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# Chapter 5

## Demographics and biochemistry profile of kidney transplant recipients in the UK in 2007: national and centre-specific analyses

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### Key Words

Anaemia · Bone metabolism · Chronic kidney disease · eGFR · Epidemiology · Graft function · Live donor · Outcomes · Quality improvement · Renal transplantation · Survival

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### Abstract

**Introduction:** Outcomes following renal transplantation are usually reported as graft or patient survival. However, graft function, haemoglobin and blood pressure are also important measures of quality of care. **Methods:** Transplant activity and incident graft survival data were obtained from NHS Blood and Transplant (NHSBT), laboratory and clinical variables and prevalent survival data were obtained from the UK Renal Registry (UKRR). Data were analysed separately for prevalent and one year post-transplant patients. **Results:** Increasing live and non-heartbeating donors were responsible for the increasing transplant activity. Transplant waiting list numbers continued to rise by 8%. Graft failure occurred in 3.2% of prevalent transplant patients. Death rates remained stable at 2.3/100 patient years. Malignancy

accounted for 21% of these deaths. There was centre variation in outcomes such as eGFR and haemoglobin in prevalent and 1 year post-transplant recipients. Analysis of prevalent transplants by chronic kidney disease stage showed 16% with eGFR <30 and 2.2% <15. Of those in stage 5T, 26% had Hb <10 g/dl, 27% phosphate ≥ 1.8 mmol/L and 50% an iPTH ≥ 32 pmol/L. These patients were less likely to achieve the UK standards in comparison to CKD5 dialysis patients. **Conclusion:** Wide variations in clinical and biochemical outcomes may be secondary to variations in the care administered to transplant recipients across the UK.

### Introduction

This chapter includes independent analyses regarding renal transplant activity and survival data from the Directorate of Organ Donation and Transplantation (ODT, formerly UK Transplant) within NHS Blood and Transplant (NHSBT) and analyses regarding

demographics, clinical and biochemical variables in renal transplant recipients from the UK Renal Registry (UKRR). Whilst NHSBT records all information regarding the episode of transplantation, the UKRR holds 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 delivered clinical care to renal transplant recipients within the UK. This further allows for comparison of key outcomes between centres and provides insight into the processes involved in the care of such patients in the UK. The number preceding the centre name in each figure indicates the percentage of missing data for that centre.

The chapter is divided into five sections: (1) Transplant activity and survival data; (2) Transplant demographics; (3) Clinical and laboratory outcomes; (4) Analysis by chronic kidney disease (CKD) stage; (5) Causes of death in transplant recipients. Methodology, results and conclusions of these analyses are discussed in detail for all five sections separately.

**Transplant activity, waiting list activity and survival data**

*Introduction*

NHSBT prospectively collects data on all relevant aspects around the episode of transplantation (donor and recipient) and also requests transplant centres to provide an annual paper based data return on the status of the recipient’s graft function. This enables the organisation to generate comprehensive analysis of renal transplant activity and graft survival statistics which are regularly updated on its website.

NHSBT attributes a recipient to the centre that performed the transplant operation irrespective of where the patient is cared for before or after the procedure and hence only reports on transplant centre performance. Patients whose clinical management has been transferred back to a dialysis centre may be lost to NHSBT follow up although will still be monitored by the UKRR.

The UK Renal Registry methodology is described in chapter 15. The UKRR collects quarterly clinical data via an electronic data extraction process from hospital based renal IT systems, on all RRT patients across all their modalities until death.

**Method**

Following a period of consolidation and re-organisation in 2005/06, there are now 19 adult renal transplant centres in England, 2 in Scotland and one each in Northern Ireland and Wales.

Comprehensive information from 1995 onwards, concerning the number of patients on the transplant waiting list, the number of transplants performed, the number of heartbeating, non-heartbeating and living donors, and patient and graft survival are available on the NHSBT website ([www.uktransplant.org.uk/ukt/statistics/statistics.jsp](http://www.uktransplant.org.uk/ukt/statistics/statistics.jsp)).

**Results**

As of 31st December 2007, there were 8,875 patients (including adult and paediatric) active or suspended on the renal or renal plus other organ waiting list, an increase of 8% compared to 2006. During 2007, absolute numbers of live donor and non-heartbeating donor transplants continued to increase and comprised 36.2% and 13.5% of all kidney transplants performed respectively (table 5.1). Combined pancreas and kidney transplant numbers continued to increase with nearly twice as many recipients in 2007 compared to 2005.

There was no statistically significant difference in one year and five year risk-adjusted patient and graft survival rates amongst UK renal transplant centres (table 5.2). These graft survival rates included grafts with primary non-function (which are excluded in some countries).

Using data from the UKRR on prevalent renal only transplant patients on 1/1/2007, the death rate during 2007 was 2.3/100 patient years (CI 2.1–2.6) when cen-

**Table 5.1.** Kidney and kidney plus other organ transplant numbers in the UK, 1st January 2005–31st December 2007

Organ	2005	2006	2007	% change 2006–2007
Heartbeating donor kidney <sup>a</sup>	997	990	907	–8
Non-heartbeating kidney	200	250	300	20
Living donor kidney	543	671	804	20
Kidney and liver	11	17	9	–47
Kidney and heart	2	1	1	
Kidney and pancreas <sup>b</sup>	102	138	197	43
<b>Total kidney transplants</b>	<b>1,855</b>	<b>2,067</b>	<b>2,218</b>	<b>7</b>

<sup>a</sup> Includes en bloc kidney transplants (5 in 2005, 5 in 2006, 8 in 2007) and double kidney transplants (6 in 2005, 11 in 2006, 8 in 2007)

<sup>b</sup> Includes non-heartbeating transplants (2 in 2006, 13 in 2007) and transplant including liver (1 in 2007)

**Table 5.2.** Risk-adjusted first adult kidney transplant only, graft and patient survival percentage rates for UK centres<sup>a</sup>

Centre	Deceased donor 1 yr survival		Deceased donor 5 yr survival		Living kidney donor 1 yr survival		Living kidney donor 5 yr survival	
	Graft	Patient	Graft	Patient	Graft	Patient	Graft	Patient
Belfast	95	96	76	84	96	100	92	100
Birmingham	90	96	84	90	91	98	91	96
Bristol	94	95	87	88	98	99	94	100
Cambridge	92	97	82	88	96	99	91	96
Cardiff	91	95	85	91	94	99	86	96
Coventry	97	97	91	89	97	100	90	95
Edinburgh	91	97	82	88	97	98	89	91
Glasgow	93	96	80	86	96	100	87	96
Guy's	92	96	84	88	98	100	94	94
Leeds	93	97	77	84	98	98	91	91
Leicester	90	92	79	87	95	95	86	93
Liverpool	89	99	82	88	90	94	84	94
Manchester	94	95	80	87	97	100	84	93
Newcastle	92	95	82	79	95	99	92	91
Nottingham	85	93	82	85	95	98	92	100
Oxford	94	95	87	87	97	99	88	97
Plymouth	93	95	73	86	94	100	65	89
Portsmouth	91	94	80	85	95	94	91	95
Royal Free	92	96	80	88	96	100	87	100
Royal London	94	96	82	84	95	98	77	96
Sheffield	91	99	84	91	95	100	83	95
St George's	93	98	88	89	95	99	85	93
WLRTC <sup>b</sup>	95	97	87	87	95	98	89	98
<b>All centres</b>	<b>92</b>	<b>96</b>	<b>82</b>	<b>87</b>	<b>96</b>	<b>98</b>	<b>88</b>	<b>95</b>

<sup>a</sup> 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

<sup>b</sup> WLRTC – West London Renal and Transplant Centre

Cohorts for survival rate estimation: 1 year survival: 1 Jan 2002–31 Dec 2006; 5 year survival: 1 Jan 1998–31 Dec 2002; First grafts only – re-grafts excluded for patient survival estimation. Since the cohorts to estimate 1 and 5 years survival are different, some centres may appear to have 5 year survival figures better than 1 year survival

sored for return to dialysis and 2.5/100 patient years (CI 2.2–2.7) without censoring for dialysis.

During 2007, 3.2% of prevalent transplant patients experienced graft failure (excluding death as cause of graft failure). These two figures have remained almost constant at this level since 2000.

This year the centre variation is not shown in the percentage of dialysis patients aged <65 years on the active waiting list.

## Conclusions

The number of heartbeating kidney donors continued to decline, whilst numbers of non-heartbeating and live donors in 2007 increased to exceed this total.

There was no difference in the graft survival between UK centres. Graft failure rates remained stable at 3.2% per annum and transplant patient death rates also remained stable at 2.3 per 100 patient years.

## Demographics

### Introduction

As of 31st December 2007, 71 of the 72 adult renal centres in the UK were electronically linked to the UKRR. Only Colchester was unable to provide individual patient data, although this centre does not look after any transplant patients.

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 ongoing post-transplant care, some others only refer back when their graft is failing. The time post-transplantation that such referral may happen also varies between transplant centres. The UKRR is able to detect duplicate patients (being reported from both transplant and referring centre) and in such situations care is attributed to the referring centre.

## Methods

Four centres (Bangor, Colchester, Wirral, 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. Eleven centres (nine centres in Scotland, Kent and London St Georges) do not currently submit sequential laboratory data to the UKRR and were not included in the analyses on post-transplant outcomes.

