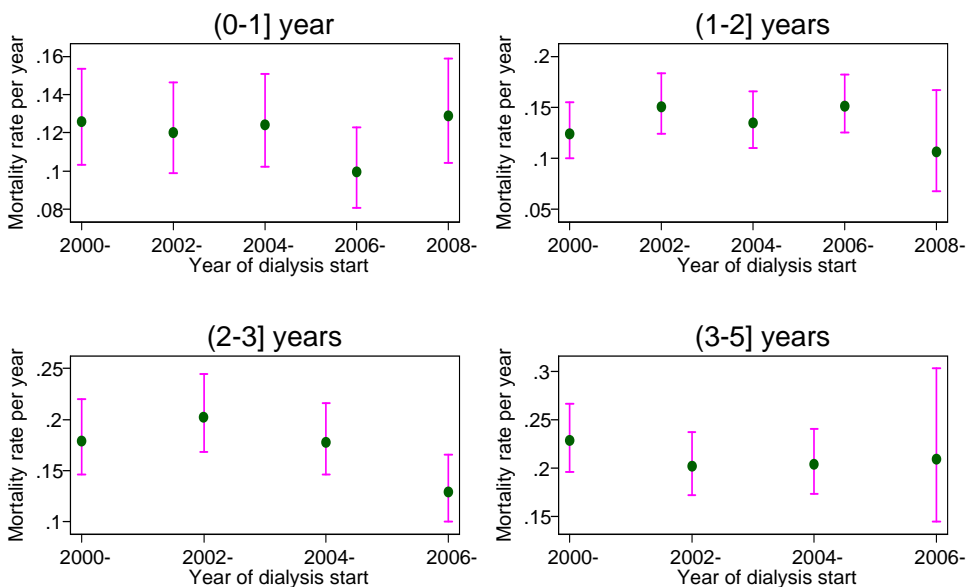
### Dialysis Mortality Rates Australia



ANZDATA, censored at transplantation  
Australia only

Figure 3.5

### Dialysis Mortality Rates New Zealand



ANZDATA, censored at transplantation  
NZ only

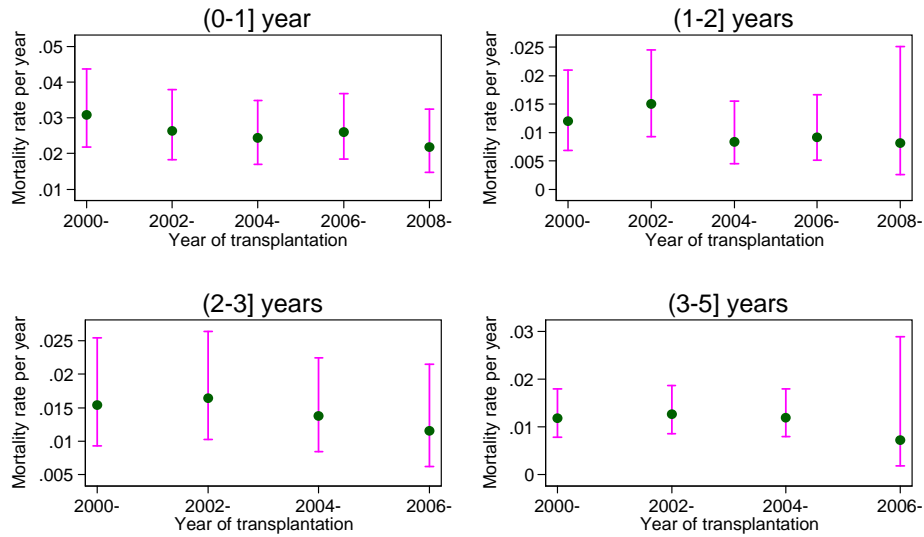
The bracket convention indicates which time points are included or excluded.

For example, (1-2] years indicated that the time periods includes from year 1 up to (but not including) 2 years.

Error bars indicate 95% confidence intervals around point estimates.

