UK Renal Registry 15th Annual Report: Chapter 3 Demographic and Biochemistry Profile of Kidney Transplant Recipients in the UK in 2011: national and centre-specific analyses

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Blood pressure · Bone metabolism · Chronic kidney disease · Deceased donor · eGFR · Epidemiology · Ethnicity · Graft function · Haemoglobin · Live donor · Outcomes · Renal transplantation · Survival

Summary

- There was a small increase in overall renal transplant numbers in 2011, with a continuing rise in kidney donation from donors after circulatory death (8%) and a slight fall in kidney donation from brainstem death donors.
- In 2011, death-censored renal transplant failure rates in prevalent patients were similar to previous years at 2.2% per annum. Transplant patient death rates remained stable at 2.3 per 100 patient years.
- The median age of incident and prevalent renal transplant patients in the UK was 49.0 and 51.7 years respectively.
- The median eGFR of prevalent renal transplant recipients was 51.3 ml/min/1.73 m^2.
- The median eGFR of patients one year post transplantation was 55.9 ml/min/1.73 m^2 post live transplant, 51.8 ml/min/1.73 m^2 post brainstem death transplant and 49.4 ml/min/1.73 m^2 post circulatory death transplantation.
- 13.6% of prevalent transplant patients had eGFR <30 ml/min/1.73 m^2.
- The median decline in eGFR slope beyond the first year after transplantation was -0.49 ml/min/1.73 m^2/year.
- In 2011, infection (23%), malignancy (21%), and cardiac disease (16%) remained amongst the commonest causes of death in patients with a functioning renal transplant.

Introduction

This chapter includes independent analyses regarding renal transplant activity and survival data from the UK Transplant Registry, held by the Organ Donation and Transplantation Directorate (ODT) of NHS Blood and Transplant (NHSBT). The UK Renal Registry (UKRR) has performed additional analyses of renal transplant recipient follow-up data examining demographics, clinical and biochemical variables. NHSBT records all the information regarding the episode of transplantation (donor and recipient details) and the UKRR holds additional information on key clinical and biochemical variables in renal transplant recipients. The co-operation between these two organisations results in a comprehensive database describing the clinical care delivered to renal transplant patients within the UK. This further allows for the comparison of key outcomes between centres and provides insight into the processes involved in the care of such patients in the UK.

This chapter is divided into six sections: (1) transplant activity, waiting list and survival data; (2) transplant demographics; (3) clinical and laboratory outcomes; (4) analysis of prevalent patients by chronic kidney disease (CKD) stage; (5) eGFR slope analysis; and (6) causes of death in transplant recipients. Methodology, results and conclusions of these analyses are discussed in detail for all six sections separately.

The UK Renal Registry methodology is described elsewhere [1]. The UKRR collects quarterly clinical data via an electronic data extraction process from hospital based renal IT systems on all patients receiving renal replacement therapy. Throughout the chapter, the number preceding the centre name in each figure indicates the percentage of missing data for that centre for that variable.

Unless otherwise specified, prevalent transplant patients were defined as patients with a functioning renal transplant on the 31st December 2011.

Transplant activity, waiting list activity and survival data

Introduction

NHSBT prospectively collects donor and recipient data around the episode of transplantation. They also request transplant centres provide an annual paper based data return on the status of the recipient's graft function. This enables ODT to generate comprehensive analyses of renal transplant activity and graft survival statistics.

NHSBT attributes a patient to the centre that performed the transplant operation irrespective of where the patient was cared for before or after the procedure and hence only reports on transplant centre performance.

Methods

In 2011, there were 23 UK adult renal transplant centres, 19 in England, 2 in Scotland and 1 each in Northern Ireland and Wales.

Comprehensive information from 1999 onwards concerning the number of patients on the transplant waiting list, the number of transplants performed, the number of deceased kidney donors (donor after brainstem death and donor after circulatory death), living kidney donors, patient survival and graft survival is available on the NHSBT website (http://www.organdonation.nhs.uk/ukt/statistics/statistics.asp).

Results

During 2011, 2,752 kidney or kidney plus other organ transplants were performed. The absolute number of living kidney donors showed little change in 2011 representing 37.3% of all transplants performed whilst donor after circulatory death transplants continued to increase and comprised 21.6% of all kidney transplants performed. The rise in numbers of transplants from donors after brainstem death noted in 2010 was reversed in 2011, showing a 4% decline (table 3.1).

There were small differences in one and five year risk-adjusted patient and graft survival rates amongst UK renal transplant centres (table 3.2). These graft survival rates include grafts with primary non-function (which are excluded from analysis by some countries).

Table 3.1. Kidney and kidney plus other organ transplant numbers in the UK, 1/1/2009–31/12/2011

Organ	2009	2010	2011	% change 2010–2011
Donor after brainstem death[a]	944	989	951	−4
Donor after circulatory death[b]	496	549	594	8
Living donor kidney	983	1,027	1,026	0
Kidney and liver	15	9	16	78
Kidney and heart	1	0	0	
Kidney and pancreas[c]	158	150	163	9
Small bowel (inc kidney)	3	1	2	100
Total kidney transplants	**2,600**	**2,725**	**2,752**	**1**

[a] Includes en bloc kidney transplants (3 in 2009, 7 in 2010, 7 in 2011) and double kidney transplants (6 in 2009, 6 in 2010, 5 in 2011)
[b] Includes en bloc kidney transplants (1 in 2009, 2 in 2010, 2 in 2011) and double kidney transplants (4 in 2009, 16 in 2010, 32 in 2011)
[c] Includes donor after circulatory death transplants (19 in 2009, 29 in 2010, 28 in 2011)

Table 3.2. Risk-adjusted first adult kidney transplant only, graft and patient survival percentage rates for UK centres*

	Deceased donor 1 year survival		Deceased donor 5 year survival		Living kidney donor 1 year survival		Living kidney donor 5 year survival	
Centre	Graft	Patient	Graft	Patient	Graft	Patient	Graft	Patient
B QEH	88	96	82	89	95	98	85	97
Belfast	92	96	88	92	94	100	97	93
Bristol	95	96	86	85	98	99	95	98
Camb	92	98	86	89	98	99	93	97
Cardff	94	98	86	88	94	98	86	97
Covnt	95	96	89	92	95	100	86	96
Edin	88	94	82	83	95	98	92	96
Glasgw	94	96	84	82	96	96	96	100
L Barts	92	93	86	91	97	98	86	94
L Guys	93	95	82	89	96	98	93	95
L Rfree	95	96	87	93	98	100	93	93
L St.G	94	98	86	92	100	100	89	97
L West	95	98	89	92	96	99	88	96
Leeds	94	96	85	89	96	100	91	97
Leic	91	89	84	83	95	97	92	93
Liv RI	91	97	80	94	95	100	88	92
M RI	95	95	85	88	98	98	92	97
Newc	93	94	83	86	98	99	92	95
Nottm	91	94	78	85	95	97	92	96
Oxford	95	97	89	86	97	96	96	95
Plymth	90	96	86	90	95	99	90	93
Ports	95	94	80	88	94	98	84	91
Sheff	90	99	81	92	100	100	88	100
All centres	**93**	**96**	**84**	**88**	**97**	**99**	**91**	**96**

* Information courtesy of NHSBT: number of transplants, patients and 95%CI for each estimate; statistical methodology for computing risk-adjusted estimates can be obtained from the NHSBT website (see http://www.organdonation.nhs.uk/ukt/statistics/statistics.asp)
Cohorts for survival rate estimation: 1 year survival: 1/1/2006–31/12/2010; 5 year survival: 1/1/2002–31/12/2006; first grafts only – re-grafts excluded for patient survival estimation. Since the cohorts to estimate 1- and 5-year survival are different, some centres may appear to have 5 year survival better than 1 year survival

Using data from the UKRR on prevalent renal-only transplant patients on 1st January 2011, the death rate during 2011 was 2.2/100 patient years (CI 2.0–2.4) when censored for return to dialysis and 2.3/100 patient years (CI 2.2–2.5) without censoring for dialysis. These death rates are similar to those observed over the last few years.

During 2011, 2.2% of prevalent transplant patients experienced graft failure (excluding death as a cause of graft failure). This is the second consecutive year when graft failure rates have fallen. Whilst it might be premature to assume that graft failure rates are falling in the UK the 0.5% fall noted in the last 5 years is certainly encouraging.

Conclusions

In 2011, the increased number of kidney transplants performed was mostly due to the growing use of organs from donors after circulatory death. Graft failure rates have fallen for the second consecutive year to 2.2% per annum whilst the patient death rate of 2.3 per 100 patient years was similar to recent years.

Transplant demographics

Introduction

Since 2008, all UK renal centres have established electronic linkage to the UKRR or Scottish Renal Registry, giving the UKRR complete coverage of individual patient level data across the UK. Hope Hospital has been renamed Salford Royal and so is now abbreviated in the report as 'Salford' rather than as 'M Hope' and 'Tyrone' and 'Derry' are now grouped together as 'West NI'.

The following sections need to be interpreted in the context of variable repatriation policies; some transplant centres continue to follow up and report on all patients they transplant, whereas others refer patients back to

non-transplant centres for most or all ongoing post-transplant care. Some transplant centres only refer back patients when their graft is failing. The time post-transplantation that a patient is referred back to their local centre varies between transplant centres. The UKRR is able to detect duplicate patients (being reported from both transplant and referring centres) and in such situations care is attributed to the referring centre. This process may result in some discrepancies in transplant numbers particularly in Oxford/Reading and Clywd/Liverpool RI.

Methods

Three centres (Bangor, Colchester and Liverpool Aintree) did not have any transplant patients and were excluded from some of the analyses. Their dialysis patients were included in the relevant dialysis population denominators. Wirral which previously was also excluded having not had any registered transplant patients has been included in this year's report having taken on transplant patients in 2011. The nine Scottish centres only submit limited laboratory data to the UKRR and were not included in the analyses on post-transplant outcomes.

For the analysis of primary renal diagnosis (PRD) in transplant recipients, a few centres were excluded from some of the take-on years because of concerns relating to the reliability of PRD coding (with these centres submitting a high percentage of uncertain or missing aetiology codes). This year, individuals with a primary renal diagnosis (PRD) 'glomerulonephritis biopsy unproven' were grouped within the 'glomerulonephritis' PRD group, rather than within 'uncertain' (as has been the case in previous reports) to reflect better coding and bringing the registry in line with coding methodology adopted in other renal registries.

Information on patient demographics (age, gender, ethnicity and PRD) for patients in a given renal centre was obtained from UKRR patient registration data fields. Individual patients were assigned to the centre that returned data for them during 2011. The prevalence of transplant patients in areas covered by individual primary care trusts (PCT) or Health Boards/Social Care Areas (HB) was estimated based on the post code of the registered address for patients on renal replacement therapy (RRT). Data on ethnic origin, supplied as Patient Administration System (PAS) codes, were retrieved from fields within renal centre IT systems. For the purpose of this analysis, patients were grouped into Whites, South Asians, Blacks, Others and Unknown. The details of ethnicity regrouping into the above categories are provided in appendix H: Coding http://www.renalreg.com. The UKRR requires a standard set of data items regarding comorbid conditions at the time of commencement of renal replacement therapy and first registration of the patient with the UKRR.

Results and discussion

Prevalent transplant numbers across the UK are described in table 3.3.

The prevalence of renal transplant recipients in each PCT/HB in England, Northern Ireland (Health and Social Care Trust Areas), Scotland (Health Boards) and Wales (Local Health Boards) and the proportion of prevalent patients according to modality in the renal centres across the UK is described in tables 3.4 and 3.5 respectively. After standardisation for age and gender, unexplained variability was evident in the prevalence of renal transplant recipients, with some areas having higher than the predicted number of prevalent transplant patients per million population and others lower. There are a number of potential explanations for these inconsistencies, including geographical differences in access to renal transplantation in the UK which is examined in greater detail in chapter 9 Access to Transplantation.

The proportion of prevalent RRT patients with a transplant relative to the number on dialysis has been relatively stable over the last decade.

Age and gender

The gender ratio amongst incident and prevalent transplant patients has remained stable for at least the last ten years (table 3.6, figure 3.1). Note absolute patient numbers differ from those published in previous reports as a result of additional data validation and reallocation of patients. The average age of incident transplant patients has steadily increased during the same time period. There has also been a gradual increase in the average age of prevalent transplant patients, which could reflect the increasing age at which patients are transplanted and/or improved survival after renal transplantation over the last few years. The prevalent transplant patient workload across the UK had increased to 26,297 patients at the end of 2011. The continued expansion of this patient group means there is a need for careful planning by renal centres for future service provision and resource allocation.