Information on patient demographics (age, gender, ethnicity and primary renal diagnosis) for patients in a given renal centre were obtained from UKRR patient registration data fields. Individual patients were assigned to the centre that returned data for that particular patient during 2007. The prevalence of transplant patients in areas covered by individual primary care trust (PCT) was estimated based on the post code of the registered address for patients on RRT. Data on ethnic origin, supplied as Patient Administration System (PAS) codes, was retrieved from fields within renal centre IT systems. For the purpose of this analysis patients were grouped into Whites, South Asians, Blacks, Chinese and Others. The details of regrouping of the PAS codes into the above ethnic categories are provided in Report 2008 appendix G at [www.renalreg.org](http://www.renalreg.org). 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. The detailed methods of comorbidity data collection by the UKRR are described elsewhere [1].

## Results and discussion

Prevalent transplant numbers across the 4 nations in the UK are described in table 5.3. The prevalent patient

cohort had a median time with a functioning transplant of 10.4 years.

The prevalence of renal transplant recipients in each PCT in England, Health Authority in Northern Ireland, Scotland and Wales and the proportion of prevalent patients according to modality in the renal centres across the UK are described in tables 5.4 and 5.5 respectively. After standardisation for age and gender, unexplained variability was evident in the prevalence of renal transplant recipients with some areas having higher or lower than the predicted number of prevalent transplant patients per million population. Further work to study whether this was secondary to differential access to transplantation is currently being undertaken by the UKRR.

The relative proportion of prevalent RRT patients with a transplant versus those on dialysis has been stable since at least 2000. While the proportion of patients on HD has been increasing, the proportion (and total numbers) on PD has been falling. However, the increasing transplant activity has not been able to keep pace with the number of patients joining the national organ waiting list, which has grown much more rapidly since 2004 when the UKRR first started reporting the variation between centres in the percentage of dialysis patients on the national transplant waiting list.

### *Age and gender*

The gender ratio amongst incident and prevalent transplant patients has remained stable since 2002 (table 5.6 and figure 5.1). Whilst the median age of incident transplant patients has not changed much since 2002, there has been a small but steady increase in the median age of prevalent transplant patients, suggesting but not proving, that survival after renal transplantation has improved in the UK over the last 6 years.

### *Primary renal diagnosis*

The number of patients achieving simultaneous kidney-pancreas (SPK) transplantation has increased by more than 200% since 2003 and this was reflected in

**Table 5.3.** Prevalence of transplants in adults in the UK on 31/12/2007

	England	Wales	Scotland	N Ireland	UK
All UK centres	17,568	1,041	1,927	596	21,132
Total population mid-2007 (millions)*	51.1	3.0	5.1	1.8	61.0
Prevalence pmp transplant	344	349	375	339	347

\* Office of National Statistics, UK

**Table 5.4.** The prevalence per million population of patients with a renal transplant and standardised rate ratio in the UK, as on 31 December 2004–2007<sup>a</sup> PCT/HA – Primary care trust in England; Health Authorities in N Ireland, Wales and Scotland<sup>b</sup> Population numbers based on 2006 mid-year estimates by age group and gender obtained from the ONS

Estimates are not provided for PCTs/HAs for given year during which centres were not electronically linked to the UKRR

<sup>c</sup> O/E = age and gender standardised acceptance rate ratio

PCTs/HAs with significantly high average rate ratios are bold in darker grey areas; PCTs with significantly low average rate ratios are italicised in darker grey areas

UK Area	Region	PCT/HA <sup>a</sup>	Population covered <sup>b</sup>	Rate pmp				Age and gender standardised rate ratio 2007				
				2004	2005	2006	2007	O/E <sup>c</sup>	L 95% CL	U 95% CL		
North East	County Durham and Tees Valley	County Durham	500,400	350	370	372	394	1.10	0.96	1.26		
		Darlington	99,100	303	323	323	343	0.97	0.70	1.36		
		Redcar, Cleveland	139,200	431	431	445	474	<b>1.33</b>	<b>1.05</b>	<b>1.69</b>		
		Hartlepool	91,100	384	373	395	406	1.17	0.85	1.62		
		Middlesbrough	138,500	397	397	397	404	1.22	0.94	1.59		
		North Tees	189,200	312	328	370	349	1.00	0.79	1.28		
	Northumberland, Tyne and Wear	Gateshead	190,500	399	446	415	409	1.16	0.93	1.44		
		Newcastle	270,400	307	329	348	377	1.16	0.95	1.41		
		North Tyneside	195,100	405	456	441	487	<b>1.37</b>	<b>1.12</b>	<b>1.67</b>		
		Northumberland	309,900	378	381	378	390	1.05	0.88	1.25		
		South Tyneside	151,000	338	364	377	411	1.17	0.91	1.50		
		Sunderland Teaching	280,600	381	364	367	385	1.09	0.91	1.32		
	North West	Cheshire and Merseyside	Wirral	311,100	289	296	315	302	0.87	0.71	1.06	
			Liverpool	436,200	282	298	303	303	0.91	0.77	1.08	
Central and E Cheshire			451,200				301	<i>0.83</i>	<i>0.70</i>	<i>0.98</i>		
Western Cheshire			235,100	315	315	306	345	0.96	0.77	1.19		
Knowsley			151,500	304	297	297	317	0.94	0.71	1.25		
Sefton			277,500	263	270	288	303	0.85	0.69	1.06		
Halton and St Helens			297,000	239	259	266	300	0.85	0.69	1.05		
Warrington			194,300	278	273	314	381	1.07	0.85	1.34		
Cumbria and Lancashire		Blackburn with Darwen	141,200	198	184	198	326	1.03	0.77	1.37		
		Blackpool	142,800	217	210	231	315	0.89	0.66	1.19		
		North Lancashire	329,000	228	231	277	313	0.89	0.73	1.08		
		Cumbria	496,000	266	270	302	329	0.89	0.76	1.04		
		Central Lancashire	451,600	219	217	244	301	0.85	0.72	1.01		
		East Lancashire	384,500	289	283	304	395	1.14	0.97	1.34		
Greater Manchester		Ashton, Leigh and Wigan	305,500	144	167	206	383	1.07	0.89	1.28		
		Bolton	262,500	187	221	248	415	<b>1.21</b>	<b>1.01</b>	<b>1.47</b>		
		Bury	182,900	66	87	98	355	1.02	0.80	1.31		
		Manchester	451,900				277	0.91	0.77	1.09		
		Heywood, Middleton and Rochdale	206,400				383	1.13	0.91	1.41		
		Oldham	219,800	114	114	150	346	1.03	0.83	1.30		
		Salford	217,800	147	152	170	266	0.79	0.61	1.03		
		Stockport	280,800				335	0.94	0.77	1.15		
		Tameside and Glossop	247,700				384	1.10	0.90	1.34		
		Trafford	212,100				316	0.91	0.72	1.16		
		Yorkshire and the Humber	N & E Yorkshire and N Lincolnshire	East Riding of Yorkshire	331,100	227	257	257	293	<i>0.79</i>	<i>0.65</i>	<i>0.96</i>
				Hull	256,200	246	262	304	336	1.01	0.82	1.25
North East Lincolnshire	159,900			244	231	256	294	0.85	0.64	1.13		
North Lincolnshire	155,200			226	258	284	296	0.82	0.61	1.09		
North Yorkshire and York	783,200			260	277	309	327	0.91	0.81	1.03		
South Yorkshire	Barnsley		223,700	335	326	353	353	0.99	0.79	1.23		
	Doncaster		290,400	275	282	320	313	0.89	0.73	1.10		
	Rotherham		253,000	285	265	292	324	0.92	0.74	1.14		
	Sheffield		526,100	239	251	272	285	0.85	0.73	1.00		