Figure 3.6

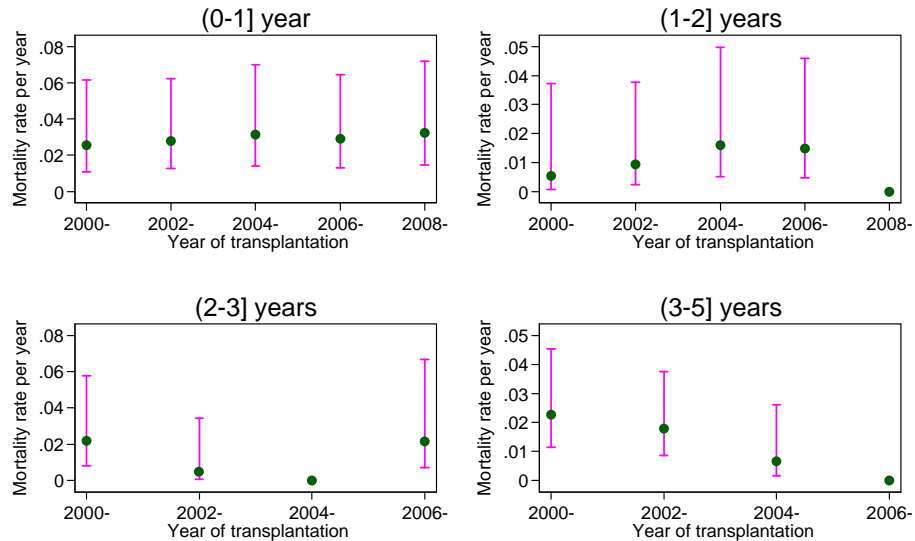
### Transplant Recipient Mortality Rates Australia



ANZDATA, survival of prevalent transplants, Australia only  
Includes deaths up to 30 days after transplant failure

Figure 3.7

### Transplant Recipient Mortality Rates New Zealand



ANZDATA, survival of prevalent transplants, NZ only  
Includes deaths up to 30 days after transplant failure; some CI not calculated due to small numbers

The bracket convention indicates which time points are included or excluded.

For example, (1-2] years indicated that the time periods includes from year 1 up to (but not including) 2 years.

Error bars indicate 95% confidence intervals around point estimates.



## CAUSE OF DEATHS

### AUSTRALIA

#### DIALYSIS DEPENDENT

The most common causes of death were “social causes” (37%), followed by cardiac (34%), infection (12%), vascular and miscellaneous both (9%).

Of the withdrawal of treatment from “social” causes, most were withdrawal related to psychosocial causes, followed by malignancy, cardiovascular, peripheral vascular, cerebrovascular and access problems. Thirty one percent were diabetics. There were four patients < 40 years of age (the youngest 30 years of age) and 187 patients were ≥ 80 years of age; the oldest was 95 years.

Myocardial infarction (16%) and “cardiac arrest” (15%) formed the majority of the cardiac group.

The site of infection was most commonly reported as “septicaemia”, followed by lung, peritoneum, wound and infection in other sites.

The details of the site and identity of the organisms can be found in Appendix II at the Website. ([anzdata.org.au/v1/annual\\_reports\\_download.html](http://anzdata.org.au/v1/annual_reports_download.html))

There were 71 patients (5%) who died from malignancy compared to 92 patients in 2008. A further 92 patients (6%) withdrew from dialysis due to malignancy.

#### FUNCTIONING TRANSPLANT

Among those with a functioning transplant, malignancy was the most common cause of death (27%), followed by cardiac (23%), then infection (20%), vascular (12%) and “social causes” (8%).

### DEATHS OF YOUNG ADULTS

#### 15-24 YEARS OF AGE

There were four deaths in the age group 15-24 years; three males and one female; one male was indigenous. There were two satellite, one home and one hospital haemodialysis dependent. All died from cardiac causes. The youngest was 22 years of age and two had previous failed transplants.