Table 3.3. The prevalence per million population (pmp) of renal transplants in adults in the UK on 31/12/2011

	England	N Ireland	Scotland	Wales	UK
All UK centres	22,011	707	2,197	1,382	26,297
Total population, mid-2011 estimates from ONS* (millions)	53.0	1.8	5.3	3.1	63.2
Prevalence pmp transplant	415	390	415	451	416

* Office of National Statistics, UK

Table 3.4. The prevalence per million population (pmp) of patients with a renal transplant and standardised rate ratio in the UK, as on 31st December 2007–2011

[a] PCT/HB = Primary Care Trust (England); Health and Social Care Trust Areas (Northern Ireland); Health Board (Scotland) and Local Health Board (Wales)
[b] Population numbers based on the 2010 mid-year estimates by age group and gender (data obtained from the Office of National Statistics)
[c] O/E = age and gender standardised acceptance rate ratio
PCTs with significantly high average rate ratios are bold in greyed areas
PCTs with significantly low average rate ratios are italicised in greyed areas
Blank cells = no data returned to the UKRR for that year
LCL = lower 95% confidence limit
UCL = upper 95% confidence limit

UK Area	PCT/HB[a]	Population covered[b]	Rate pmp					Age and gender standardised rate ratio 2011		
			2007	2008	2009	2010	2011	O/E[c]	LCL	UCL
North East	County Durham	510,800	378	390	397	413	431	0.99	0.86	1.12
	Darlington	100,600	358	378	338	368	417	0.97	0.72	1.31
	Gateshead	192,000	380	391	406	411	432	1.00	0.81	1.24
	Hartlepool	91,400	394	361	350	394	405	0.96	0.69	1.32
	Middlesbrough	**142,100**	**380**	**415**	**450**	**457**	**514**	**1.29**	**1.03**	**1.62**
	Newcastle	292,200	359	359	366	366	387	1.02	0.84	1.22
	North Tyneside	**198,400**	**484**	**494**	**514**	**565**	**590**	**1.35**	**1.13**	**1.62**
	Northumberland	312,100	401	407	407	391	442	0.96	0.81	1.13
	Redcar and Cleveland	**137,300**	**495**	**524**	**539**	**546**	**554**	**1.26**	**1.01**	**1.58**
	South Tyneside	154,100	422	422	428	415	461	1.07	0.85	1.35
	Stockton-on-Tees Teaching	192,600	337	384	400	395	384	0.90	0.72	1.14
	Sunderland Teaching	283,400	399	409	399	413	455	1.06	0.89	1.26
North West	Ashton, Leigh and Wigan	307,200	348	361	342	394	462	1.06	0.90	1.25
	Blackburn with Darwen Teaching	140,000	314	321	329	329	371	0.96	0.73	1.26
	Blackpool	140,200	285	335	342	342	342	0.79	0.60	1.05
	Bolton Teaching	**266,500**	**390**	**432**	**439**	**454**	**507**	**1.22**	**1.03**	**1.45**
	Bury	183,500	360	349	409	409	420	0.99	0.79	1.24
	Central and Eastern Cheshire	*457,200*	*302*	*304*	*306*	*341*	*361*	*0.81*	*0.69*	*0.94*
	Central Lancashire	459,200	296	318	329	359	388	0.90	0.78	1.04
	Cumbria Teaching	*494,400*	*316*	*332*	*372*	*394*	*394*	*0.86*	*0.75*	*0.99*
	East Lancashire Teaching	381,200	399	412	409	407	438	1.03	0.88	1.20
	Halton and St Helens	296,700	283	310	327	361	381	0.88	0.73	1.06
	Heywood, Middleton and Rochdale	205,000	390	405	420	429	468	1.14	0.93	1.39
	Knowsley	149,200	308	315	342	355	342	0.83	0.63	1.09
	Liverpool	445,300	310	332	350	375	409	1.03	0.89	1.19
	Manchester Teaching	498,800	233	247	249	297	333	0.95	0.81	1.10
	North Lancashire Teaching	*329,100*	*319*	*313*	*310*	*304*	*310*	*0.71*	*0.59*	*0.86*
	Oldham	219,600	351	369	387	410	414	1.02	0.83	1.25
	Salford	229,100	266	306	327	362	388	0.97	0.79	1.20
	Sefton	272,800	323	301	319	356	363	0.83	0.68	1.01
	Stockport	284,700	330	351	376	400	418	0.96	0.80	1.15
	Tameside and Glossop	250,700	415	415	423	459	503	1.18	0.99	1.40
	Trafford	217,100	290	309	299	336	359	0.85	0.68	1.06
	Warrington	199,100	387	387	417	387	402	0.92	0.74	1.14
	Western Cheshire	234,300	333	324	367	393	410	0.94	0.77	1.14
	Wirral	*308,800*	*298*	*324*	*340*	*350*	*353*	*0.83*	*0.68*	*1.00*
Yorkshire and the Humber	Barnsley	227,500	347	374	378	400	413	0.95	0.77	1.16
	Bradford and Airedale Teaching	**512,700**	**363**	**392**	**419**	**447**	**453**	**1.18**	**1.04**	**1.34**
	Calderdale	**202,800**	**414**	**454**	**464**	**498**	**533**	**1.24**	**1.03**	**1.50**
	Doncaster	290,900	313	333	358	364	395	0.92	0.77	1.10
	East Riding of Yorkshire	*338,500*	*301*	*331*	*357*	*369*	*381*	*0.83*	*0.70*	*0.99*
	Hull Teaching	263,800	322	341	364	371	394	0.98	0.81	1.19

Table 3.4. Continued

UK Area	PCT/HB[a]	Population covered[b]	Rate pmp					Age and gender standardised rate ratio 2011		
			2007	2008	2009	2010	2011	O/E[c]	LCL	UCL
Yorkshire and the Humber	Kirklees	409,900	403	403	415	432	456	1.11	0.96	1.28
	Leeds	798,700	287	300	318	344	369	0.95	0.85	1.07
	North East Lincolnshire	158,800	283	321	346	365	403	0.95	0.74	1.21
	North Lincolnshire	*157,500*	*273*	*279*	*260*	*267*	*273*	*0.61*	*0.46*	*0.83*
	North Yorkshire and York	802,100	322	363	385	403	423	0.96	0.87	1.07
	Rotherham	254,300	326	362	381	421	456	1.06	0.88	1.27
	Sheffield	555,700	266	299	319	355	378	0.95	0.83	1.09
	Wakefield District	325,500	304	323	320	353	372	0.85	0.71	1.02
East Midlands	*Bassetlaw*	*112,100*	*294*	*294*	*285*	*312*	*303*	*0.67*	*0.48*	*0.94*
	Derby City	247,100	239	259	308	364	393	0.99	0.81	1.20
	Derbyshire County	*729,900*	*281*	*296*	*300*	*319*	*353*	*0.79*	*0.70*	*0.89*
	Leicester City	**306,800**	**469**	**495**	**567**	**567**	**610**	**1.63**	**1.42**	**1.89**
	Leicestershire County and Rutland	687,200	354	386	391	418	435	1.00	0.89	1.12
	Lincolnshire Teaching	*705,000*	*278*	*292*	*296*	*312*	*333*	*0.75*	*0.66*	*0.85*
	Northamptonshire Teaching	687,600	305	352	368	394	414	0.97	0.86	1.08
	Nottingham City	306,300	232	235	248	323	340	0.95	0.78	1.15
	Nottinghamshire County Teaching	668,000	314	328	347	391	424	0.96	0.86	1.08
West Midlands	Birmingham East and North	409,300	327	352	366	381	408	1.08	0.93	1.26
	Coventry Teaching	315,700	323	348	361	383	409	1.06	0.89	1.26
	Dudley	*307,500*	*273*	*276*	*289*	*302*	*315*	*0.73*	*0.60*	*0.89*
	Heart of Birmingham Teaching	**285,100**	**372**	**396**	**400**	**414**	**414**	**1.25**	**1.05**	**1.50**
	Herefordshire	*179,400*	*290*	*284*	*307*	*307*	*318*	*0.69*	*0.54*	*0.90*
	North Staffordshire	211,900	316	335	359	363	387	0.87	0.70	1.08
	Sandwell	292,900	335	355	372	376	386	0.96	0.80	1.16
	Shropshire County	*293,400*	*293*	*307*	*348*	*358*	*372*	*0.82*	*0.68*	*0.99*
	Solihull	*206,300*	*291*	*301*	*305*	*310*	*330*	*0.77*	*0.60*	*0.97*
	South Birmingham	342,200	316	345	345	380	397	1.03	0.87	1.21
	South Staffordshire	*611,300*	*294*	*319*	*329*	*345*	*357*	*0.80*	*0.70*	*0.91*
	Stoke on Trent	248,000	319	359	387	419	415	1.00	0.82	1.21
	Telford and Wrekin	*162,400*	*216*	*246*	*289*	*302*	*308*	*0.73*	*0.55*	*0.96*
	Walsall Teaching	256,800	339	358	382	401	428	1.04	0.87	1.26
	Warwickshire	536,200	360	364	382	425	457	1.04	0.91	1.17
	Wolverhampton City	*239,300*	*272*	*288*	*309*	*309*	*305*	*0.75*	*0.60*	*0.95*
	Worcestershire	*557,300*	*280*	*291*	*316*	*341*	*350*	*0.78*	*0.68*	*0.90*
East of England	Bedfordshire	416,300	315	336	363	380	389	0.90	0.77	1.05
	Cambridgeshire	616,400	290	321	359	393	412	0.97	0.86	1.10
	Hertfordshire	1,107,500	276	331	351	395	415	0.99	0.90	1.08
	Great Yarmouth and Waveney	*214,700*	*163*	*224*	*284*	*303*	*317*	*0.72*	*0.57*	*0.91*
	Luton	198,900	342	357	367	402	458	1.21	0.98	1.48
	Mid Essex	374,500	296	318	360	379	425	0.97	0.83	1.13
	Norfolk	*764,800*	*306*	*310*	*329*	*339*	*350*	*0.80*	*0.71*	*0.90*
	North East Essex	329,500		285	307	325	355	0.84	0.70	1.00
	Peterborough	173,600	271	265	311	323	363	0.90	0.70	1.15
	South East Essex	*338,200*	*263*	*299*	*337*	*343*	*343*	*0.80*	*0.66*	*0.95*
	South West Essex	410,000	290	305	329	366	388	0.93	0.80	1.09
	Suffolk	*601,900*	*286*	*297*	*331*	*349*	*380*	*0.87*	*0.77*	*0.99*
	West Essex	286,400	276	279	328	360	367	0.85	0.71	1.04
London	Barking and Dagenham	179,700	262	273	339	362	428	1.19	0.95	1.48
	Barnet	**348,000**	**414**	**422**	**486**	**517**	**578**	**1.43**	**1.25**	**1.64**
	Bexley	**228,300**	**434**	**456**	**473**	**512**	**526**	**1.27**	**1.06**	**1.52**
	Brent Teaching	**256,300**	**476**	**648**	**706**	**741**	**757**	**1.90**	**1.65**	**2.19**