Table 5.4. Continued

UK Area	Region	PCT/HA <sup>a</sup>	Population covered <sup>b</sup>	Rate pmp				Age and gender standardised rate ratio 2007		
				2004	2005	2006	2007	O/E <sup>c</sup>	L 95% CL	U 95% CL
Yorkshire and the Humber	West Yorkshire	Bradford and Airedale	493,000	318	337	347	381	<b>1.19</b>	<b>1.04</b>	<b>1.38</b>
		Calderdale	198,600	363	393	398	418	1.19	0.96	1.48
		Wakefield District	321,000	271	293	302	305	0.86	0.70	1.05
		Kirklees	398,400	364	399	427	429	<b>1.27</b>	<b>1.09</b>	<b>1.47</b>
		Leeds	750,300	271	276	309	320	0.98	0.86	1.11
East Midlands	Leicestershire, Northamptonshire, Rutland, Trent	Leicester City	289,700	414	428	466	504	<b>1.62</b>	<b>1.38</b>	<b>1.90</b>
		Leicestershire County and Rutland	673,600	312	334	346	370	1.03	0.91	1.17
		Northamptonshire	669,200	178	278	287	308	0.88	0.76	1.01
		Nottinghamshire County	657,500	283	287	301	312	0.87	0.76	1.00
		Bassetlaw	111,000	216	243	252	297	0.81	0.58	1.14
		Derby City	236,400	186	207	241	250	0.75	0.58	0.97
		Derbyshire County	720,800	216	225	241	284	0.78	0.68	0.89
		Lincolnshire	688,700	267	276	280	282	0.77	0.67	0.89
West Midlands	Birmingham and The Black Country	Dudley	305,200	249	239	249	272	0.77	0.62	0.95
		Birmingham East and North	395,900	288	296	326	331	1.05	0.89	1.25
		Heart of Birmingham Teaching	271,400	376	398	424	457	<b>1.63</b>	<b>1.37</b>	<b>1.95</b>
		South Birmingham	339,400	295	295	301	330	1.02	0.85	1.23
		Sandwell	287,700	313	334	337	358	1.07	0.89	1.30
		Solihull	203,000	217	241	281	281	0.80	0.61	1.03
		Walsall Teaching	254,700	283	298	310	353	1.04	0.85	1.28
	Coventry, Warwickshire, Herefordshire, Worcestershire, Shropshire and Staffordshire	Wolverhampton City	236,900	257	257	257	300	0.89	0.71	1.13
		Coventry Teaching	306,600	307	326	339	372	1.15	0.96	1.38
		Herefordshire	178,000	258	270	292	287	0.77	0.59	1.02
		Warwickshire	522,300	347	343	352	360	1.00	0.86	1.15
		Worcestershire	553,000	222	248	259	277	0.76	0.65	0.89
		North Staffordshire	211,400				312	0.86	0.68	1.10
		South Staffordshire	603,500				295	0.81	0.70	0.94
		Shropshire County	289,500	200	228	231	276	0.75	0.61	0.94
East of England	Bedfordshire and Hertfordshire	Stoke on Trent	247,600				335	0.97	0.79	1.21
		Telford and Wrekin	161,800	130	136	179	222	0.64	0.46	0.89
		Bedfordshire	403,600	240	273	295	334	0.95	0.80	1.12
		Luton	187,200	240	321	385	417	<b>1.30</b>	<b>1.04</b>	<b>1.62</b>
	Essex	West Hertfordshire	530,600	98	181	200	313	0.90	0.77	1.05
		East and North Hertfordshire	527,800	189	263	288	322	0.93	0.80	1.08
		Mid Essex	361,400	224	260	291	315	0.88	0.73	1.06
North East Essex		315,400	193	235	247	254	0.73	0.58	0.91	
South East Essex		329,900	179	215	249	294	0.83	0.68	1.02	
Norfolk, Suffolk, Cambridgeshire	South West Essex	388,300	201	234	242	301	0.88	0.73	1.05	
	West Essex	274,700	244	266	280	280	0.80	0.64	0.99	
	Cambridgeshire	589,600	241	266	282	309	0.88	0.76	1.02	
	Peterborough	163,400	190	196	233	251	0.75	0.55	1.02	
	Norfolk	738,900	225	240	272	294	0.81	0.71	0.93	
London	North Central London	Suffolk	585,300	231	239	270	287	0.81	0.70	0.94
		Great Yarmouth and Waveney	210,600	128	123	157	147	0.41	0.29	0.58
		Barnet	328,400		317	335	442	<b>1.33</b>	<b>1.13</b>	<b>1.57</b>
		Camden	227,200		233	268	304	0.93	0.74	1.18
		Enfield	285,400		347	382	417	<b>1.25</b>	<b>1.04</b>	<b>1.49</b>
		Haringey Teaching	225,600		293	346	381	1.17	0.95	1.44
Islington	185,500		307	345	404	1.24	0.99	1.55		

Table 5.4. Continued

UK Area	Region	PCT/HA <sup>a</sup>	Population covered <sup>b</sup>	Rate pmp				Age and gender standardised rate ratio 2007			
				2004	2005	2006	2007	O/E <sup>c</sup>	L 95% CL	U 95% CL	
London	North East London	Barking and Dagenham	165,400	236	266	272	290	0.94	0.71	1.25	
		City and Hackney Teaching	216,200			282	338	1.08	0.86	1.36	
		Havering	227,500				268	0.77	0.60	0.99	
		Newham	248,300	226	254	270	294	0.99	0.79	1.24	
		Redbridge	251,800	258	286	326	357	1.09	0.88	1.34	
		Tower Hamlets	212,500	179	216	249	254	0.86	0.66	1.12	
		Waltham Forest	222,100			329	374	1.16	0.93	1.43	
	North West London	Brent Teaching	271,400			140	486	1.47	1.24	1.74	
		Ealing	306,400	255	277	304	493	1.47	1.25	1.72	
		Hammersmith and Fulham	171,400	233	239	245	338	1.03	0.79	1.33	
		Harrow	214,600				517	1.53	1.27	1.84	
		Hillingdon	250,100	184	248	268	364	1.10	0.90	1.35	
		Hounslow	218,600	220	256	293	425	1.28	1.04	1.56	
		Kensington and Chelsea	178,000				258	0.74	0.55	0.99	
	Westminster	231,700				268	0.79	0.62	1.01		
	South East London	Bexley	221,600	370	393	402	456	1.33	1.10	1.62	
		Bromley	299,400	314	344	371	418	1.21	1.01	1.44	
		Greenwich Teaching	222,600	207	247	270	337	1.05	0.84	1.32	
		Lambeth	272,200	217	224	231	298	0.91	0.73	1.14	
		Lewisham	255,600	360	364	395	458	1.39	1.16	1.67	
		Southwark	269,000	387	413	431	472	1.46	1.22	1.73	
	South West London	Croydon	337,000	211	228	285	329	0.98	0.81	1.18	
		Kingston	156,000				378	1.12	0.87	1.45	
		Richmond and Twickenham	179,500				245	0.70	0.52	0.94	
		Sutton and Merton	382,000				395	1.17	1.00	1.37	
		Wandsworth	279,200				376	1.16	0.96	1.41	
	South East	Hampshire and Isle of Wight	Isle of Wight National Health Service	138,200	304	297	297	282	0.77	0.56	1.06
Hampshire			1,265,900	292	293	320	339	0.95	0.87	1.05	
Portsmouth City Teaching			196,300	346	331	346	362	1.13	0.89	1.42	
Southampton City			229,100	301	314	336	354	1.12	0.90	1.39	
Kent and Medway		West Kent									
		Medway									
		Eastern and Coastal Kent									
Surrey and Sussex		Hastings and Rother	176,200	221	244	244	272	0.77	0.58	1.02	
		Brighton and Hove City	251,500	195	207	250	282	0.84	0.66	1.06	
		East Sussex Downs and Weald	330,200	233	227	218	270	0.76	0.61	0.93	
		Surrey	1,073,400	231	245	288	354	1.00	0.90	1.11	
		West Sussex	770,600	241	256	276	321	0.91	0.80	1.03	
Thames Valley		Milton Keynes	230,100	256	278	304	343	1.00	0.80	1.24	
		Berkshire East	382,200	283	267	283	434	1.29	1.10	1.50	
		Berkshire West	445,400	328	272	290	411	1.19	1.03	1.38	
		Oxfordshire	607,400	354	367	400	413	1.21	1.07	1.37	
		Buckingham-shire	500,700	328	350	397	431	1.22	1.07	1.39	
South West		Avon, Gloucestershire and Wiltshire	Bath and North East Somerset	175,600	222	239	251	279	0.82	0.62	1.09
			Bristol	410,700	377	380	399	426	1.32	1.14	1.53
	Gloucestershire		578,500	306	327	339	344	0.97	0.84	1.11	
	Swindon		192,600	301	332	332	337	0.98	0.77	1.24	
	South Gloucestershire		254,200	366	382	397	437	1.23	1.02	1.48	
Wiltshire	448,600	241	254	274	292	0.82	0.69	0.98			