#### 25-34 YEARS OF AGE

There were 19 deaths in this age group; ten females and nine males. Fifteen were caucasoid, two indigenous and one each Indian and Pacific People. Three patients died with a functioning transplant. Fourteen were treated with haemodialysis (eight satellite, six hospital) and one each on home automated peritoneal dialysis and home CAPD. Five of the dialysis patients had previous failed transplants.

Causes of death were: satellite haemodialysis (two from infection, two cardiac and one each from withdrawal, suicide, a coroner’s case still pending and unexpected death at home). Hospital haemodialysis (two from infection and one each from withdrawal, malignancy, cardiac causes and a coroner’s case still pending).

#### 25-34 YEARS OF AGE (Continued)

Home CAPD and home automated peritoneal dialysis (one CVA and chronic respiratory failure respectively).

The functioning transplant deaths were caused by a motor vehicle accident, withdrawal and infection.

Six patients were diabetic; five were Type 1.

### NEW ZEALAND

#### DIALYSIS DEPENDENT

Cardiac events comprised the most common cause of death (45%). Other causes were “social” (25%), infection (14%), vascular (10%) and miscellaneous (7%).

Treatment withdrawal was reported in 83 patients (25%). Thirty six percent were diabetics. There was only one patient under 40 years of age; the youngest was 34 years and there were nine patients ≥ 80 years of age; the oldest was 88 years.

There were 12 patients (4%) who died from malignancy compared to 25 patients (7%) in 2008. A further 14 patients (4%) withdrew from dialysis in 2009 due to malignancy.

#### FUNCTIONING TRANSPLANT

Amongst the 34 deaths of patients with a functioning transplant, the causes were malignancy (50%), cardiac (26%), infection (9%) and “social causes” (6%). There were no deaths from vascular causes.

### DEATHS OF YOUNG ADULTS

#### 15-24 YEARS OF AGE

Two patients between 15-24 years of age died; one caucasoid and one Maori; both female and both 17 years of age.

One patient was hospital peritoneal dialysis dependent and died from an intra-operative air embolism and the other had a functioning transplant who died from a microglioma.

#### 25-34 YEARS OF AGE

Two patients between 25-34 years of age died: both males and caucasoid.

One was hospital haemodialysis dependent and died from withdrawal due to psychosocial causes and the other a functioning second transplant from cardiac causes. Neither were diabetic.