Table 3.4. Continued

UK Area	PCT/HB[a]	Population covered[b]	Rate pmp					Age and gender standardised rate ratio 2011		
			2007	2008	2009	2010	2011	O/E[c]	LCL	UCL
London	Bromley	312,400	416	435	448	483	493	1.17	1.00	1.37
	Camden	235,500	276	344	386	408	454	1.17	0.97	1.42
	City and Hackney Teaching	231,000	277	312	338	359	359	0.96	0.78	1.19
	Croydon	345,400	310	327	368	379	411	1.00	0.85	1.18
	Ealing	**318,300**	**437**	**566**	**587**	**631**	**653**	**1.62**	**1.41**	**1.85**
	Enfield	**295,000**	**414**	**461**	**468**	**505**	**573**	**1.43**	**1.23**	**1.66**
	Greenwich Teaching	**228,100**	**307**	**333**	**395**	**438**	**469**	**1.22**	**1.01**	**1.47**
	Hammersmith and Fulham	169,800	283	347	436	471	477	1.22	0.98	1.51
	Haringey Teaching	**225,100**	**360**	**413**	**466**	**511**	**555**	**1.40**	**1.17**	**1.66**
	Harrow	**230,300**	**456**	**595**	**664**	**725**	**738**	**1.79**	**1.54**	**2.08**
	Havering	*236,100*	*263*	*280*	*305*	*313*	*335*	*0.79*	*0.64*	*0.99*
	Hillingdon	**266,200**	**334**	**432**	**488**	**526**	**575**	**1.45**	**1.24**	**1.70**
	Hounslow	**236,700**	**342**	**444**	**515**	**566**	**575**	**1.43**	**1.21**	**1.69**
	Islington	**193,900**	**397**	**433**	**474**	**511**	**536**	**1.39**	**1.15**	**1.69**
	Kensington and Chelsea	169,500	277	342	360	431	448	1.06	0.85	1.33
	Kingston	169,000	349	373	391	396	414	1.03	0.81	1.30
	Lambeth	284,400	281	316	359	359	394	1.01	0.84	1.21
	Lewisham	266,400	402	398	420	439	458	1.15	0.96	1.37
	Newham	**240,200**	**287**	**316**	**387**	**441**	**466**	**1.31**	**1.09**	**1.58**
	Redbridge	**270,300**	**314**	**363**	**392**	**474**	**499**	**1.27**	**1.07**	**1.50**
	Richmond and Twickenham	190,800	204	257	294	309	341	0.80	0.63	1.02
	Southwark	**287,100**	**401**	**404**	**460**	**491**	**526**	**1.35**	**1.15**	**1.58**
	Sutton and Merton	403,000	362	375	409	427	442	1.08	0.93	1.25
	Tower Hamlets	238,100	235	231	265	315	323	0.92	0.74	1.15
	Waltham Forest	**227,400**	**378**	**405**	**431**	**475**	**510**	**1.32**	**1.10**	**1.59**
	Wandsworth	289,200	342	349	353	373	422	1.10	0.92	1.31
	Westminster	253,400	233	320	395	430	430	1.06	0.88	1.28
South East Coast	Brighton and Hove City	258,400	267	290	313	344	364	0.91	0.74	1.11
	East Sussex Downs and Weald	*336,100*	*271*	*301*	*318*	*327*	*342*	*0.78*	*0.65*	*0.93*
	Eastern and Coastal Kent	742,200	298	346	380	406	441	1.04	0.93	1.16
	Hastings and Rother	179,700	295	312	312	328	351	0.79	0.62	1.01
	Medway	256,600	316	378	413	417	429	1.02	0.85	1.24
	Surrey	1,114,400	337	354	371	386	391	0.91	0.83	1.00
	West Kent	685,100	343	371	401	404	410	0.95	0.85	1.07
	West Sussex	*800,000*	*318*	*338*	*345*	*364*	*381*	*0.88*	*0.78*	*0.98*
South Central	**Berkshire East**	**406,500**	**364**	**408**	**445**	**504**	**526**	**1.29**	**1.13**	**1.48**
	Berkshire West	**471,500**	**375**	**409**	**445**	**454**	**477**	**1.15**	**1.01**	**1.31**
	Buckinghamshire	512,100	414	420	426	453	467	1.08	0.96	1.23
	Hampshire	1,297,200	325	358	373	392	405	0.93	0.85	1.01
	Isle of Wight National Health Service	*140,200*	*257*	*307*	*321*	*335*	*335*	*0.74*	*0.55*	*0.98*
	Milton Keynes	247,000	312	332	352	393	429	1.03	0.85	1.24
	Oxfordshire	624,200	394	409	413	433	449	1.09	0.97	1.22
	Portsmouth City Teaching	207,200	333	362	362	405	401	1.05	0.85	1.30
	Southampton City	239,800	334	342	354	350	396	1.06	0.86	1.29
South West	*Bath and North East Somerset*	*179,800*	*284*	*289*	*323*	*311*	*306*	*0.75*	*0.58*	*0.98*
	Bournemouth and Poole Teaching	310,800	357	347	344	354	376	0.91	0.76	1.09
	Bristol	**441,100**	**385**	**419**	**431**	**460**	**472**	**1.23**	**1.07**	**1.41**
	Cornwall and Isles of Scilly	537,900	368	405	431	441	465	1.04	0.92	1.17
	Devon	749,700	328	351	384	400	403	0.90	0.81	1.01
	Dorset	404,900	403	427	437	454	452	1.00	0.86	1.16
	Gloucestershire	*593,600*	*322*	*334*	*335*	*345*	*382*	*0.88*	*0.77*	*1.00*

Table 3.4. Continued

UK Area	PCT/HB[a]	Population covered[b]	Rate pmp					Age and gender standardised rate ratio 2011		
			2007	2008	2009	2010	2011	O/E[c]	LCL	UCL
South West	North Somerset	212,100	344	368	391	415	424	0.96	0.78	1.18
	Plymouth Teaching	**258,900**	**417**	**463**	**498**	**506**	**537**	**1.35**	**1.14**	**1.59**
	Somerset	525,500	352	352	371	390	424	0.96	0.84	1.09
	South Gloucestershire	264,900	430	438	442	464	479	1.12	0.94	1.34
	Swindon	206,900	314	348	358	420	440	1.04	0.85	1.28
	Torbay	134,400	335	394	446	469	491	1.11	0.87	1.42
	Wiltshire	459,800	296	313	318	352	381	0.87	0.75	1.01
Wales	*Betsi Cadwaladr University*	*678,500*	*314*	*333*	*343*	*355*	*368*	*0.84*	*0.74*	*0.95*
	Powys Teaching	131,100	336	359	374	412	404	0.87	0.67	1.14
	Hywel Dda	374,800	358	382	398	398	424	0.96	0.82	1.12
	Abertawe Bro Morgannwg University	**504,800**	**428**	**442**	**468**	**501**	**563**	**1.32**	**1.17**	**1.48**
	Cwm Taf	**290,600**	**516**	**544**	**578**	**643**	**678**	**1.61**	**1.40**	**1.85**
	Aneurin Bevan	**561,300**	**433**	**451**	**472**	**515**	**534**	**1.25**	**1.12**	**1.40**
	Cardiff and Vale University	**466,100**	**390**	**408**	**414**	**446**	**478**	**1.22**	**1.07**	**1.39**
Scotland	Ayrshire & Arran	366,900	376	403	398	395	395	0.88	0.75	1.04
	Borders	113,000	310	363	372	434	434	0.94	0.71	1.24
	Dumfries and Galloway	148,100	344	371	392	392	412	0.89	0.69	1.14
	Fife	364,800	296	318	326	345	370	0.85	0.72	1.01
	Forth Valley	*293,100*	*297*	*307*	*304*	*324*	*348*	*0.80*	*0.66*	*0.97*
	Grampian	550,500	345	358	391	407	420	0.96	0.84	1.09
	Greater Glasgow & Clyde	**1,204,100**	**409**	**428**	**434**	**445**	**462**	**1.09**	**1.01**	**1.19**
	Highland	310,700	380	435	489	518	515	1.12	0.96	1.30
	Lanarkshire	562,700	370	389	411	423	448	1.04	0.92	1.17
	Lothian	*837,000*	*307*	*327*	*338*	*356*	*375*	*0.89*	*0.80*	*1.00*
	Orkney	19,800	455	556	455	404	404	0.86	0.43	1.73
	Shetland	22,500	267	222	267	267	222	0.49	0.21	1.19
	Tayside	402,400	417	432	430	432	440	1.02	0.88	1.18
	Western Isles	26,500	302	302	302	302	302	0.65	0.33	1.30
Northern Ireland	Belfast	335,700	375	378	399	441	450	1.15	0.98	1.35
	Northern	458,600	325	347	360	375	392	0.95	0.82	1.10
	Southern	357,700	296	296	299	319	358	0.91	0.77	1.09
	South Eastern	347,100	340	354	363	366	398	0.95	0.81	1.13
	Western	299,900	293	303	320	340	357	0.89	0.74	1.08

Primary renal diagnosis

The overall proportion of patients with a PRD of glomerulonephritis was slightly higher than that reported in previous reports as a consequence of reclassifying 'glomerulonephritis biopsy unproven' this year (as discussed in methods). This change in methodology notwithstanding the primary renal diagnosis of patients receiving kidney transplants in the UK has remained relatively stable over the last five years (table 3.7).

Ethnicity

It was difficult to compare the proportion of patients within each ethnic group receiving a transplant to those commencing dialysis from the same group because data on ethnicity were missing in a considerable number of patients who were classified as ethnicity 'unknown' (table 3.8). The percentages of patients with unknown ethnicity between 2006 and 2010 provided in this year's chapter are different from those in last year's chapter [2]; this reflects retrospective input of ethnicity data, improving data completeness.

Clinical and laboratory outcomes

Introduction

There continued to be marked variation in the completeness of data (tables 3.9a, 3.9b) reported by each renal centre, particularly for blood pressure. Better data records (or possibly better extraction of data held within

Table 3.5. Distribution of prevalent patients on RRT by centre and modality on 31/12/2011

Centre	Total	% HD	% PD	% Transplant
Transplant centres				
B QEH	1,923	46	9	45
Belfast	686	33	4	62
Bristol	1,311	36	5	59
Camb	1,086	34	4	62
Cardff	1,536	32	7	61
Covnt	886	41	10	49
Edin	700	37	6	57
Glasgw	1,477	42	3	55
L Barts	1,900	47	9	44
L Guys	1,680	36	2	62
L Rfree	1,773	40	5	55
L St.G	719	41	8	51
L West	3,022	47	1	52
Leeds	1,420	36	6	57
Leic	1,926	44	8	47
Liv RI	1,251	30	6	64
M RI	1,635	29	6	65
Newc	916	29	5	66
Nottm	1,019	39	9	52
Oxford	1,444	29	6	65
Plymth	465	28	10	62
Ports	1,394	38	7	56
Sheff	1,260	47	5	48
Dialysis centres				
Abrdn	479	45	5	51
Airdrie	344	50	3	47
Antrim	224	59	6	35
B Heart	666	67	7	26
Bangor	109	81	19	
Basldn	238	65	11	24
Bradfd	472	42	7	52
Brightn	777	44	10	46
Carlis	219	30	11	59
Carsh	1,410	53	7	39
Chelms	216	55	12	33
Clwyd	167	46	12	43
Colchr	120	100		
D & Gall	122	40	11	48
Derby	466	44	24	32
Donc	248	65	10	24
Dorset	587	41	9	50
Dudley	287	51	18	31
Dundee	400	46	6	49
Dunfn	278	53	10	37
Exeter	813	46	10	44
Glouc	390	50	10	40
Hull	764	42	12	46
Inverns	224	37	8	55
Ipswi	340	37	9	54
Kent	865	43	8	49
Klmarnk	300	49	15	36
L Kings	882	53	10	37
Liv Ain	194	92	8	
Middlbr	753	42	2	56
Newry	191	58	6	36

Table 3.5. Continued

Centre	Total	% HD	% PD	% Transplant
Norwch	612	50	10	40
Prestn	1,023	51	6	43
Redng	688	40	13	48
Salford	846	43	13	44
Shrew	342	55	10	35
Stevng	638	65	5	31
Sthend	214	57	8	35
Stoke	695	46	12	42
Sund	390	46	4	50
Swanse	659	54	9	37
Truro	357	43	7	50
Ulster	137	77	2	21
West NI	272	55	7	38
Wirral	241	81	17	1
Wolve	516	60	14	27
Wrexm	237	37	8	54
York	366	39	7	54
England	44,665	43	7	49
N Ireland	1,510	48	5	47
Scotland	4,324	43	6	51
Wales	2,708	41	8	51
UK	53,207	43	7	49

Table 3.6. Median age and gender ratio of incident and prevalent transplant patients 2006–2011

	Incident transplants			Prevalent transplants*		
Year	N	Median age	M:F ratio	N	Median age	M:F ratio
2006	1,955	45.2	1.6	17,709	49.9	1.5
2007	2,118	45.6	1.6	20,793	50.2	1.5
2008	2,337	46.4	1.5	22,281	50.4	1.5
2009	2,481	48.4	1.6	23,534	50.7	1.5
2010	2,578	49.6	1.7	24,934	51.2	1.5
2011	2,549	49.0	1.7	26,269	51.7	1.6

* As on 31st December for given year

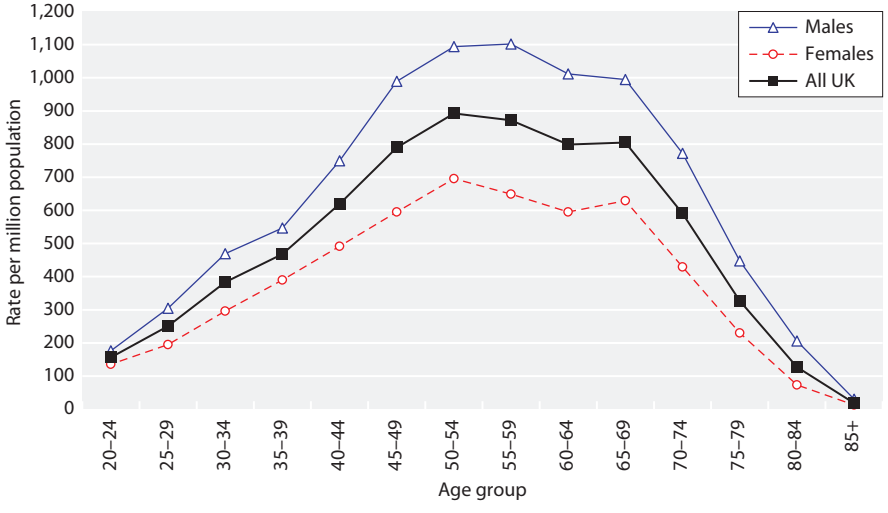

Fig. 3.1. Transplant prevalence rate per million population by age and gender on 31/12/2011

Table 3.7. Primary renal diagnosis in renal transplant recipients 2006–2011

	New transplants by year							Established transplants on 01/01/2011	
	2006	2007	2008	2009	2010	2011			
Primary diagnosis	%	%	%	%	%	%	N	%	N
Aetiology uncertain	14.4	14.0	13.2	13.6	13.5	14.1	329	16.3	3,921
Diabetes	13.2	14.4	12.8	12.5	11.7	11.9	277	9.2	2,205
Glomerulonephritis	22.0	23.6	22.5	23.7	19.9	23.0	537	23.6	5,670
Polycystic kidney disease	12.8	13.6	13.7	13.5	13.5	12.2	284	12.8	3,083
Pyelonephritis	12.6	12.0	12.2	11.4	9.4	10.4	243	14.4	3,456
Reno-vascular disease	6.1	5.4	7.0	6.2	6.7	6.5	151	5.7	1,381
Other	16.4	15.5	16.7	15.2	15.5	16.5	384	16.2	3,901
Not available	2.5	1.5	1.9	3.9	9.7	5.4	126	1.8	421

renal IT systems) would facilitate more meaningful comparisons between centres and help to determine the causes of inter-centre differences in outcomes. For this reason, along with differences in repatriation policies of prevalent transplant patients between centres as highlighted previously, caution needs to be exercised when comparing centre performance.