Table 5.4. Continued

UK Area	Region	PCT/HA <sup>a</sup>	Population covered <sup>b</sup>	Rate pmp				Age and gender standardised rate ratio 2007		
				2004	2005	2006	2007	O/E <sup>c</sup>	L 95% CL	U 95% CL
South West	Dorset and Somerset	Bournemouth and Poole	297,900	279	299	316	342	1.00	0.82	1.21
		Dorset	403,100	293	315	335	375	1.03	0.88	1.20
		North Somerset	201,200	403	388	388	348	0.96	0.76	1.22
		Somerset	518,800	297	320	330	339	0.95	0.82	1.10
	South West Peninsula	Devon	740,600	269	271	296	325	0.90	0.79	1.02
		Plymouth Teaching	247,900	343	395	420	436	<b>1.29</b>	<b>1.07</b>	<b>1.56</b>
		Torbay	133,000	278	308	331	361	1.01	0.76	1.34
	Cornwall and Isles of Scilly	526,200	272	306	321	357	0.98	0.85	1.13	
Wales	Bro Taf	Cardiff	317,500	356	378	406	431	<b>1.36</b>	<b>1.15</b>	<b>1.61</b>
		Merthyr Tydfil	55,800	484	520	538	609	<b>1.75</b>	<b>1.25</b>	<b>2.45</b>
		Rhondda, Cynon, Taff	234,100	397	444	496	513	<b>1.49</b>	<b>1.24</b>	<b>1.78</b>
		Vale of Glamorgan	123,200	341	325	333	333	0.95	0.70	1.29
	Dyfed Powys	Carmarthenshire	177,800	326	349	382	388	1.08	0.85	1.36
		Ceredigion	77,100	350	324	324	324	0.92	0.62	1.37
		Pembrokeshire	116,800	308	351	325	351	0.97	0.71	1.32
		Powys	130,900	222	222	260	290	0.78	0.57	1.08
	Gwent	Blaenau Gwent	69,500	403	388	403	432	1.23	0.86	1.76
		Caerphilly	171,300	356	374	385	414	1.19	0.95	1.51
		Monmouthshire	87,800	478	513	513	513	<b>1.39</b>	<b>1.04</b>	<b>1.86</b>
		Newport	140,500	370	342	320	370	1.10	0.83	1.44
		Torfaen	91,000	451	451	462	505	<b>1.45</b>	<b>1.09</b>	<b>1.94</b>
	Morgannwg	Bridgend	132,600	370	400	415	445	1.26	0.97	1.62
		Neath Port Talbot	137,100	299	321	416	430	1.21	0.94	1.56
		Swansea	227,000	374	388	423	449	<b>1.31</b>	<b>1.08</b>	<b>1.59</b>
	North Wales	Conwy	111,300	314	314	314	314	0.87	0.63	1.22
		Denbighshire	95,900	250	302	292	292	0.82	0.56	1.18
		Flintshire	150,000	273	287	307	373	1.04	0.80	1.35
		Gwynedd	118,200	262	288	279	313	0.90	0.65	1.24
Isle of Anglesey		68,800	203	203	218	247	0.68	0.42	1.09	
Wrexham		131,000	321	313	374	374	1.06	0.80	1.40	
Scotland	Aberdeen City	207,000	333	333	348	357	1.01	0.81	1.27	
	Aberdeenshire	236,300	317	334	339	351	0.95	0.76	1.18	
	Angus	109,500	521	521	548	557	<b>1.51</b>	<b>1.18</b>	<b>1.94</b>	
	Argyll & Bute	91,200	263	274	351	362	0.96	0.68	1.35	
	Scottish Borders	110,300	236	263	254	281	0.75	0.53	1.07	
	Clackmannan-shire	48,800	225	246	246	246	0.68	0.39	1.20	
	West Dunbartonshire	91,100	296	296	307	362	1.02	0.73	1.44	
	Dumfries & Galloway	148,000	291	297	311	331	0.87	0.66	1.16	
	Dundee City	142,100	387	387	429	450	<b>1.32</b>	<b>1.04</b>	<b>1.69</b>	
	East Ayrshire	119,300	251	260	277	285	0.79	0.56	1.10	
	East Dunbartonshire	105,700	407	416	426	454	1.25	0.94	1.66	
	East Lothian	92,600	324	313	292	302	0.84	0.58	1.21	
	East Renfrewshire	89,000	382	404	427	449	1.27	0.93	1.73	
	Edinburgh, City of	463,300	287	315	296	319	0.94	0.80	1.10	
	Falkirk	149,500	314	328	294	348	0.97	0.74	1.27	
	Fife	359,200	267	287	298	301	0.84	0.70	1.02	
	Glasgow City	580,600	382	401	410	439	<b>1.31</b>	<b>1.16</b>	<b>1.48</b>	
	Highland	215,400	292	320	344	367	0.98	0.79	1.22	
	Inverclyde	81,300	344	369	332	332	0.93	0.64	1.35	
	Midlothian	79,000	316	329	342	392	1.09	0.77	1.56	
Moray	86,700	334	404	438	427	1.16	0.84	1.60		



**Table 5.4.** Continued

UK Area	Region	PCT/HA <sup>a</sup>	Population covered <sup>b</sup>	Rate pmp				Age and gender standardised rate ratio 2007		
				2004	2005	2006	2007	O/E <sup>c</sup>	L 95% CL	U 95% CL
Scotland		North Ayrshire	135,300	325	377	414	443	1.23	0.95	1.58
		North Lanarkshire	323,700	324	346	349	361	1.03	0.86	1.24
		Orkney Islands	20,000	500	550	550	450	1.20	0.63	2.31
		Perth & Kinross	140,200	300	307	314	328	0.89	0.67	1.19
		Renfrewshire	169,300	360	384	413	437	1.21	0.97	1.52
		Shetland Islands	22,000	318	273	273	273	0.74	0.33	1.65
		South Ayrshire	111,900	349	349	366	375	1.01	0.75	1.37
		South Lanarkshire	307,700	367	374	374	383	1.07	0.89	1.28
		Stirling	87,600	274	251	240	240	0.68	0.45	1.05
		West Lothian	165,700	338	362	326	344	0.97	0.75	1.26
		Eilean Siar	25,900	193	232	232	309	0.81	0.41	1.62
Northern Ireland	Northern Ireland	Antrim	51,500	369	447	466	1.41	0.95	2.11	
		Ards	76,000	329	329	329	0.92	0.62	1.37	
		Armagh	56,400	319	355	355	1.09	0.71	1.70	
		Ballymena	61,400	228	261	277	0.81	0.51	1.31	
		Ballymoney	29,300	205	273	239	0.72	0.34	1.51	
		Banbridge	45,400	286	308	352	1.05	0.64	1.72	
		Belfast	267,600	314	329	336	1.07	0.87	1.32	
		Carrickfergus	39,800	477	477	477	1.39	0.89	2.18	
		Castlereagh	65,600	366	442	457	1.32	0.92	1.88	
		Coleraine	56,900	211	193	193	0.57	0.32	1.03	
		Cookstown	34,600	87	116	116	0.37	0.14	0.98	
		Craigavon	86,800	288	300	288	0.88	0.60	1.31	
		Derry	107,800	297	343	353	1.13	0.82	1.55	
		Down	68,400	234	249	263	0.80	0.50	1.27	
		Dungannon	52,700	209	209	247	0.78	0.45	1.34	
		Fermanagh	60,600	165	215	198	0.59	0.33	1.04	
		Larne	31,400	605	541	541	1.53	0.95	2.46	
		Limavady	33,900	354	324	324	1.00	0.55	1.81	
		Lisburn	113,300	353	406	424	1.29	0.97	1.71	
		Magherafelt	42,900	350	350	396	1.25	0.78	2.02	
		Moyle	17,000	294	353	294	0.86	0.36	2.06	
		Newry & Mourne	93,600	374	353	363	1.15	0.82	1.61	
		Newtownabbey	81,400	307	381	381	1.12	0.79	1.59	
North Down	79,000	354	342	380	1.07	0.75	1.54			
Omagh	51,200	215	273	293	0.91	0.55	1.50			
Strabane	39,200	255	332	357	1.10	0.65	1.86			

the increasing number of diabetic patients with a functioning transplant amongst incident dialysis patients as shown in table 5.7. If this trend of increasing transplantation activity for diabetics continues, there will be an inevitable decrease in the relative proportion of incident non-diabetic patients receiving a renal transplant.

#### *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 and were classified as ethnicity 'unknown' (table 5.8).

#### *Comorbidity*

Although most renal centres' renal IT system contained fields for annual comorbidity data capture, these fields were mostly incomplete. The UKRR therefore has not attempted to analyse the development of comorbidity after the start of RRT. Based on data analysis from

**Table 5.5.** Distribution of prevalent patients on RRT by centre and modality on 31/12/2007

Centre	Total	% HD	% PD	% transplant
<b>Transplant centres</b>				
B QEH	1,626	47	8	45
Belfast	748	35	8	57
Bristol	1,234	38	7	56
Camb	935	38	5	57
Cardff	1,438	34	11	55
Covnt	717	43	11	46
Edinb	720	38	11	52
Glasgw	1,605	37	6	56
L Barts	1,473	40	16	44
L Guys	1,395	34	5	61
L Rfree	1,437	42	9	49
L St G	567	36	9	55
L West	2,162	49	3	48
Leeds	1,379	37	8	56
Leic	1,594	42	13	45
Liv RI	1,284	33	8	59
M RI	1,352	26	9	65
Newc	920	27	6	67
Nottm	971	38	15	47
Oxford	1,328	26	11	63
Plymth	421	31	10	58
Ports	1,182	34	9	57
Sheff	1,172	48	8	44
<b>Dialysis centres</b>				
Abrdn	452	47	8	45
Airdrie	230	64	10	26
Antrim	200	65	8	28
B Heart	578	67	6	27
Bangor	98	66	34	0
Basldn	205	64	15	20
Bradfd	395	45	11	44
Brightn	685	49	13	39
Carlis	202	43	6	51
Carsh	1,165	48	11	41
Chelms	188	57	22	20
Clwyd	155	46	12	42
Colchr	100	100	0	0
D & Gall	77	65	21	14
Derby	301	68	26	6
Derry	62	84	6	10
Donc	107	54	36	10
Dorset	442	36	13	50
Dudley	255	45	24	31
Dundee	376	45	8	47
Dunfn	220	51	11	38
Exeter	664	45	12	42
Glouc	326	54	10	36
Hull	672	46	13	40
Inverns	207	41	19	40
Ipswi	283	36	18	47
Kent	627	46	16	38
Klmarnk	214	61	22	17
L Kings	712	48	12	40
Liv Ain	115	100	0	0
M Hope	759	42	18	40

**Table 5.5.** Continued

Centre	Total	% HD	% PD	% transplant
Middlbr	667	44	4	52
Newry	147	59	10	32
Norwch	495	53	13	35
Prestn	855	49	10	42
Redng	545	42	18	40
Shrew	285	57	14	29
Stevng	548	60	8	32
Sthend	195	63	10	27
Stoke	588	44	16	40
Sund	282	59	5	36
Swanse	544	55	15	30
Truro	286	55	9	36
Tyrone	149	56	3	41
Ulster	86	92	3	5
Wirral	216	84	16	0
Wolve	441	62	14	24
Wrexm	142	56	23	21
York	231	50	11	39
<b>England</b>	<b>37,614</b>	<b>43</b>	<b>10</b>	<b>47</b>
<b>N Ireland</b>	<b>1,392</b>	<b>50</b>	<b>8</b>	<b>43</b>
<b>Scotland</b>	<b>4,101</b>	<b>43</b>	<b>9</b>	<b>48</b>
<b>Wales</b>	<b>2,377</b>	<b>42</b>	<b>14</b>	<b>44</b>
<b>UK</b>	<b>45,484</b>	<b>43</b>	<b>10</b>	<b>46</b>

patients where appropriate comorbidity information was available, it was not surprising to find that transplanted patients had none or fewer comorbidities compared to patients who remained on dialysis or had died (table 5.9). If all renal centres consistently reported on the comorbidity of their RRT patients it would be possible to compare whether inter-centre differences exist in wait-listed and transplanted patients by comorbidity.