Figure 3.8

Cause of Death by RRT Modality 1-Jan-2009 to 31-Dec-2009

Cause of Death		Australia		New Zealand	
		Dialysis	Transplant	Dialysis	Transplant
<b>Cardiac</b>	Cardiac arrest	231	11	56	3
	Haemorrhagic Pericarditis	1	-	-	-
	Hyperkalaemia	9	-	-	-
	Hypertensive cardiac failure	3	-	-	1
	Myocardial infarction	116	6	27	2
	Myocardial infarction (presumed)	133	13	58	3
	Other causes of cardiac failure	15	1	5	-
	Pulmonary oedema	7	2	2	-
	<b>Sub Total</b>	<b>515 (34%)</b>	<b>33 (23%)</b>	<b>148 (45%)</b>	<b>9 (26%)</b>
<b>Infection</b>	CNS - bacterial	3	1	1	-
	Lung - bacterial	34	9	13	1
	Lung - viral	4 (i) (sf)	3 (cmv)	-	-
	Lung - fungal	2 (as) (ca)	2 (as)	-	-
	Lung - protozoa	-	1 (pn)	-	-
	Lung - other	6 (ni)	1 (ni)	2 (ni)	1 (ni)
	Urinary tract - bacterial	2	-	-	1
	Urinary tract - fungal	1 (ca)	-	-	-
	Wound - bacterial	20	1	-	-
	Wound - fungal	2 (ca)	-	-	-
	Wound - other	1 (ni)	-	-	-
	Shunt - bacterial	4	-	1	-
	Peritoneum - bacterial	23	1	11	-
	Peritoneum - fungal	3 (ca)	-	3 (ca)	-
	Peritoneum - other	-	-	1 (ni)	-
	Septicaemia - bacterial	48	5	3	-
	Septicaemia - fungal	-	2 (cr)	1 (ca)	-
	Septicaemia - other	9 (ni)	-	2 (ni)	-
	Liver - viral	3 (hb)	1 (hb)	1 (hb)	-
	Other site - bacterial	11	-	6	-
Other site - viral	-	1 (cmv)	-	-	
Other site - other	-	-	1 (ni)	-	
	<b>Sub Total</b>	<b>176 (12%)</b>	<b>28 (20%)</b>	<b>46 (14%)</b>	<b>3 (9%)</b>
<b>Vascular</b>	Bowel infarction	26	2	4	-
	Cerebrovascular accident	83	11	21	-
	Gastrointestinal haemorrhage	15	-	2	-
	Haemorrhage - dialysis access site	1	-	2	-
	Haemorrhage - elsewhere	6	1	-	-
	Pulmonary embolus	1	-	1	-
	Ruptured aortic aneurysm	5	3	2	-
	<b>Sub Total</b>	<b>137 (9%)</b>	<b>17 (12%)</b>	<b>32 (10%)</b>	<b>-</b>
<b>Social</b>	Accident	9	3	-	-
	Patient refused treatment	4	-	-	-
	Suicide	2	2	-	-
	Therapy ceased	9	1	2	-
	Withdrawal - access problems	25	-	-	-
	Withdrawal - cardiovascular	90	-	10	-
	Withdrawal - cerebrovascular	47	-	7	-
	Withdrawal - malignancy	92	1	14	-
	Withdrawal - peripheral vascular	62	-	13	-
Withdrawal - psychosocial	225	4	38	2	
	<b>Sub Total</b>	<b>565 (37%)</b>	<b>11 (8%)</b>	<b>83 (25%)</b>	<b>2 (6%)</b>
<b>Miscellaneous</b>	Cachexia	10	3	1	-
	Chronic respiratory failure	11	1	3	-
	Hepatic failure	8	1	1	-
	Malignancy	71	38	12	17
	Other	10	1	2	1
	Pancreatitis	11	1	2	-
	Perforation abdominal viscus	8	-	4	2
	Sclerosing peritonitis	1	-	-	-
	Uraemia caused by graft failure	-	4	-	1
Unknown	9	2	-	1	
	<b>Sub Total</b>	<b>132 (9%)</b>	<b>52 (37%)</b>	<b>22 (7%)</b>	<b>20 (59%)</b>
<b>Total (100%)</b>		<b>1525</b>	<b>141</b>	<b>331</b>	<b>34</b>

(as) aspergillus (ca) candida (cmv) cmv (cr) cryptococcus (hb) hepatitis b  
 (i) influenza (sf) swine flu (pn) pneumocystis (ni) organism not isolated