The 71 renal centres in the UK comprise 52 centres in England, 5 in Wales, 5 in Northern Ireland and 9 in Scotland. Centres in Scotland only provide summary information and therefore laboratory outcome data for comparisons were not available for the Scottish renal centres. Three centres (Bangor, Colchester, Liverpool Aintree) were reported as having no transplanted patients and were therefore excluded. After exclusion of these 12 centres, prevalent patient data from 59 renal centres across the UK were analysed.

For the one year post-transplant analyses, in which patients were assigned to the centres that performed their transplant, the two Scottish transplant centres were excluded as they only submit limited biochemical data to the UKRR. After excluding these 2 transplant centres, one year outcomes are described for 21 transplant centres across the UK.

Methods

Data for key laboratory variables are reported for all prevalent patients with valid data returns for a given renal centre (both transplanting and non-transplanting centres) and for one year post-transplant results for patients transplanted 2004–2010, with patients attributed to the transplant centre that performed the procedure.

Time since transplantation may have a significant effect on key biochemical and clinical variables and this is likely to be independent of a centre's clinical practices. Therefore, inter-centre comparison of data on prevalent transplant patients is open to bias. To minimise bias relating to fluctuations in biochemical and clinical parameters occurring in the initial post-transplant period, one year post-transplantation outcomes are also reported. It is presumed that patient selection policies and local clinical practices are more likely to be relevant in influencing outcomes 12 months post-transplant and therefore comparison of outcomes between centres is more robust. However, even the 12 months post-transplant comparisons could be biased by the fact that in some centres, repatriation of patients only occurs if the graft is failing whereas in others it only occurs if the graft function is stable.

Centres with <20 patients or <50% data completeness have been excluded from the figures.

Prevalent patient data

Biochemical and clinical data for patients with a functioning transplant followed in either a transplanting or non-transplanting centre were included in the analyses. The cohort consisted of prevalent patients as on 31st December 2011. Patients were considered as having a functioning transplant if 'transplant' was listed as the last mode of RRT in the last quarter of 2011. Patients were assigned to the renal centre that sent the data to the UKRR but some patients will have received care in more than one centre. If data for the same transplant patient were received from both the transplant centre and non-transplant centre, care was allocated to the non-transplant centre. Patients with a functioning transplant

Table 3.8. Ethnicity of patients who received a transplant in the years 2006–2011

Year	% White	% South Asian	% African Caribbean	% Other	% Unknown
2006	75.5	8.2	6.4	2.0	7.9
2007	75.6	7.9	5.9	2.0	8.7
2008	72.7	8.6	6.2	1.8	10.8
2009	71.4	10.1	6.7	2.3	9.5
2010	72.3	10.0	6.1	2.4	9.2
2011	72.6	9.3	6.6	2.1	9.5

Table 3.9a. Percentage completeness by centre for prevalent transplant patients on 31/12/2011[a]

Centre	N	Ethnicity	eGFR[b]	Blood pressure
England				
B Heart	162	100	93	0
B QEH	834	100	94	93
Basldn	55	100	98	13
Bradfd	237	98	87	74
Brightn	346	63	88	0
Bristol	745	99	99	68
Camb	626	98	100	98
Carlis	128	98	96	0
Carsh	541	96	90	0
Chelms	67	99	97	87
Covnt	417	99	90	51
Derby	133	99	98	82
Donc	60	100	100	95
Dorset	285	100	89	81
Dudley	85	100	98	35
Exeter	345	100	98	79
Glouc	154	100	97	88
Hull	335	62	95	0
Ipswi	178	99	99	85
Kent	392	95	49	87
L Barts	804	100	97	0
L Guys	1,001	81	97	0
L Kings	315	98	96	0
L RFree	928	98	94	0
L St.G	358	88	95	1
L West	1,542	100	97	0
Leeds	814	90	97	96
Leic	877	95	95	44
Liv RI	775	92	89	42
M RI	1,020	97	99	0
Middlbr	414	99	96	49
Newc	587	99	99	0
Norwch	239	97	97	47
Nottm	506	100	100	80
Oxford	902	92	99	16
Plymth	274	99	95	0
Ports	754	99	96	12
Prestn	432	100	97	0
Redng[c]	299	100	99	0
Salford	364	99	95	0
Sheff	594	100	99	96
Shrew	117	100	53	0
Stevng	192	100	69	35
Sthend	73	100	100	56
Stoke	289	59	99	0
Sund[c]	188	99	99	0
Truro	170	99	98	90
Wirral	3	100	100	0
Wolve	136	100	97	93
York	166	80	99	42
N Ireland				
Antrim	77	100	97	91
Belfast	415	100	99	47
Newry	67	100	94	90
Ulster	25	100	96	84
West NI	101	100	96	89
Wales				
Cardff	910	75	99	97
Clwyd	64	80	94	86
Swanse	230	99	97	99
Wrexm	128	100	79	0
England	**21,258**	**95**	**95**	**34**
N Ireland	**685**	**100**	**98**	**64**
Wales	**1,332**	**82**	**96**	**88**
E, W & NI	**23,275**	**94**	**95**	**38**

[a] Scottish centres not shown as a limited dataset was returned that could not be included for technical reasons
[b] Patients with missing ethnicity were classed as White for eGFR calculation
[c] Data relating to blood pressure could not be extracted from these centres due to technical problems

of less than three months duration were excluded from analyses. For haemoglobin, estimated glomerular filtration rate (eGFR), corrected calcium, phosphate and blood pressure (BP), the latest value in quarter 3 or quarter 4 of 2011 was used.

Estimated glomerular filtration rate (eGFR)

For the purpose of eGFR calculation, the original 4-variable MDRD formula was used (with a constant of 186) to calculate eGFR from the serum creatinine concentration as reported by the centre (unless otherwise stated). A wide variety of creatinine assays are in use in clinical biochemistry laboratories in the UK, and it is not possible to ensure that all measurements of creatinine concentration collected by the UKRR are harmonised. Although many laboratories are now reporting assay results that have been aligned to the isotope dilution-mass spectrometry standard (which would necessitate use of the modified MDRD formula), this was not the case at the end of 2011. Patients with valid serum creatinine results but no ethnicity data were classed as White for the purpose of the eGFR calculation.

One year post-transplant data

Patients who received a renal transplant between 1st January 2004 and 31st December 2010 were assigned according to the renal centre in which they were transplanted. In a small number of instances, the first documented evidence of transplantation in a patient's record is from a timeline entry in data returned from a non-transplant centre, in these instances the patient was re-assigned to the nearest transplant centre (table 3.10).

Patients who had died or experienced graft failure within 12 months of transplantation were excluded from the analyses. Patients with more than one transplant during 2004–2010 were included as separate episodes provided each of the transplants functioned for a year

For each patient, the most recent laboratory or blood pressure

Table 3.9b. Percentage completeness by centre for prevalent transplant patients on 31/12/2011[a]

Centre	N	Haemoglobin	Total serum cholesterol	Adjusted serum calcium[b]	Serum phosphate	Serum PTH
England						
B Heart	162	93	41	86	86	13
B QEH	834	94	72	94	93	62
Basldn	55	95	44	96	85	53
Bradfd	237	79	43	85	83	27
Brightn	346	88	23	73	84	25
Bristol	745	99	70	99	99	98
Camb	626	99	72	99	99	89
Carlis	128	95	65	92	92	14
Carsh	541	71	51	89	89	0
Chelms	67	97	66	97	97	22
Covnt	417	89	0	89	64	26
Derby	133	94	58	93	89	77
Donc	60	100	85	100	100	32
Dorset	285	89	53	55	51	20
Dudley	85	98	61	69	98	59
Exeter	345	97	91	97	94	14
Glouc	154	97	39	96	94	31
Hull	335	94	24	92	92	18
Ipswi	178	99	30	99	99	58
Kent	392	96	52	93	93	7
L Barts	804	97	96	94	94	69
L Guys	1,001	97	31	92	92	31
L Kings	315	96	41	96	96	20
L RFree	928	61	74	94	94	57
L St.G	358	94	40	95	95	46
L West	1,542	98	26	98	98	7
Leeds	814	96	91	96	96	48
Leic	877	94	89	94	94	58
Liv RI	775	89	3	87	88	71
M RI	1,020	99	49	99	99	60
Middlbr	414	95	41	93	92	12
Newc	587	99	72	97	99	37
Norwch	239	97	94	96	96	29
Nottm	506	100	60	96	95	83
Oxford	902	99	52	99	99	27
Plymth	274	83	42	91	89	20
Ports	754	95	32	94	89	13
Prestn	432	96	47	93	91	38
Redng	299	99	78	99	85	59
Salford	364	95	82	95	95	82
Sheff	594	99	39	98	98	22
Shrew	117	85	71	77	76	5
Stevng	192	96	73	95	92	45
Sthend	73	99	30	99	95	8
Stoke	289	99	97	99	99	28
Sund	188	99	88	99	99	86
Truro	170	97	49	97	97	40
Wirral	3	100	100	33	100	67
Wolve	136	97	55	97	90	46
York	166	87	61	85	96	16

Table 3.9b. Continued

Centre	N	Haemoglobin	Total serum cholesterol	Adjusted serum calcium[b]	Serum phosphate	Serum PTH
N Ireland						
Antrim	77	96	94	95	96	94
Belfast	415	99	98	97	97	25
Newry	67	94	40	94	94	63
Ulster	25	96	96	96	96	68
West NI	101	97	92	94	94	69
Wales						
Cardff	910	99	51	99	98	15
Clwyd	64	92	86	94	94	53
Swanse	230	97	72	97	97	43
Wrexm	128	98	90	97	97	99
England	**21,258**	**94**	**55**	**94**	**93**	**42**
N Ireland	**685**	**98**	**91**	**96**	**96**	**45**
Wales	**1,332**	**98**	**60**	**98**	**98**	**30**
E, W & NI	**23,275**	**94**	**56**	**94**	**93**	**41**

[a] Scottish centres not shown as a limited dataset was returned that could not be included for technical reasons
[b] Serum calcium corrected for serum albumin

for the relevant 4th/5th quarter (10–15 months) after renal transplantation was taken to be representative of the one year post-transplant outcome. Again, for the purpose of the eGFR calculation patients with valid serum creatinine results but missing ethnicity data were classed as White.