### Post-transplant follow-up

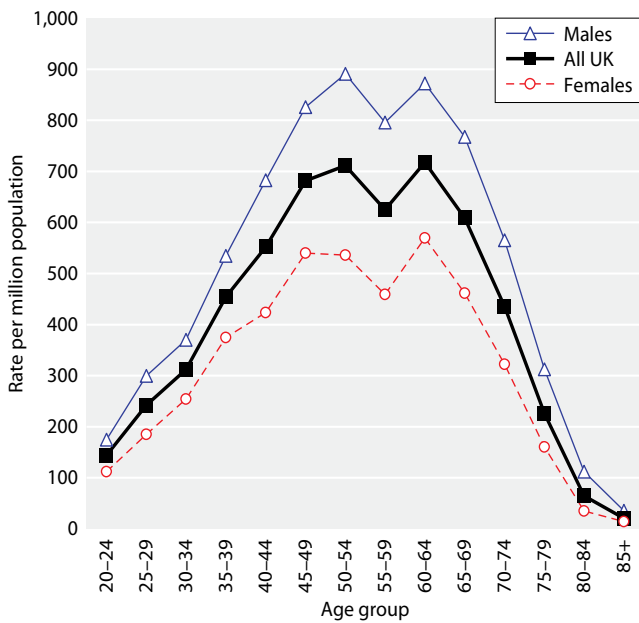
#### Introduction

There continued to be a huge variation in the extent of completeness of data (tables 5.10a and b) reported by each centre. Better data returns would facilitate more meaningful comparisons between centres and help to determine the causes of differences between centres in

**Table 5.6.** Median age and gender ratio of incident and prevalent transplant patients

Year	Incident transplants			Prevalent transplants <sup>a</sup>		
	N	Median age	M:F ratio	N	Median age	M:F ratio
2002	1,404	46.0	1.6	11,782	49.4	1.6
2003	1,509	44.5	1.5	12,815	49.5	1.6
2004	1,685	45.4	1.7	15,007	49.6	1.6
2005	1,742	45.4	1.4	16,765	49.7	1.6
2006	1,990	45.2	1.6	17,884	49.9	1.6
2007	2,196	45.7	1.5	20,819	50.1	1.5

<sup>a</sup> As on 31st December for given year, only centres submitting data to the UKRR in a given year are included



**Fig. 5.1.** Transplant prevalence rate per million population by age and gender on 31/12/2007

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 performance between centres, as unrecorded or unreported variables may be influencing outcome.

The 72 renal centres in the UK comprise of 52 centres in England, 5 in Wales, 6 in Northern Ireland and 9 in Scotland. Centres in Scotland only provided summary information and therefore laboratory outcome data for comparisons were not available for the Scottish renal centres. Kent and London St George’s were also unable to provide laboratory data on their patients and were excluded from these analyses. Four centres (Bangor, Colchester, Liverpool Aintree, Wirral) were reported as having no transplanted patients and therefore excluded. After exclusion of these 15 centres, prevalent patient data from 57 renal centres across the UK were analysed.

For the one year post-transplant outcomes, the two Scottish transplant centres and London St George’s

**Table 5.7.** Primary renal disease in renal transplant recipients

Primary diagnosis	New transplants by year					Established transplants on 1/1/2007		
	2003 %	2004 %	2005 %	2006 %	2007 %	N	%	N
Aetiology uncertain/GN <sup>a</sup>								
not biopsy proven	20.1	19.8	18.5	17.9	17.6	386	20.4	3,657
Diabetes	9.5	10.6	11.9	13.2	14.6	320	7.7	1,370
Glomerulonephritis	20.6	19.4	18.9	19.0	19.1	419	19.8	3,541
Polycystic kidney disease	12.7	12.5	11.4	12.2	12.7	279	12.0	2,139
Pyelonephritis	12.0	12.0	11.4	11.3	10.9	239	15.6	2,796
Reno-vascular disease	5.7	6.6	6.3	5.9	5.6	124	5.8	1,039
Other	15.1	13.3	14.5	15.1	15.0	329	15.8	2,831
Not available	4.4	5.8	7.2	5.4	4.6	100	2.9	511

<sup>a</sup> GN – glomerulonephritis

**Table 5.8.** Ethnicity of patients who received a transplant in the years 2002–2007

Year	% White	% South Asian	% Black	% Other	% unknown
2002	70.2	9.3	5.3	2.2	13.0
2003	71.2	5.6	4.8	2.1	16.4
2004	69.9	7.1	4.4	2.3	16.4
2005	71.9	7.2	5.4	1.2	14.3
2006	71.2	5.6	4.8	2.1	16.4
2007	68.7	7.5	5.7	2.5	15.5

**Table 5.9.** Comparison of comorbidity in patients starting RRT during 2002–2007 who underwent transplantation with those who remained on dialysis or died

Comorbidity	Not transplanted		Transplanted		p value <sup>a</sup>
	N	%	N	%	
Patients with comorbidity data	11,286		2,007		
Without comorbidity	4,782	42.4	1,541	76.8	<0.0001
Ischaemic heart disease	2,829	25.5	104	5.2	<0.0001
Peripheral vascular disease	1,438	12.9	45	2.3	<0.0001
Cerebrovascular disease	1,232	11.0	55	2.7	<0.0001
Diabetes (not cause of ERF) <sup>b</sup>	966	8.8	47	2.4	<0.0001
COPD <sup>c</sup>	855	7.7	30	1.5	<0.0001
Liver disease	298	2.7	11	0.5	<0.0001
Malignancy	1,470	13.1	36	1.8	<0.0001
Smoking	1,613	15.5	239	12.7	0.001

<sup>a</sup> Chi square p value comparing proportion with comorbidity between groups

<sup>b</sup> Established renal failure

<sup>c</sup> Chronic obstructive pulmonary disease

**Table 5.10a.** Percentage completeness by centre for prevalent transplant patients on 31/12/2007

Centre	Total number of patients	Ethnicity	eGFR <sup>a</sup>	Blood pressure	Centre	Total number of patients	Ethnicity	eGFR <sup>a</sup>	Blood pressure
Antrim	54	100.0	94.4	20.4	Liv RI	750	95.2	91.9	87.5
B Heart	154	100.0	90.9	2.0	M Hope	296	97.6	93.9	0.0
B QEH	704	99.7	87.9	1.1	M RI	844	90.2	96.8	0.1
Basldn	42	100.0	95.2	2.4	Middlbr	342	92.4	95.0	54.4
Belfast	410	100.0	97.3	90.0	Newc	591	99.5	96.8	0.7
Bradfd	170	67.1	94.1	97.1	Newry	47	100.0	87.2	4.3
Brightn	252	45.6	94.4	0.4	Norwch	170	87.1	91.8	0.6
Bristol	664	97.9	98.8	93.2	Nottm	442	95.9	98.0	96.6
Camb	511	84.7	88.5	1.6	Oxford	796	42.3	95.9	16.1
Cardff	753	42.4	97.5	96.7	Plymth	233	88.4	96.6	1.3
Carlisle	103	99.0	91.3	0.0	Ports	665	98.7	83.2	11.7
Carsh	459	97.8	92.4	0.7	Prestn	350	92.6	91.1	0.3
Chelms	37	86.5	97.3	91.9	Redng	214	100.0	99.5	99.1
Clwyd	64	71.9	93.8	93.8	Sheff	496	98.4	99.0	98.8
Covnt	323	97.2	89.2	76.5	Shrew	78	100.0	100.0	19.2
Derby	18	94.4	72.2	16.7	Stevng	174	100.0	63.8	0.6
Derry	5	100.0	80.0	80.0	Sthend	53	86.8	100.0	0.0
Donc	7	100.0	100.0	100.0	Stoke	230	40.9	97.4	14.8
Dorset	222	100.0	91.4	12.6	Sund	99	96.0	98.0	2.0
Dudley	80	100.0	96.3	88.8	Swanse	155	100.0	98.1	11.0
Exeter	276	92.4	95.3	86.6	Truro	101	82.2	98.0	70.3
Glouc	115	99.1	96.5	1.7	Tyrone	61	100.0	93.4	86.9
Hull	270	80.0	90.0	0.4	Ulster	3	100.0	100.0	100.0
Ipswi	131	97.7	95.4	95.4	Wolve	104	100.0	98.1	99.0
L Barts	625	94.7	94.6	0.0	Wrexm	29	93.1	93.1	51.7
L Guys	820	86.8	96.5	0.1	York	88	75.0	98.9	96.6
L Kings	274	96.4	94.5	0.0	<b>England</b>	<b>16,516</b>	<b>88.6</b>	<b>90.5</b>	<b>30.3</b>
L RFree	679	98.5	91.0	0.2	<b>N Ireland</b>	<b>580</b>	<b>100.0</b>	<b>95.7</b>	<b>76.2</b>
L West	1,008	84.5	43.6	0.1	<b>Wales</b>	<b>1,001</b>	<b>54.7</b>	<b>97.2</b>	<b>81.9</b>
Leeds	757	73.2	96.6	90.2	<b>E, W &amp; NI</b>	<b>18,097</b>	<b>87.1</b>	<b>91.0</b>	<b>34.6</b>
Leic	699	91.6	91.3	36.3					