## DEATHS FROM MALIGNANCY

Figure 3.9

Deaths from Malignancy 2009  
By RRT Modality at Time of Death

Australia	Dialysis	Transplant	Total
<b>Adenocarcinoma</b>			
Breast	1	-	1
Caecum	-	2	2
Cholangiole	-	1	1
Colon	1	2	3
Endometrium	1	-	1
Gastrointestinal	1	-	1
Kidney	5	1	6
Lung	4	1	5
Oesophagus	1	1	2
Ovary	1	-	1
Pancreas	1	-	1
Peri-ureteric	1	-	1
Primary Unknown	2	-	2
Prostate	4	-	4
Rectum	-	3	3
Stomach	1	-	1
Uterus	-	1	1
<b>Leukaemia</b>	5	-	5
<b>Lymphoma</b>			
Bone Marrow	1	-	1
Brain	-	1	1
Groin	-	1	1
Lung	1	-	1
Tonsil	1	-	1
<b>Lymphoproliferative</b>			
Brain	-	1	1
Neck Nodes	-	1	1
<b>Melanoma - Skin</b>	5	3	8
<b>Merkel Cell</b>	1	2	3
<b>Microglioma</b>	1	-	1
<b>Myeloma</b>	13	1	14
<b>Squamous Cell Carcinoma</b>			
Anus	1	-	1
Lung	3	-	3
Palate	-	1	1
Skin	1 (*1)	12	13
Tongue	2 (*1)	-	2
Vulva	1	-	1
<b>Transitional Cell Carcinoma</b>			
Bladder	1	-	1
<b>Other</b>			
Hepatoma	1	1	2
Large Cell - lung	1	-	1
Schwannoma - lung	1	-	1
Small Cell - Lung	2	1	3
Small Cell - Lung and SCC Tongue	1	-	1
Unknown - basal ganglia	1	-	1
Unknown - colon	1	-	1
Unknown - lung	-	1	1
Unknown - primary unknown	2	-	2
<b>Total Deaths</b>	<b>71</b>	<b>38</b>	<b>109</b>

\* (Two patients) had previously been transplanted

## AUSTRALIA

During 2009 there were 109 deaths directly due to malignancies (71 among dialysis dependent and 38 among functioning transplant patients). Deaths were attributed by modality at time of death.

## DIALYSIS DEPENDENT

Twenty five patients had cancer diagnosed before or within one month of starting their first dialysis. A further eight tumours were identified between two and eight months after the first dialysis.

There were seventeen patients (never transplanted) who had dialysed for more than five years. Two patients had a previous renal transplant.

The myeloma patients had a median survival of 17 months from diagnosis (range <1 - 42 months).

## FUNCTIONING TRANSPLANT

There were 38 deaths in 2009 in this group, compared to 54 deaths in 2008.

Twenty one died from non-skin cancer: twelve from adenocarcinoma, two from lymphoma, two from lymphoproliferative disease, one from SCC of the palate, one from multiple myeloma and three from other types of malignancies (hepatoma, small cell of the lung and an unknown primary of the lung).

Seventeen died from skin cancer: twelve from squamous cell carcinoma, three from melanoma and two from Merkel cell.



## DEATHS FROM MALIGNANCY

### NEW ZEALAND

#### DIALYSIS DEPENDENT

There were 12 deaths due to malignancy in 2009 compared to 25 in 2008; four patients were diagnosed before or within one month of starting dialysis.

Two patients who were never transplanted had dialysed for five or more years. No patients had a previous renal transplant.

Four were diagnosed with adenocarcinoma, one each with leukaemia, lymphoma, myeloma, SCC of the lung, melanoma and three other types of malignancies (cholangioma of the gall bladder and two primary unknown tumours)

#### FUNCTIONING TRANSPLANT

There were 17 deaths: eight from squamous cell carcinoma (seven skin and one of the penis), three adenocarcinoma, one microglioma, one TCC of the bladder and four other types of malignancies: one each large cell (lung), mucoepidermoid (salivary gland), myelodysplasia (bone marrow) and sarcoid (prostate).

Figure 3.10

### Deaths from Malignancy 2009 By RRT Modality at Time of Death

New Zealand	Dialysis	Transplant	Total
<b>Adenocarcinoma</b>			
Breast	1	-	1
Gall Bladder	1	1	2
Kidney	1	1	2
Primary unknown	1	1	2
<b>Leukaemia</b>	1	-	1
<b>Lymphoma</b>			
Lymph Nodes	1	-	1
<b>Melanoma</b>	1	-	1
<b>Microglioma</b>	-	1	1
<b>Myeloma</b>	1	-	1
<b>Squamous Cell Carcinoma</b>			
Lung	1	-	1
Penis	-	1	1
Skin	-	7	7
<b>TCC</b>			
Bladder	-	1	1
<b>Other</b>			
Cholangioma - gall bladder	1	-	1
Large Cell - lung	-	1	1
Mucoepidermoid - salivary gland	-	1	1
Myelodysplasia - bone marrow	-	1	1
Sarcoid - prostate	-	1	1
Unknown - primary unknown	2	-	2
<b>Total Deaths</b>	<b>12</b>	<b>17</b>	<b>29</b>