Results and discussion

Post-transplant eGFR in prevalent transplant patients

When interpreting eGFR post-transplantation, it is important to remember that estimated GFR formulae

Table 3.10. Number of patients per transplant centre after allocation of patients in non-transplant centres* (transplanted between 2004–2010)

Transplant centre	Total number of patients per transplant centre	Non-transplant centre	Number of patients reallocated to a transplant centre
B QEH	848	Stoke	4
Belfast	261	Antrim	2
		Newry	7
		West NI	4
Bristol	684	Dorset	1
Camb	939	Stevng	2
Cardff	674		n/a
Covnt	333		n/a
L Barts	652		n/a
L Guys	1,076	Kent	3
L Rfree	476		n/a
L St.G	367	Carsh	14
L West	1,047		n/a
Leeds	910		n/a
Leic	479		n/a
Liv RI	541	Prestn	1
M RI	652	Salford	23
Newc	735		n/a
Nottm	334		n/a
Oxford	953		n/a
Plymth	388		n/a
Ports	412		n/a
Sheff	363		n/a
Total	**13,124**		**61**

* Only transplant centres in England, N Ireland and Wales included

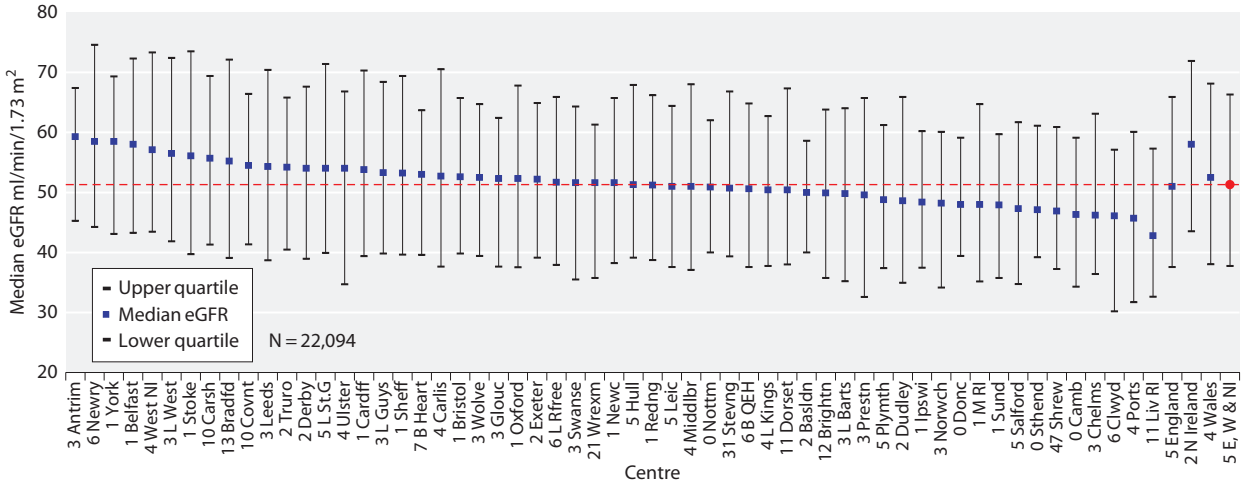

Fig. 3.2. Median eGFR in prevalent transplant patients by centre on 31/12/2011

only have a modest predictive performance in the transplant population [3]. Median eGFR in each centre and percentage of patients with eGFR <30 ml/min/1.73 m^2 are shown in figures 3.2 and 3.3. The median eGFR was 51.3 ml/min/1.73 m^2, with 13.6% of prevalent transplant recipients having an eGFR <30 ml/min/1.73 m^2. Table 3.11 summarises the proportion of transplant patients with an eGFR <30 ml/min/1.73 m^2 by centre. Whilst local repatriation policies on timing of transfer of care for patients with failing transplants from transplant centres to referring centres might explain some of the differences, it is notable that both transplanting and non-transplanting centres feature at both ends of the scale. The accuracy of the 4-variable MDRD equation in estimating GFR ⩾60 ml/min/1.73 m^2 is questionable [4], therefore a figure describing this is not included in this chapter.

Figure 3.4 shows the percentage of prevalent patients by centre with eGFR <30 ml/min/1.73 m^2 as a funnel plot, enabling a more reliable comparison of outcomes between centres across the UK. The solid lines show the 2 standard deviation limits (95%) and the dotted lines the limits for 3 standard deviations (99.9%). With 58 centres included and a normal distribution, 2–3 centres would be expected to fall between the 95%–99% CI (1 in 20) and no centres should fall outside the 99.9% limits.

There continued to be variation between centres; these data show over-dispersion with 15 centres falling outside the 95% CI of which eight centres were outside the 99.9% CI. Five centres (Bristol, Belfast, Newry, London West,

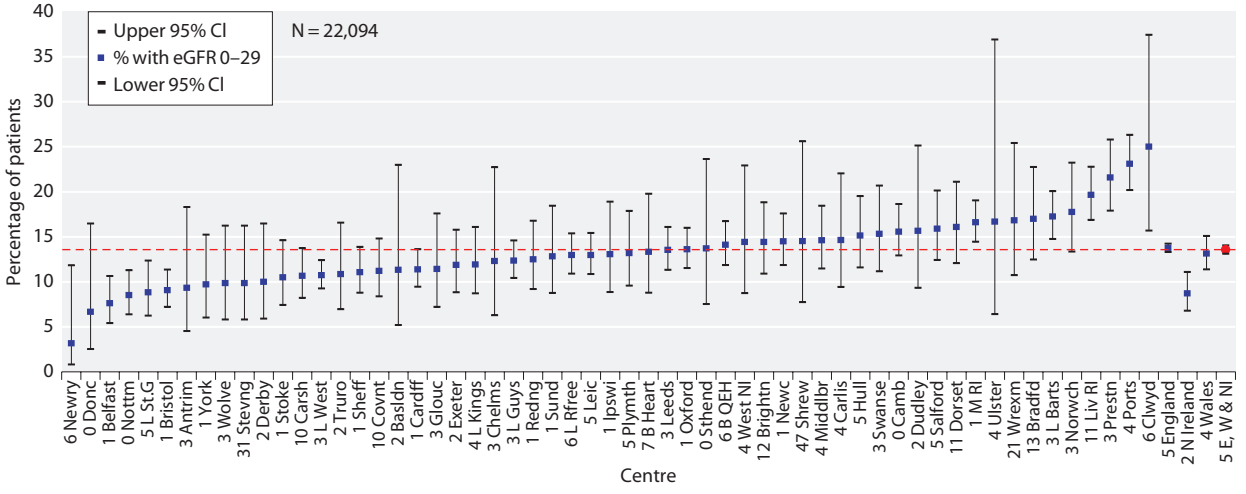

Fig. 3.3. Percentage of prevalent transplant patients by centre on 31/12/2011 with eGFR <30 ml/min/1.73 m^2

Table 3.11. Proportion of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 on 31/12/2011

Centre	N	% with eGFR <30	Centre	N	% with eGFR <30
Ulster	24	16.7	Redng	296	12.5
Basldn	53	11.3	L Kings	302	11.9
Clwyd	60	25	Brightn	305	14.4
Donc	60	6.7	Hull	317	15.1
Shrew	62	14.5	Exeter	337	11.9
Newry	63	3.2	L St.G	340	8.8
Chelms	65	12.3	Salford	346	15.9
Sthend	73	13.7	Covnt	375	11.2
Antrim	75	9.3	Middlbr	397	14.6
Dudley	83	15.7	Belfast	407	7.6
West NI	97	14.4	Prestn	417	21.6
Wrexm	101	16.8	Carsh	488	10.7
Carlis	123	14.6	Nottm	505	8.5
Derby	130	10	Newc	580	14.5
Stevng	132	9.8	Sheff	587	11.1
Wolve	132	9.8	Camb	623	15.6
Glouc	149	11.4	Liv RI	692	19.7
B Heart	150	13.3	Ports	727	23.1
York	165	9.7	Bristol	739	9.1
Truro	166	10.8	L Barts	777	17.2
Ipswi	176	13.1	B QEH	786	14.1
Sund	187	12.8	Leeds	791	13.5
Kent	191	15.2	Leic	833	13.0
Bradfd	206	17	L Rfree	872	13.0
Swanse	222	15.3	Oxford	897	13.6
Norwch	231	17.7	Cardff	897	11.4
Dorset	255	16.1	L Guys	971	12.4
Plymth	258	13.2	M RI	1,011	16.6
Stoke	286	10.5	L West	1,501	10.7

Nottingham) fell outside the lower 99.9% CI suggesting a lower than expected proportion of patients with eGFR <30 ml/min/1.73 m^2. Liverpool RI, Portsmouth and Preston fell outside the upper 99.9% CI suggesting a higher than expected proportion of patients with eGFR <30 ml/min/1.73 m^2.

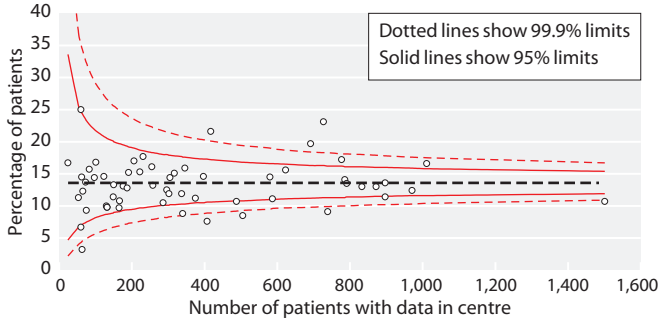

Fig. 3.4. Funnel plot of percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 by centre size on 31/12/2011

eGFR in patients one year after transplantation

Graft function at one year post-transplantation may predict subsequent long-term graft outcome [5]. Figures 3.5a, 3.5b, and 3.5c show the median one year post-transplant eGFR for patients transplanted between 2004–2010, by transplant type. Living kidney donation had the highest median eGFR at one year (55.9 ml/min/1.73 m^2), followed by donation after brainstem death (51.8 ml/min/1.73 m^2) and donation after circulatory death (49.4 ml/min/1.73 m^2).

Figures 3.6a, 3.6b and 3.6c show one year post-transplant eGFR by donor type and year of transplantation. An upward trend in eGFR ($p < 0.001$) over the time period was noticed with both live and donation after brainstem death transplant, but not with donation after circulatory death ($p = 0.1$).

Haemoglobin in prevalent transplant patients

Transplant patients have previously fallen under the remit of the UK Renal Association Complications of

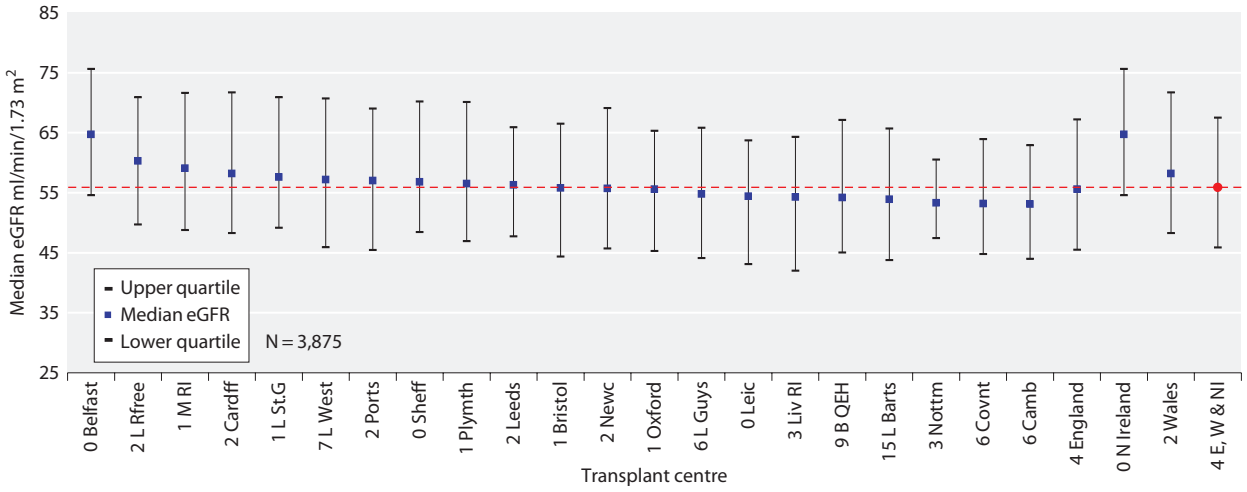

Fig. 3.5a. Median eGFR one year post-live donor transplant by transplant centre 2004–2010

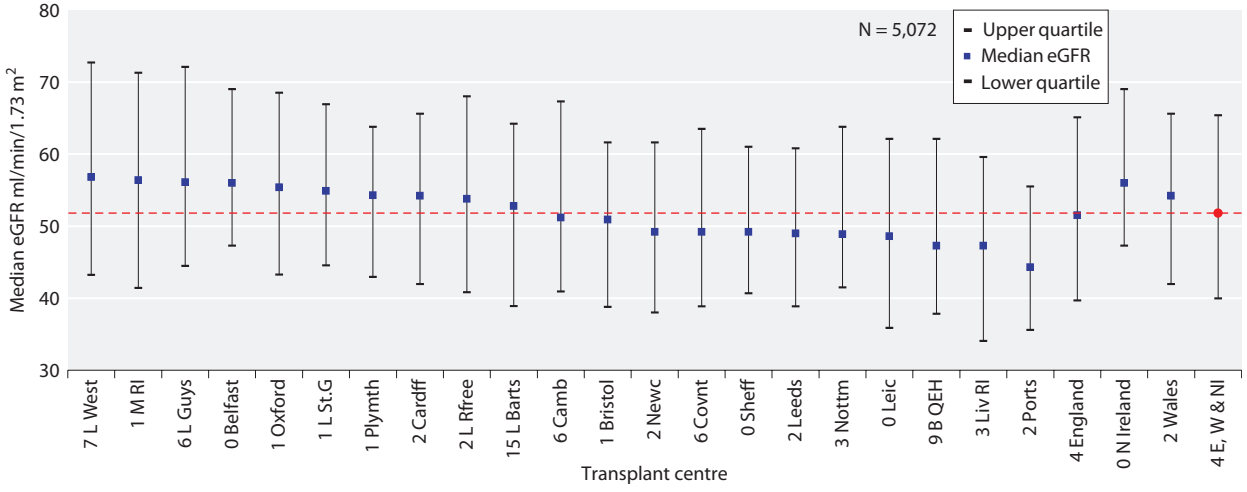

Fig. 3.5b. Median eGFR one year post-brainstem death donor transplant by transplant centre 2004–2010