<sup>a</sup> Patients with missing ethnicity were classed as White for eGFR calculation; eGFR – estimated glomerular filtration rate

**Table 5.10b.** Percentage completeness by centre for prevalent transplant patients on 31/12/2007

Centre	Patients N	Haemoglobin	Total serum cholesterol	Adjusted serum calcium <sup>a</sup>	Serum phosphate	Serum PTH
Antrim	54	94	94	94	94	85
B Heart	154	90	58	88	86	18
B QEH	704	88	87	88	87	60
Basldn	42	95	93	95	90	67
Belfast	410	97	98	97	97	20
Bradfd	170	89	89	93	91	38
Brightn	252	94	37	87	87	32
Bristol	664	99	94	98	98	78
Camb	511	88	83	87	87	70
Cardff	753	97	79	97	97	19
Carlisle	103	94	88	91	89	7
Carsh	459	89	70	92	91	2
Chelms	37	95	86	97	97	11
Clwyd	64	94	83	92	94	56
Covnt	323	88	2	89	75	21
Derby	18	72	22	56	50	33
Derry	5	80	100	80	80	20
Donc	7	86	86	71	71	0
Dorset	222	91	88	90	62	14
Dudley	80	95	90	94	94	45
Exeter	276	95	86	94	85	20
Glouc	115	97	67	96	95	23
Hull	270	89	52	90	90	26
Ipswi	131	95	89	95	95	43
L Barts	625	95	97	94	94	80
L Guys	820	96	90	90	90	25
L Kings	274	95	82	95	95	0
L RFree	679	82	86	91	91	55
L West	1,008	44	82	43	42	4
Leeds	757	94	96	93	96	25
Leic	699	90	90	91	91	64
Liv RI	750	92	6	89	91	47
M Hope	296	93	95	94	94	85
M RI	844	96	62	97	97	61
Middlbr	342	93	76	93	93	18
Newc	591	97	95	97	97	57
Newry	47	87	91	85	83	36
Norwch	170	92	93	91	91	22
Nottm	442	98	93	96	96	83
Oxford	796	96	77	95	95	38
Plymth	233	93	92	94	92	16
Ports	665	84	52	83	79	7
Prestn	350	89	85	89	86	52
Redng	214	99	100	99	98	81
Sheff	496	99	74	99	99	17
Shrew	78	100	96	96	95	60
Stevng	174	84	80	83	82	47
Sthend	53	100	94	96	96	15
Stoke	230	97	99	97	97	30
Sund	99	98	76	98	93	79
Swanse	155	98	98	98	98	39
Truro	101	97	77	98	98	50
Tyrone	61	85	98	92	92	26
Ulster	3	100	100	100	100	33
Wolve	104	97	85	98	86	63

**Table 5.10b.** Continued

Centre	Patients N	Haemoglobin	Total serum cholesterol	Adjusted serum calcium <sup>a</sup>	Serum phosphate	Serum PTH
Wrexham	29	93	83	93	93	59
York	88	89	83	51	97	22
<b>England</b>	<b>16,516</b>	<b>90</b>	<b>77</b>	<b>89</b>	<b>88</b>	<b>41</b>
<b>N Ireland</b>	<b>580</b>	<b>95</b>	<b>97</b>	<b>95</b>	<b>95</b>	<b>28</b>
<b>Wales</b>	<b>1,001</b>	<b>97</b>	<b>82</b>	<b>97</b>	<b>97</b>	<b>26</b>
<b>E, W &amp; NI</b>	<b>18,097</b>	<b>90</b>	<b>78</b>	<b>90</b>	<b>89</b>	<b>40</b>

<sup>a</sup> Serum calcium adjusted for serum albumin

were excluded as they did not submit biochemical data to the UKRR, Belfast and Manchester RI have only recently commenced submitting data to the UKRR and were therefore also excluded. After excluding these 5 from the 23 transplant centres, one year outcomes are described for 18 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 2000–2006 with patients attributed to the transplant centre that performed the procedure.

Time post-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 such bias, outcomes are also reported in patients one year post-transplantation. 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 are more robust. It should be noted that several dialysis centres only receive patients back to their clinical care when the graft is failing.

### Prevalent patient data

Data from both transplanting and non-transplanting renal centres concerning biochemical and clinical variables for patients with a functioning transplant were included in the analyses. The cohort comprised of prevalent patients as on 31/12/2007. 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 for whom the exact date of transplant was not known were excluded from analyses. Four centres (Derby, Derry, Doncaster and Ulster) with <20 patients are not shown

in the figures. Patients were considered as having a functioning transplant if 'transplant' was listed as the last mode of RRT in the last quarter of 2007. For haemoglobin, estimated glomerular filtration rate (eGFR), calcium and phosphate, the last value in quarter 3 or quarter 4 of 2007 was used. For blood pressure and cholesterol, the latest value from 2007 was used. For parathyroid hormone (PTH), the latest value in the last 3 quarters of 2007 was used.

### Estimated glomerular filtration rate (eGFR)

For the purpose of eGFR calculation, the 4-variable MDRD formula was used, although serum creatinine has not been standardised to that of the assay used at the MDRD laboratory, and the different creatinine assay methods in use in the UK have not been taken into account. The majority of UK NHS laboratories are believed to have made appropriate adjustments taking into account differences between the Beckman assay and their current assays when reporting eGFR values. In the UK there is now a further move towards standardising against an isotope dilution mass spectrometry (ID-MS) traceable creatinine result, which will then require use of an adjusted 4v MDRD equation. The UK Association of Clinical Biochemists had stated that most UK laboratories were using the kinetic Jaffe assay and the standard 4v MDRD equation is most appropriate (personal communication, E Lamb). Patients with valid serum creatinine results but no ethnicity data were classed as White for the purpose of the eGFR calculation as few transplanted patients were from an ethnic minority.

### One year post-transplant data

Patients who received a renal transplant between 1 January 2000 and 31 December 2006 were assigned according to the renal centre in which they were transplanted (table 5.11).

Brighton (until 1996) and Carshalton/St Helier's (until 2003) were transplanting centres, with subsequent transplants performed at London St George's. Patients who had died or experienced graft failure within 12 months post-transplantation were excluded from analysis. For patients with more than one transplant during 2000–2006, they were included as separate episodes provided each of the transplants functioned for a year.

For each patient, the most recent laboratory or blood pressure for the relative 4th/5th quarter (9–15 months) after renal transplantation, was taken to be representative of the one year



**Table 5.11.** Number of patients reallocated to transplanting centre

Transplant centre	Number of patients per transplant centre	Number of patients reallocated to transplant centre	Non-transplant centre
B QEH	587	2	Shrew
		4	Stoke
Bristol	572	1	Glouc
Camb	586	1	Norwch
		26	Stevng
Cardff	545	1	Swanse
Covnt	238	n/a	
L Barts	450	n/a	
L Guys	963	257	L Kings
L Rfree	500	2	Sthend
L St.G	360	4	Brightn
		190	Carsh
L West	509	n/a	
Leeds	773	20	Hull
Leic	352	n/a	
Liv RI	780	216	Prestn
		2	Wrexm
M RI	645	32	M Hope
Newc	584	11	Carlis
		18	Middlbr
		14	Sund
Nottm	245	3	Derby
Oxford	619	n/a	
Plymth	290	3	Truro
Ports	361	n/a	
Sheff	291	n/a	
<b>Total</b>	<b>10,250</b>	<b>807</b>	

n/a not applicable

post-transplant outcome. For the purpose of eGFR calculation, if there was a valid serum creatinine but no ethnicity data available, patients were classed as White.