No dialysis patients were previously transplanted



## DEATHS FROM WITHDRAWAL FROM TREATMENT RELATED TO MALIGNANCY

Figure 3.11

Deaths from Withdrawal from Treatment  
Due to Malignancy 2009  
By RRT Modality at Time of Death

Dialysis Dependent	Australia	New Zealand
<b>Adenocarcinoma</b>		
Breast	2	-
Colon	9	-
Colorectal	1	-
Kidney	7	-
Lung	4	1
Oesophagus	1	-
Pancreas	2	-
Primary Unknown	1	-
Prostate	4	-
Rectum	1	-
Stomach	2	-
Tongue	1	-
Uterus	1	-
<b>Leukaemia</b>	-	1
<b>Lymphoma</b>		
Multiple Nodes	2	-
Stomach	1	-
<b>Melanoma</b>	1	-
<b>Merkel Cell</b>	2	-
<b>Myeloma</b>	15	5
<b>Squamous Cell Carcinoma</b>		
Floor of Mouth	1	-
(L) Mandible	1	-
(R) Lung	1	-
Skin	2	2
<b>Transitional Cell Carcinoma</b>		
Bladder	6	1
Kidney	2	-
Urinary System	1	-
<b>Other</b>		
Carcinoid - colon	1	-
Carcinoid - gastro intestinal tract	1	-
Cholangiocarcinoma - pancreas	-	1
Fibrous histiocytoma	1	-
Glioblastoma - brain	1	-
Hepatoma - liver	2	-
Hodgkin's disease	1	-
Leiomyosarcoma - retroperitoneal	1	-
Papillary - thyroid	2	-
Poorly differentiated - small intestine	1	-
Sarcoma - lung	1	-
Small cell - lung	1	-
Unknown - lungs	2	-
Unknown - pancreas	1	-
Unknown - primary unknown	5	1
Unknown - prostate	-	1
Unknown - rectum	-	1
<b>Total Deaths</b>	<b>92</b>	<b>14</b>

### AUSTRALIA

During 2009 there were 92 deaths among dialysis patients attributed to withdrawal from treatment related to malignancy compared to 106 in 2008.

#### DIALYSIS DEPENDENT

Forty two of the 92 patients had cancer diagnosed before their first dialysis or within two months of commencing treatment. Seven further tumours were identified less than twelve months after the first dialysis.

There were 15 patients (never transplanted) who had dialysed for more than five years. Three patients had dialysed for less than two months and 13 patients had dialysed between two and six months before treatment was withdrawn.

Four patients withdrawing from dialysis treatment had a previous transplant.

There were 36 cases with adenocarcinoma, 15 with myeloma, nine with transitional cell carcinoma, five with squamous cell carcinoma, three with lymphoma, two with Merkel Cell and one with a melanoma. There were 21 other types of malignancies.

The myeloma patients had a median survival from diagnosis of 19.0 months (range 1-66 months).

#### FUNCTIONING TRANSPLANT

There was one patient in this group in 2009 who had treatment withdrawn due to a lymphoma of the brain.

### NEW ZEALAND

#### DIALYSIS DEPENDENT

Fourteen patients had withdrawal from treatment related to malignancy in 2009.

Eight of the fourteen patients had cancer diagnosed before their first dialysis or within a month of starting treatment.

There were five myeloma, two squamous cell of the skin, one adenocarcinoma of the lung, one leukaemia, one transitional cell carcinoma and four other types of malignancies.

Two patients (never transplanted) had dialysed for more than five years, one patient for less than two months and two patients between two and six months before treatment was withdrawn. Only one had a previous renal transplant.