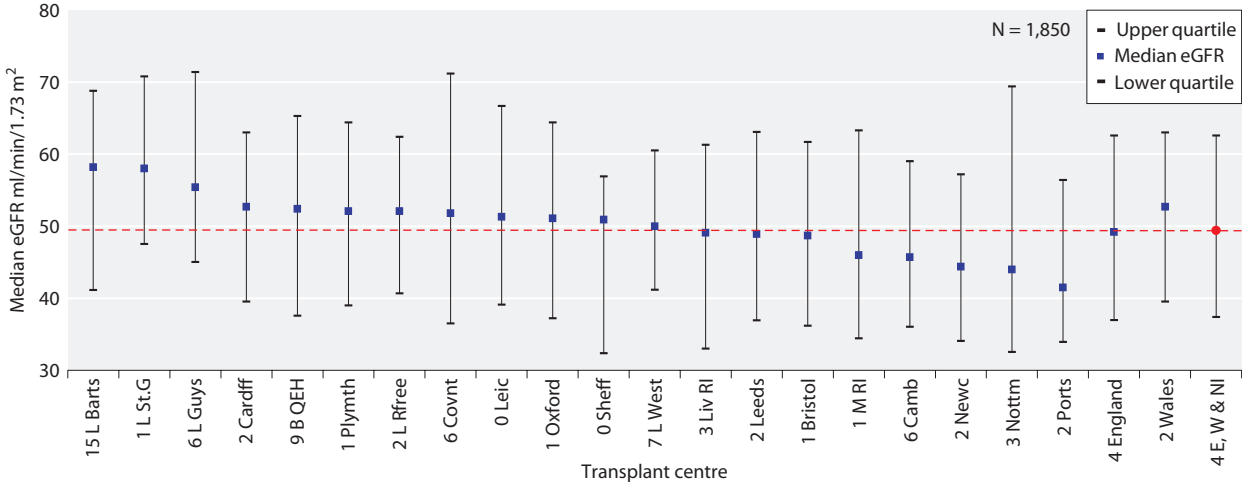

Fig. 3.5c. Median eGFR one year post-circulatory death donor transplant by transplant centre 2004–2010

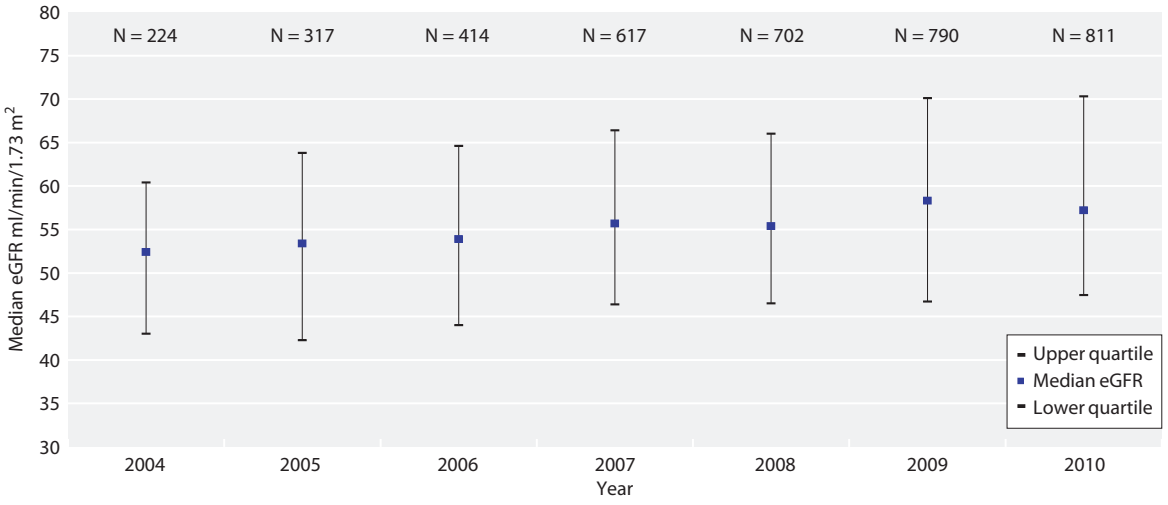

Fig. 3.6a. Median eGFR one year post-live donor transplant by year of transplantation 2004–2010

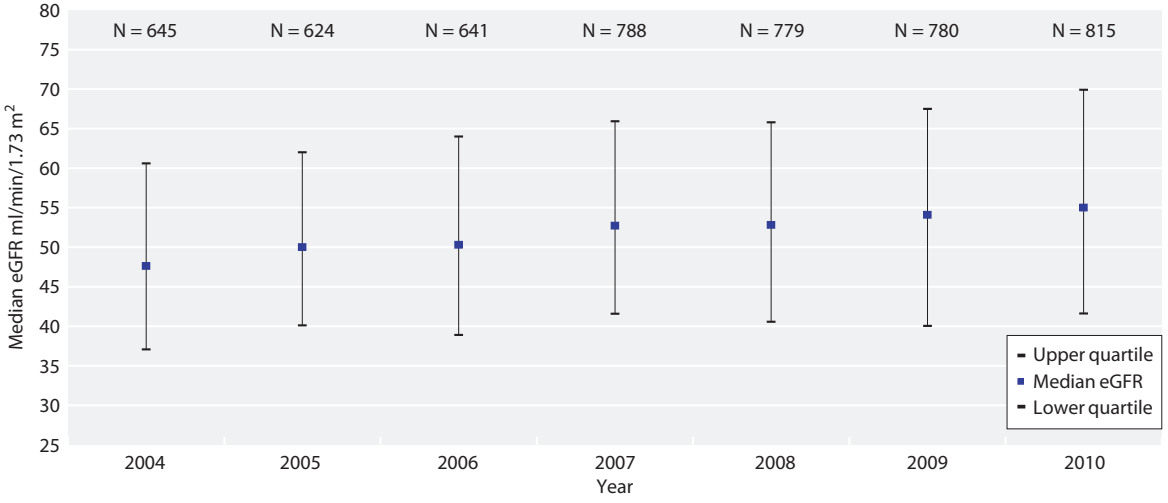

Fig. 3.6b. Median eGFR one year post-brainstem death donor transplant by year of transplantation 2004–2010

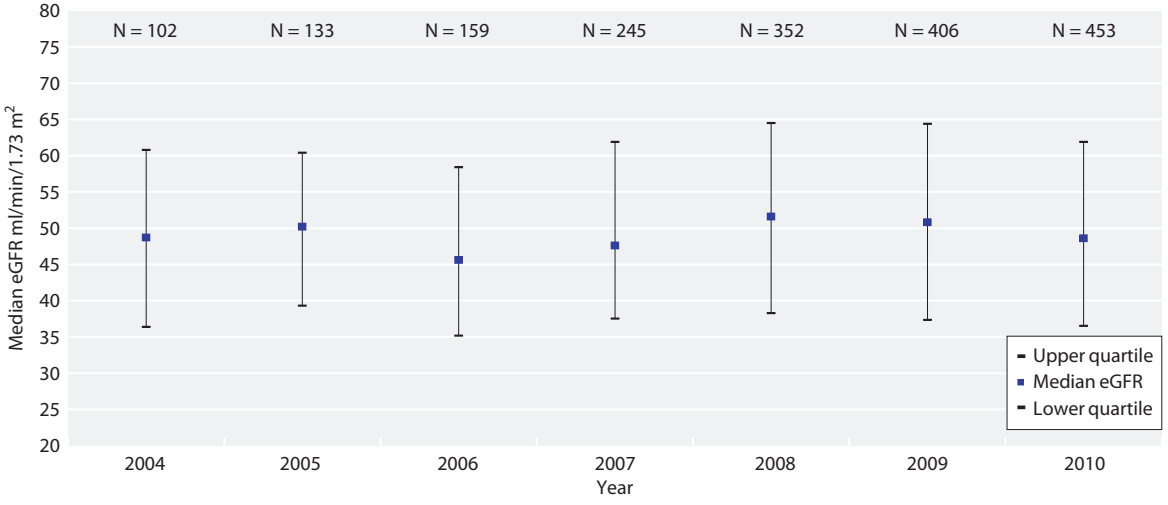

Fig. 3.6c. Median eGFR one year post-circulatory death donor transplant by year of transplantation 2004–2010

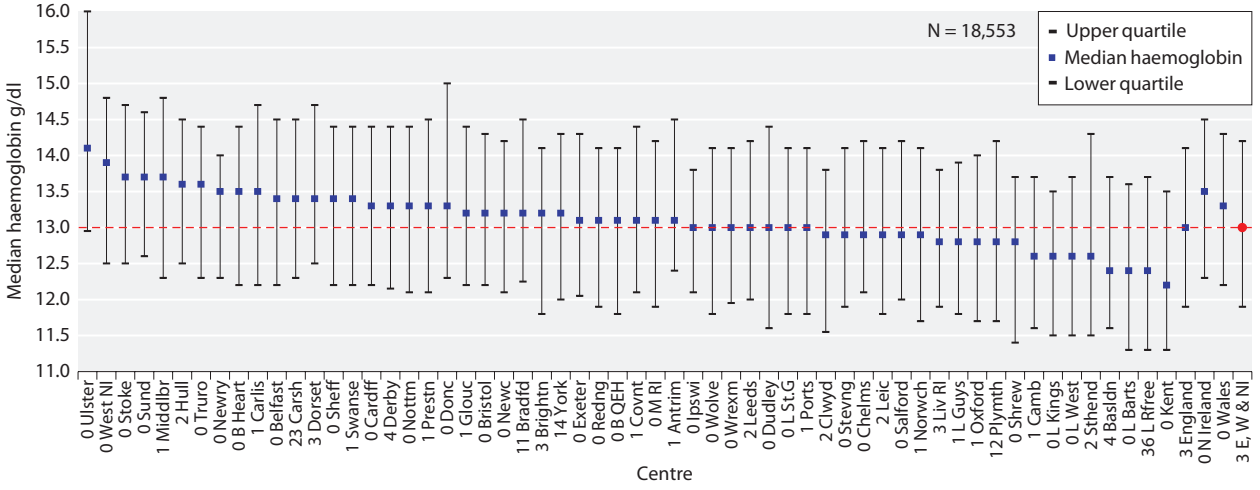

Fig. 3.7a. Median haemoglobin for prevalent transplant patients with eGFR $\geqslant 30$ ml/min/1.73 m^2 by centre on 31/12/2011

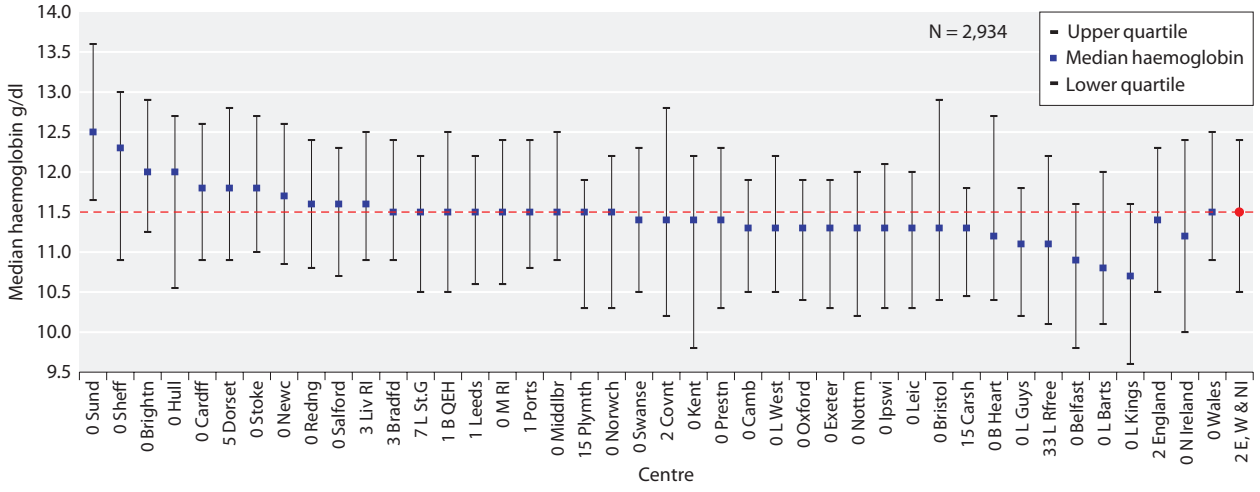

Fig. 3.7b. Median haemoglobin for prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 by centre on 31/12/2011

Chronic Kidney Disease (CKD) guidelines. Updated guidelines regarding the management of anaemia in CKD were published by the association in November 2010 [6] which have now been adopted for this report. These guidelines recommend achieving a population distribution centred on a mean of 11 g/dl with a range of 10–12 g/dl [7]. However, many transplant patients with good transplant function will have haemoglobin concentrations >12 g/dl without the use of erythopoiesis stimulating agents, and so it is inappropriate to audit performance using the higher limit.