## Results and Discussion

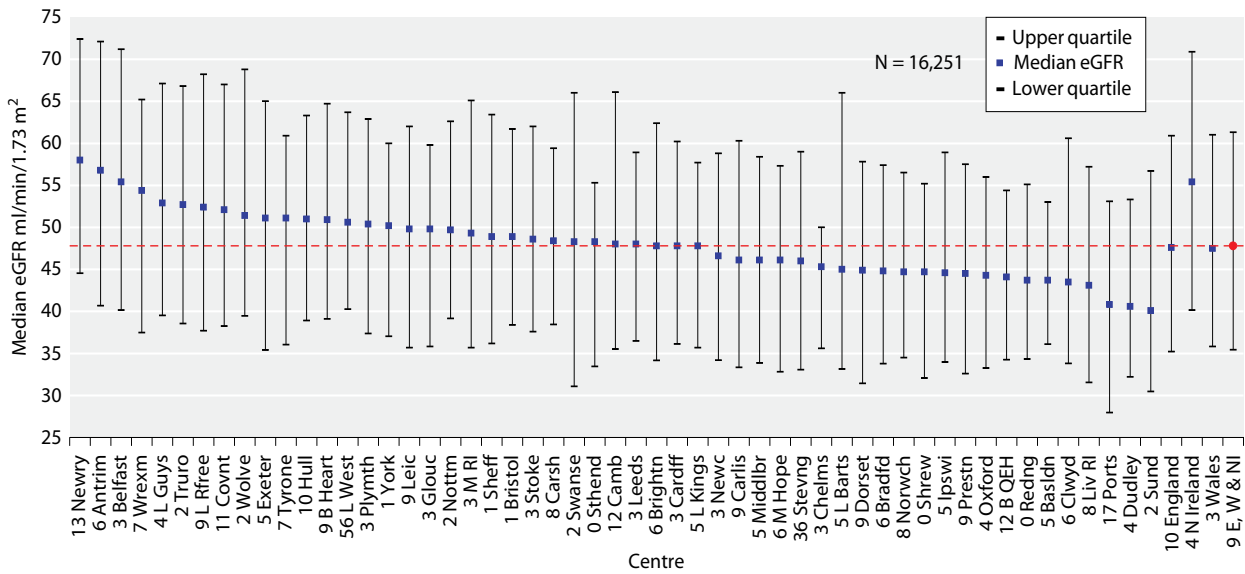
### *Post-transplant eGFR in prevalent transplant patients*

Median eGFR in each centre and percentage of patients with eGFR <30 ml/min/1.73 m<sup>2</sup> are shown in figures 5.2 and 5.3. The median eGFR was 47.8 ml/min/1.73 m<sup>2</sup>, with 16% of prevalent transplant recipients having an eGFR <30 ml/min/1.73 m<sup>2</sup>. Whilst local repatriation policies on timing of transfer of care of patients with failing transplant from transplant centres to referring centres might explain some of the differences, it is notable that both transplanting and non-transplant centres feature at both ends of the scale. The accuracy of 4v MDRD in estimating GFR ≥60 ml/min/1.73 m<sup>2</sup> was poor and therefore a figure describing this

is not included in this feature. Centres with a high prevalence of patients with eGFR <30 ml/min/1.73 m<sup>2</sup> were likely to expend significant resources in the management of complications related to declining renal function as well as ensuring safe transition to dialysis and/or re-transplantation.

Figure 5.4 represents the percentage of prevalent patients by centre with eGFR <30 mls/min/1.73 m<sup>2</sup> as a funnel plot enabling for the first time to more accurately compare outcomes in 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 the 53 centres included, it would be expected by chance that 2–3 centres would fall between the 2–3 standard deviation (sd) limit (1 in 20) (1 above and 1 below) and no centres should fall outside 3 sd limits.

These data show over dispersion with 13 centres within the 2–3 sd limits with 2 above (London Barts, Swansea) and 11 below. Swansea is known to receive late repatriation of transplant patients from the Cardiff



**Fig. 5.2.** Median eGFR in prevalent transplant patients by centre on 31/12/07

transplant centre only when grafts are failing so it is not unexpected for this centre to have a high proportion of patients with  $eGFR < 30 \text{ ml/min/1.73 m}^2$ .

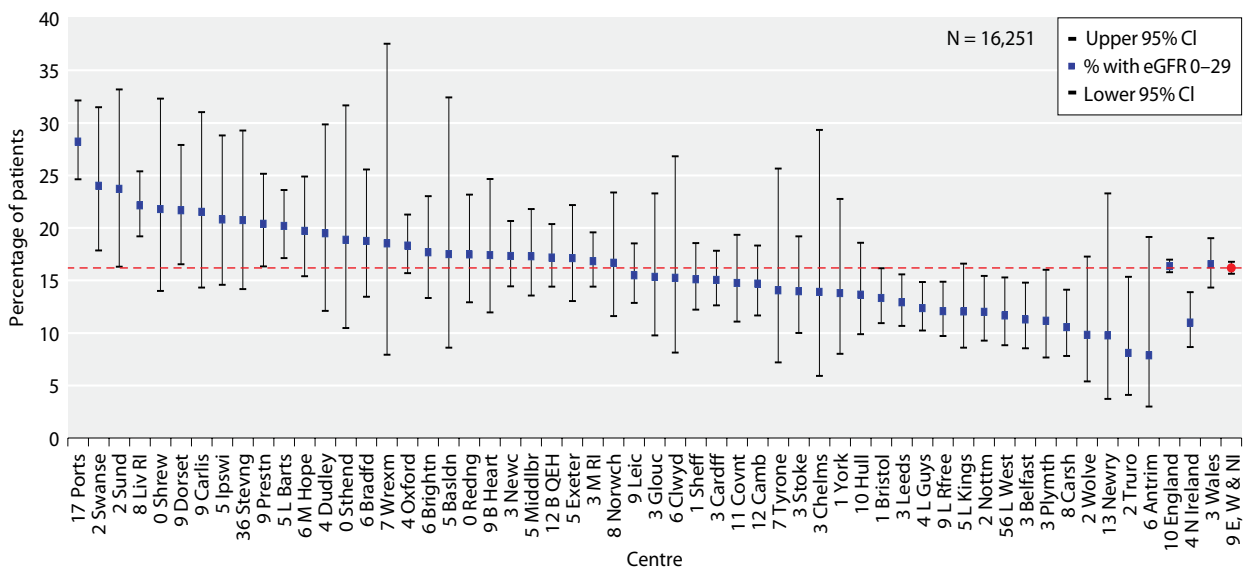
There are 3 centres who fall outside the 3 sd limits with 2 above (Liverpool RI, Portsmouth) and 1 below (Carshalton). The 2 centres that fall outside the upper 99% CI (indicating a higher than expected proportion of patients with  $eGFR < 30 \text{ ml/min/1.73 m}^2$ ), interestingly are both transplant centres.

*eGFR in patients one year after transplantation*

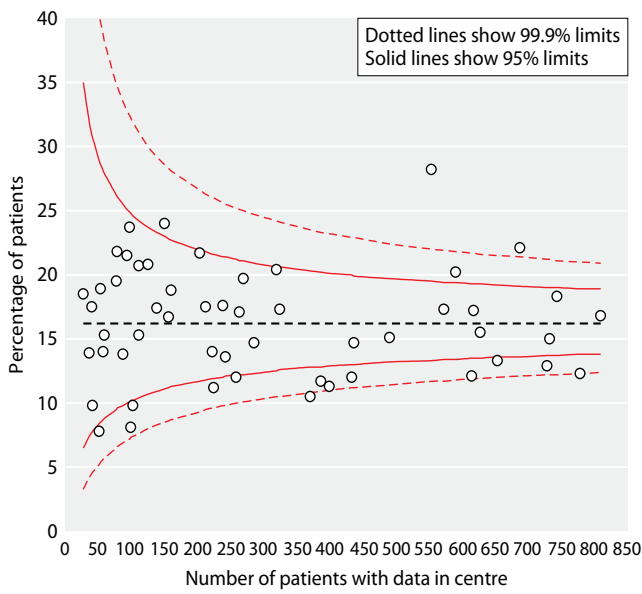
Graft function at one year post-transplantation may predict subsequent long term graft outcome. Table 5.12

shows the proportion of prevalent transplant patients with  $eGFR < 30 \text{ ml/min/1.73 m}^2$ . Both patient level variables and centre practices will influence the efficiency of graft function at one year post-transplantation. Whilst it is outside the remit of this analysis to control for patient level variables, one year graft function remained one of the most important outcome variables in renal transplantation other than survival data. Figure 5.5 shows the median one year post-transplant eGFR for patients transplanted 2000–2006 was  $49.4 \text{ ml/min/1.73 m}^2$ .

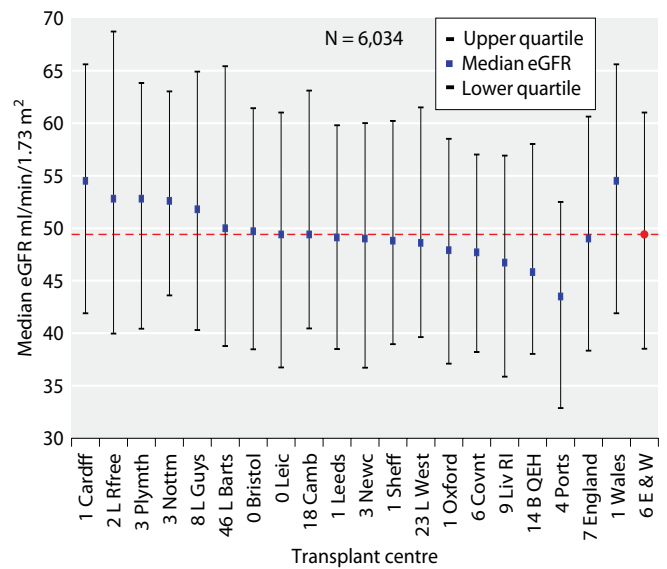
There was a significant difference in one year post-transplant median eGFR between centres for patients