A number of factors including comorbidity, immunosuppressive medication, graft function, ACE inhibitor use, erythropoietin (EPO) use, intravenous or oral iron use, as well as centre practices and protocols for management of anaemia, affect haemoglobin concentrations in transplant patients. Most of these data are not collected by the UKRR and therefore caution must be used when interpreting analyses of haemoglobin attainment. Figures 3.7a and 3.7b report centre results stratified according to graft function as estimated by eGFR. The percentage of prevalent transplant patients achieving Hb $\geqslant 10.0$ g/dl in each centre, stratified by eGFR, is displayed in figures 3.8a and 3.8b.

Figure 3.9 describes the percentage of prevalent patients by centre with haemoglobin <10.0 g/dl as a funnel plot enabling more reliable comparison of outcomes between centres across the UK. With 58 centres included and a normal distribution, 2–3 centres would be expected to fall between the 95%–99.9% CI (1 in 20) and no centres should fall outside the 99.9% CI purely as a chance event.

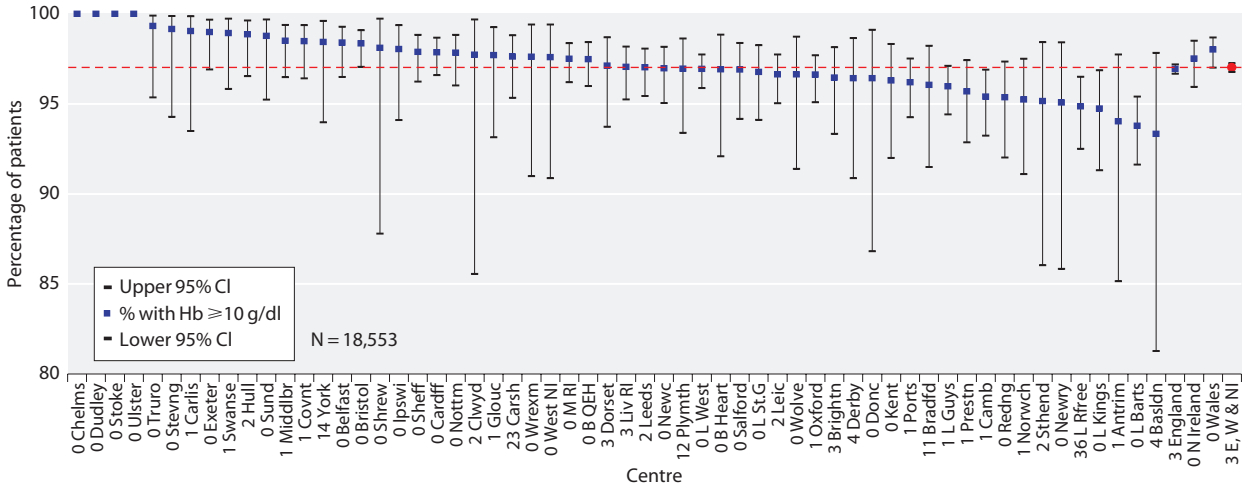

Fig. 3.8a. Percentage of prevalent transplant patients with eGFR ⩾30 ml/min/1.73 m^2 achieving haemoglobin ⩾10.0g/dl by centre on 31/12/2011

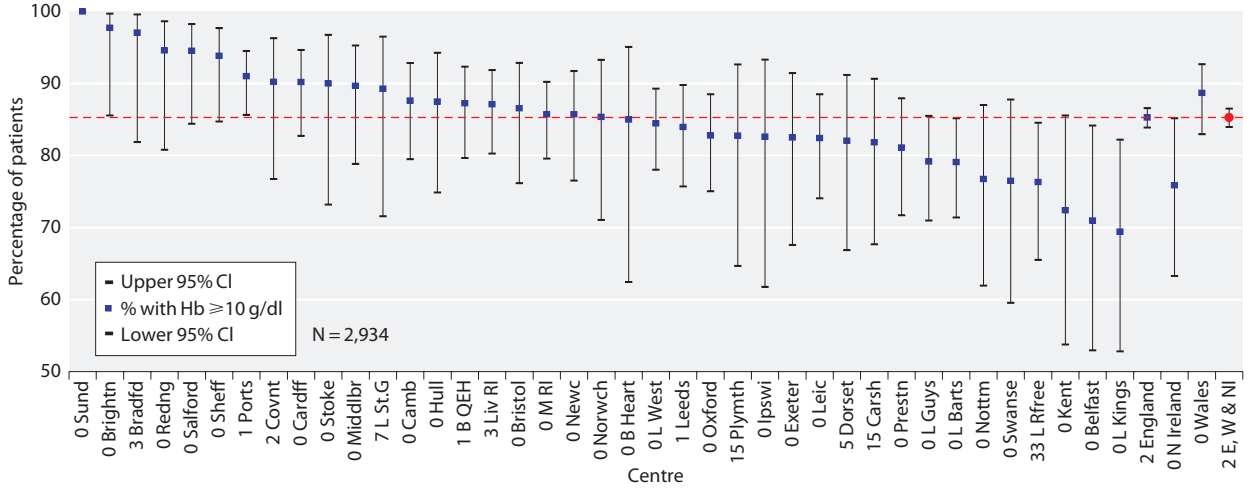

Fig. 3.8b. Percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 achieving haemoglobin ⩾10.0g/dl by centre on 31/12/2011

One centre (London Barts) fell outside the upper 99.9% CI and three further centres (London Kings, London Royal Free and Preston) fell outside the upper 95% CI indicating a higher than predicted proportion of transplant patients not achieving the haemoglobin target. Three centres fell outside the lower 99.9% CI, indicating they performed better than expected with fewer than predicted patients having a haemoglobin <10.0 g/dl.

Blood pressure in prevalent transplant patients

In the absence of controlled trial data, the opinion-based recommendation of the UK Renal Association (RA) published in the 2010 guideline for the care of

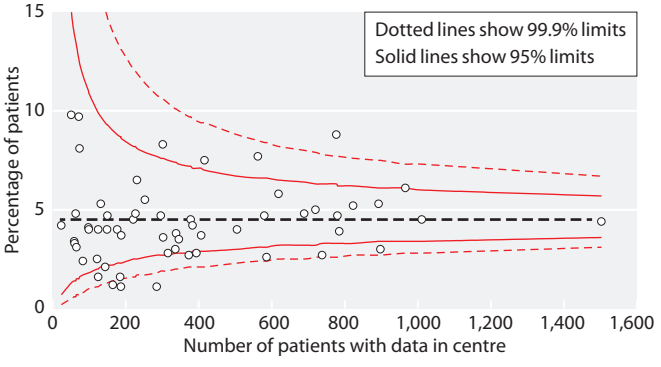

Fig. 3.9. Funnel plot of percentage of prevalent transplant patients with haemoglobin <10.0g/dl by centre size on 31/12/2011

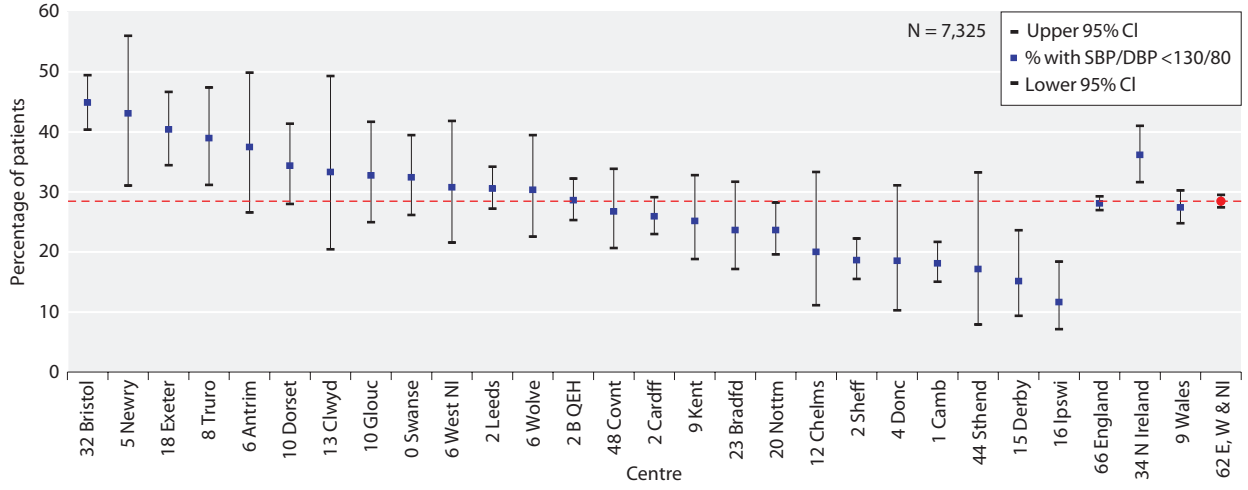

Fig. 3.10a. Percentage of prevalent transplant patients with eGFR ⩾30 ml/min/1.73 m^2 achieving blood pressure of <130/80 mmHg by centre on 31/12/2011

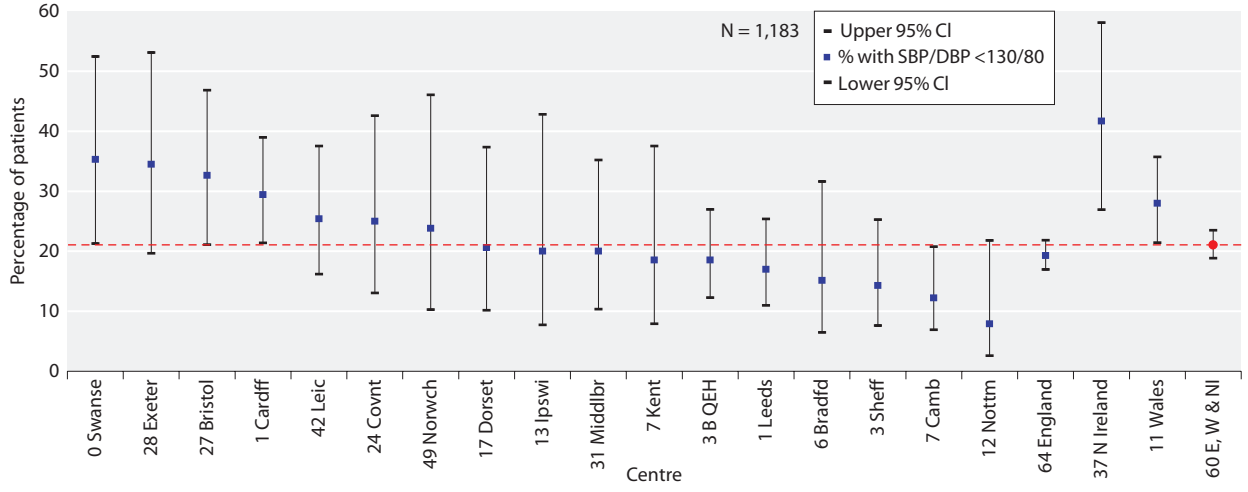

Fig. 3.10b. Percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 achieving blood pressure of <130/80 mmHg by centre on 31/12/2011

the kidney transplant recipients is that ***'Blood pressure should be <130/80 mmHg (or <125/75 mmHg if proteinuria)'*** [8]. This blood pressure target is the same as that used in previous annual reports [9].

As indicated in table 3.9a, completeness for blood pressure data returns was variable and only centres with >50% data returns were included for consideration. Despite this restriction, caution needs to be exercised in interpretation of these results because of the volume of missing data and potential bias, (e.g. a centre may be more likely to record and report blood pressure data electronically in patients with poor BP control). Figures 3.10a and 3.10b show the percentage of patients with a blood pressure of <130/80 mmHg, by eGFR. The percentage of patients with BP <130/80 (systolic BP <130 **and** diastolic BP <80 mmHg) was higher (28.5% vs. 21.1%) in those with better renal function (eGFR ⩾30 ml/min/1.73 m^2).

Analysis of prevalent patients by CKD stage

Introduction

Approximately 2.2% of prevalent transplant patients returned to dialysis in 2011, a similar percentage to that seen over the last few years. Amongst patients with native chronic kidney disease, late presentation is associated with poor outcomes, largely attributable to lack of specialist management of anaemia, acidosis,

hyperphosphataemia and to inadequate advance preparation for dialysis. Transplant recipients on the other hand, are almost always followed up regularly in specialist transplant or renal clinics and it would be reasonable to expect patients with failing grafts to receive appropriate care and therefore have many of their modifiable risk factors addressed before complete graft failure and return to dialysis.

Methods

The transplant cohort consisted of prevalent transplant recipients as on 31st December 2011 (N = 22,109) and were classified according to the KDIGO staging criteria with the suffix of 'T' to represent their transplant status. Patients with missing ethnicity information were classified as White for the purpose of calculating eGFR. Prevalent dialysis patients, except those who commenced dialysis in 2011, comprised the comparison dialysis cohort (N = 19,150) including 2,241 peritoneal dialysis patients. Only patients on peritoneal dialysis were considered when examining differences in serum phosphate between transplant recipients and dialysis patients. For both the transplant and dialysis cohorts, the analysis used the most recent available value from the last two quarters of the 2011 laboratory data.

Results and discussion

Table 3.12 shows that 13.6% of the prevalent transplant population (3,005 patients), had moderate to advanced renal impairment of eGFR <30 ml/min/1.73 m^2. The table also demonstrates that patients with failing grafts achieved UK Renal Association standards for some key biochemical and clinical outcome variables less often than dialysis patients. This substantial group of patients represents a considerable challenge, as resources need to be channelled to improve key outcome variables and achieve a safe and timely modality switch to another form of renal replacement therapy.

Table 3.12. Analysis by CKD stage for prevalent transplant patients compared with prevalent dialysis patients on 31/12/2011

	Stage 1–2T (⩾60)	Stage 3T (30–59)	Stage 4T (15–29)	Stage 5T (<15)	Stage 5D
Number of patients	7,603	11,501	2,635	370	19,150
% of patients	34.4	52.0	11.9	1.7	
eGFR ml/min/1.73 m^2 [a]					
mean ± SD	76.8 ± 15.2	45.6 ± 8.4	23.9 ± 4.2	11.9 ± 2.3	
median	72.7	45.8	24.5	12.2	
Systolic BP mmHg					
mean ± SD	133.3 ± 16.7	135.8 ± 17.5	139.3 ± 19.8	139.4 ± 18.2	130.5 ± 24.5
% ⩾130	56.4	63.5	70.0	72.7	48.6
Diastolic BP mmHg					
mean ± SD	77.8 ± 10.0	78.0 ± 10.1	78.0 ± 11.0	78.7 ± 11.3	68.4 ± 14.5
% ⩾80	45.8	46.9	48.2	51.0	21.7
Cholesterol mmol/L					
mean ± SD	4.5 ± 1.0	4.6 ± 1.1	4.7 ± 1.2	4.8 ± 1.3	4.0 ± 1.1
% ⩾5	30.1	33.5	35.6	39.5	17.4
Haemoglobin g/dl					
mean ± SD	13.6 ± 1.6	12.7 ± 1.6	11.6 ± 1.5	10.6 ± 1.6	11.2 ± 1.4
% <10.0	1.6	3.9	12.0	34.0	16.7
Phosphate mmol/L [b]					
mean ± SD	0.9 ± 0.2	1.0 ± 0.2	1.2 ± 0.3	1.5 ± 0.4	1.6 ± 0.4
% ⩾1.8	0.0	0.1	1.6	19.8	27.0
Corrected calcium mmol/L					
mean ± SD	2.4 ± 0.2	2.4 ± 0.2	2.4 ± 0.2	2.3 ± 0.2	2.3 ± 0.2
% >2.6	8.5	8.5	5.4	7.1	6.3
% <2.2	8.2	8.3	14.6	21.8	18.9
PTH pmol/L					
median	8.7	9.7	15.9	31.3	28.2
% ⩾32	3.6	5.7	19.7	48.4	44.2

[a] Prevalent transplant patients with no ethnicity data were classed as White
[b] Only PD patients included in stage 5D, N = 2,241

eGFR slope analysis

Introduction

The gradient of deterioration in eGFR (slope) may predict patients likely to have early graft failure. The eGFR slope and its relationship to specific patient characteristics are presented here.

Methods

Patients from England, Wales or Northern Ireland aged ⩾18 years receiving a renal transplant between 1st January 2001 and 31st December 2009, were considered for inclusion. A minimum duration of 18 months graft function was required and three or more creatinine measurements from the second year of graft function onwards were used to plot eGFR slope. If a transplant failed but there were at least three creatinine measurements between 18 months post-transplant and graft failure, the patient was included but no creatinine measurements after the quarter preceding the recorded date of transplant failure were analysed.

Slopes were calculated using linear regression, assuming linearity, and the effect of age, ethnicity, gender, diabetes, donor type, year of transplant and current transplant status were analysed. P values were calculated using the Kruskal-Wallis test. eGFR was calculated using the CKD-EPI equation and results expressed as ml/min/1.73 m^2/year. The CKD-EPI equation was used in preference to the MDRD formula as it is thought to have a greater degree of accuracy at higher levels of eGFR [11].

Results and discussion

The study cohort consisted of 11,664 patients. The median GFR slope was –0.49 ml/min/1.73 m^2/year (table 3.13). The gradient was steeper for Black recipients (−1.17 ml/min/1.73 m^2/year), in keeping with previously published data suggesting poorer outcomes for this group [12, 13]. eGFR slope was steeper in recipients of deceased donor kidneys (−0.51 ml/min/1.73 m^2/year) compared to patients who received organs from live donors (−0.47 ml/min/1.73 m^2/year) although this did

Table 3.13. Differences in median eGFR slope between prevalent transplant patients

Patient characteristic		N	Median slope	Lower quartile	Upper quartile	p-value
Age at transplant	<40	3,893	−0.89	−3.95	1.20	<0.0001
	40–55	4,590	−0.33	−2.74	1.75	
	>55	3,181	−0.28	−2.70	1.85	
Ethnicity	Asian	980	−0.63	−3.81	1.90	0.0018
	Black	656	−1.17	−4.39	1.48	
	Other	205	−0.43	−4.24	2.05	
	White	9,284	−0.45	−2.92	1.58	
Gender	Male	7,129	−0.32	−2.81	1.70	<0.0001
	Female	4,535	−0.79	−3.64	1.49	
Diabetes	Non-diabetic	9,966	−0.40	−2.97	1.65	<0.0001
	Diabetic	1,431	−0.95	−3.88	1.35	
Donor	Cadaveric	7,828	−0.51	−3.02	1.57	0.90
	Live	3,836	−0.47	−3.24	1.72	
Year of transplant	2001	834	−0.61	−2.28	0.65	<0.001
	2002	804	−0.56	−2.38	0.62	
	2003	1,000	−0.58	−2.25	0.87	
	2004	1,177	−0.44	−2.18	1.09	
	2005	1,124	−0.19	−2.35	1.64	
	2006	1,475	−0.37	−2.82	1.48	
	2007	1,598	−0.42	−3.02	1.94	
	2008	1,785	−0.47	−3.67	2.53	
	2009	1,867	−0.93	−6.11	3.55	
Status of transplant at end of follow-up	Died	675	−1.16	−4.36	1.79	<0.0001
	Failed	793	−6.13	−11.65	−2.86	
	Re-transplanted	51	−3.48	−6.44	−1.47	
	Functioning	10,145	−0.23	−2.44	1.79	
All		**11,664**	**−0.49**	**−3.08**	**1.62**	

not reach statistical significance. Female patients had a steeper slope (−0.79 ml/min/1.73 m^2/year) than males (−0.32 ml/min/1.73 m^2/year), as did diabetic patients (−0.95 ml/min/1.73 m^2/year) compared to non-diabetic patients (−0.40 ml/min/1.73 m^2/year). The slope was steeper in younger recipients, possibly reflecting increased risk of immunological damage. As might be expected, the steepest slope was in patients where the transplant subsequently failed. This analysis has assumed linearity of progression of fall in GFR and further work is underway to characterise the patterns of progression more precisely.

The findings in this study differ slightly from previous UKRR work exploring eGFR changes in transplant recipients [14]. This identified that male donor to female recipient transplantation, younger recipients, diabetes, white ethnicity, and human leukocyte antigen (HLA) mismatch were associated with faster decline in eGFR. These differences may be explained by patients with eGFR >60 ml/min/1.73 m^2 at one year post-transplantation being excluded and the more complex multivariable model used in the previous work. Udayaraj and colleagues [14] also adjusted for factors such as HLA mismatch and donor age, which were not available for the patients studied in this chapter.

Causes of death in transplant recipients

Introduction

Differences in causes of death between dialysis and transplant patients may be expected due to selection for transplantation and use of immunosuppression. Chapter 5 includes a more detailed discussion on causes of death in dialysis patients.

Methods

The cause of death is sent by renal centres as an ERA-EDTA registry code. These have been grouped into the following categories: cardiac disease, cerebrovascular disease, infection, malignancy, treatment withdrawal, other and uncertain.

This year, individuals with an ERA code 99 (Other identified cause of death) have been removed from category 'Uncertain' (where they were previously coded) to category 'Other' to reflect better coding of the data and bringing the registry in line with the coding methodology adopted in other renal registries. This has substantially reduced the proportion of patient deaths due to 'Uncertain' cause of death with a rise noted in deaths from 'other' causes.

Some centres have high data returns to the UKRR regarding cause of death, whilst others return no information. Provision of this information is not mandatory.

Adult patients aged 18 years and over, from England or Wales, were included in the analyses on cause of death. Previous analyses were limited to data from centres with a high rate of return for cause of death. When this was compared with an analysis of all the cause of death data on the database, the percentages in corresponding ERA-EDTA categories remained unchanged so the latter data were therefore included. Analysis of prevalent patients included all those aged over 18 years and receiving RRT on 31st December 2011.

Results and discussion

Tables 3.14, 3.15 and figure 3.11 show the differences in the causes of death between prevalent dialysis and transplant patients. Death due to cardiovascular disease was less common in transplanted patients than in dialysis patients, perhaps reflecting the cardiovascular screening undertaken during transplant work-up; transplant recipients are a pre-selected lower risk group of patients. The re-classification of ERA code 99 this year (see methods) has meant that within this cohort the leading cause of death was from 'Other' causes, although similar proportions are seen to have the cause of death attributed to infection and malignancy across all age groups. There has been a reduction over time in the proportion of

Table 3.14. Cause of death by modality in prevalent RRT patients on 1/1/2011

	All modalities		Dialysis		Transplant	
Cause of death	N	%	N	%	N	%
Cardiac disease	584	21	522	22	62	16
Cerebrovascular disease	130	5	104	4	26	7
Infection	526	19	437	18	89	23
Malignancy	275	10	193	8	82	21
Treatment withdrawal	449	16	438	18	11	3
Other	684	25	582	25	102	26
Uncertain	115	4	95	4	20	5
Total	**2,763**		**2,371**		**392**	
No cause of death data	1,372	33	1,138	32	234	37

Table 3.15. Cause of death in prevalent transplant patients on 1/1/2011 by age

	All age groups		<65 years		⩾65 years	
Cause of death	N	%	N	%	N	%
Cardiac disease	62	16	34	16	28	16
Cerebrovascular disease	26	7	12	6	14	8
Infection	89	23	53	25	36	20
Malignancy	82	21	42	19	40	23
Treatment withdrawal	11	3	6	3	5	3
Other	102	26	59	27	43	24
Uncertain	20	5	10	5	10	6
Total	**392**		**216**		**176**	
No cause of death data	234	37	117	35	117	40

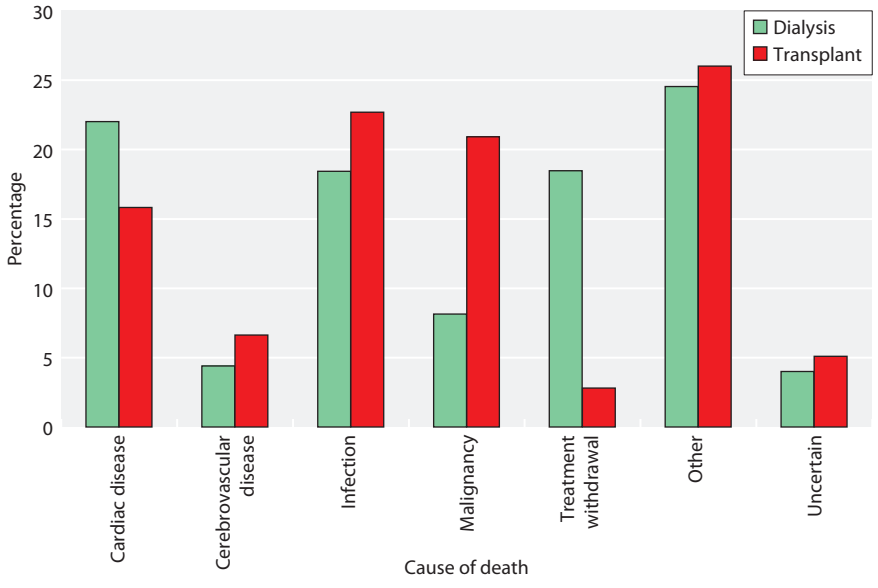

Fig. 3.11. Cause of death by modality for prevalent patients on 1/1/2011

deaths in transplant patients attributed to cardiovascular or stroke disease (43% in 2003 compared to 23% in 2011) with an increase in the proportion ascribed to infection or malignancy (30% in 2003 compared to 44% in 2011). This change has also been reported in other registries, e.g. ANZDATA (http://www.anzdata.org.au) and may reflect better management of cardiovascular risk (although table 3.12 shows BP management remained suboptimal). Explanations for the rising death rate secondary to malignancy may include the increasing age of transplant recipients and the increased intensity of immunosuppressive regimens leading to complications of over-immunosuppression.

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