**Fig. 5.3.** Percentage of prevalent transplant patients by centre on 31/12/07 with  $eGFR < 30 \text{ ml/min/1.73 m}^2$



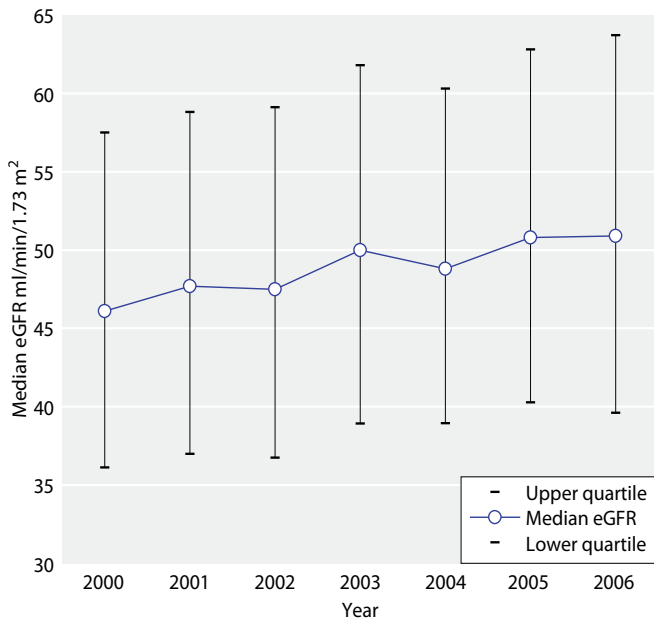
**Fig. 5.4.** Funnel plot of percentage of prevalent patients with eGFR <30 ml/min/1.73 m<sup>2</sup> by centre size on 31/12/07



**Fig. 5.5.** Median eGFR one year post-transplant by transplant centre for patients transplanted between 2000–2006

**Table 5.12.** Proportion of prevalent transplant patients with eGFR <30 ml/min/1.73 m<sup>2</sup>

Centre	Number of patients with eGFR data	Patients with eGFR <30 (%)	Centre	Number of patients with eGFR data	Patients with eGFR <30 (%)
Wrexm	27	18.5	Hull	242	13.6
Chelms	36	13.9	L Kings	258	12.0
Basldn	40	17.5	Exeter	263	17.1
Newry	41	9.8	M Hope	269	19.7
Antrim	51	7.8	Covnt	285	14.7
Sthend	53	18.9	Prestn	319	20.4
Tyrone	57	14.0	Middlbr	324	17.3
Clwyd	59	15.3	Carsh	370	10.5
Dudley	77	19.5	L West	386	11.7
Shrew	78	21.8	Belfast	399	11.3
York	87	13.8	Nottm	433	12.0
Carlisle	93	21.5	Camb	436	14.7
Sund	97	23.7	Sheff	490	15.1
Truro	99	8.1	Ports	553	28.2
Wolve	102	9.8	Newc	572	17.3
Stevng	111	20.7	L Barts	590	20.2
Glouc	111	15.3	L Rfree	614	12.1
Ipswi	125	20.8	B QEH	617	17.2
B Heart	138	17.4	Leic	627	15.5
Swanse	150	24.0	Bristol	653	13.3
Norwch	156	16.7	Liv RI	687	22.1
Bradfd	160	18.8	Leeds	728	12.9
Dorset	203	21.7	Cardff	732	15.0
Redng	212	17.5	Oxford	743	18.3
Stoke	222	14.0	L Guys	778	12.3
Plymth	224	11.2	M RI	809	16.8
Brightn	238	17.6			



**Fig. 5.6.** Median eGFR one year post-transplant by year of transplantation 2000–2006

transplanted during the years 2000 to 2006 (Kruskal-Wallis  $p < 0.0001$ ). This difference persisted even after the exclusion of Portsmouth which had the lowest median eGFR value in this analysis.

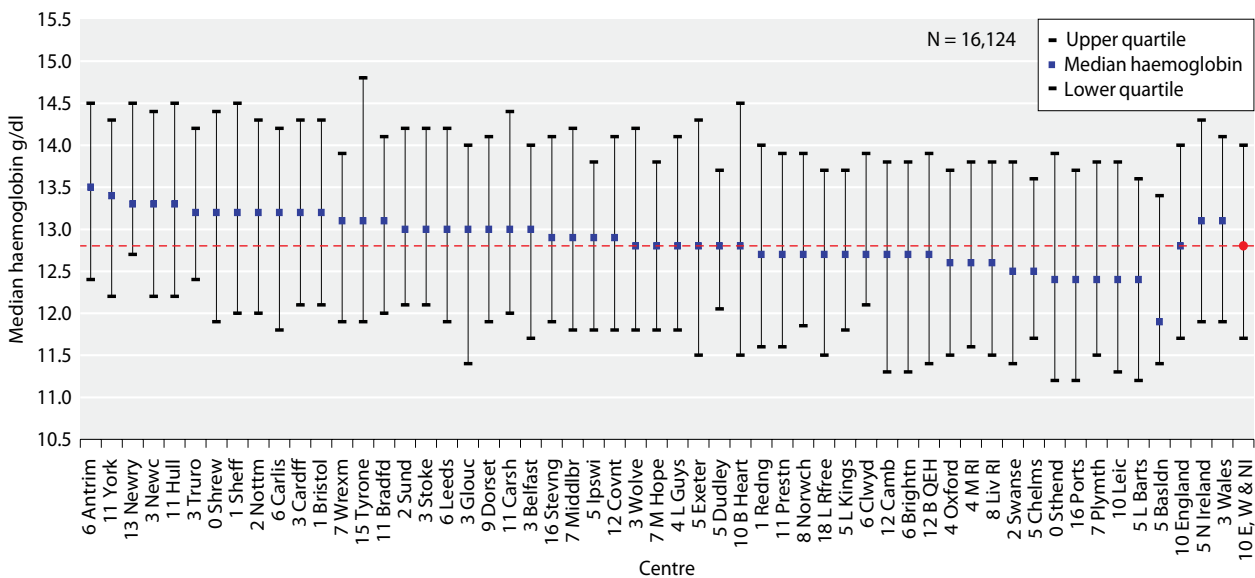
Regression analysis (least squares) indicated a small upward trend (+0.9 ml/min change in eGFR/year) in the one year post-transplant median eGFR between 2001 and 2006 (figure 5.6). This suggests better graft function for patients transplanted more recently. Live donor transplantation as a proportion of the total

number of transplants has been increasing year on year since 2000. Such recipients are known to have a higher one year post-transplant eGFR compared to deceased donor transplant recipients [2]. Therefore it may be possible to explain the slight upward trend seen in figure 5.6 solely on the basis of changing donor demographics in the UK. However, due to a number of patients with missing donor information in the years 2005 and 2006 this analysis is inconclusive. In conjunction with transplant data from NHSBT, the UKRR hope it will be possible to explore this further in next year’s report. Amongst individual transplant centres, only two centres (Leicester and Portsmouth) did not demonstrate a positive slope in one year post-transplant eGFR (data not shown).

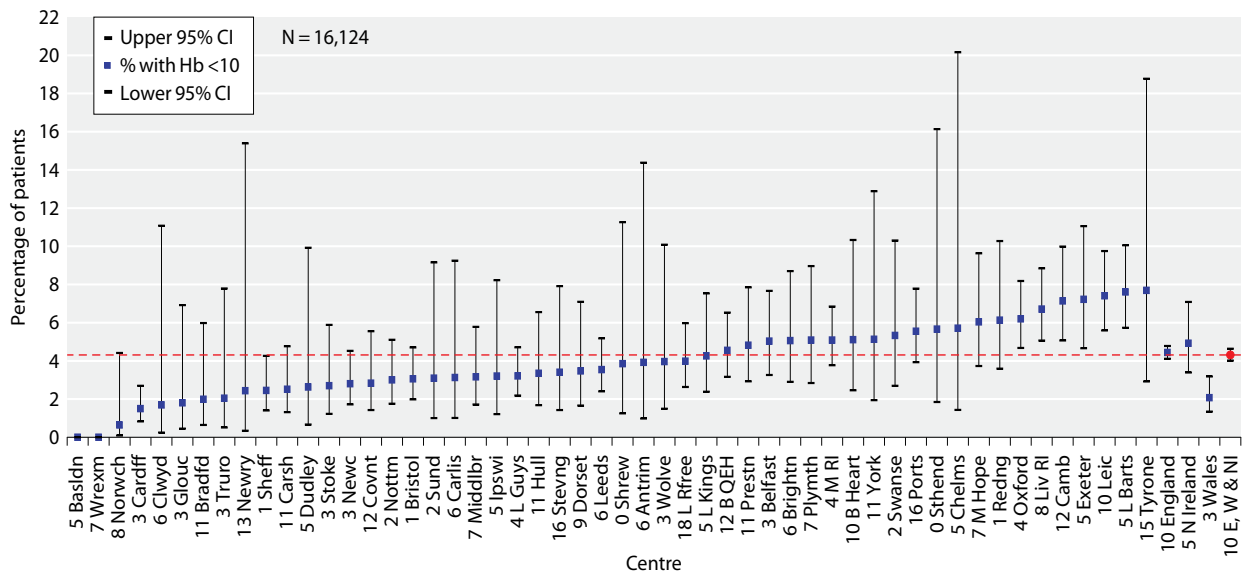
*Haemoglobin in prevalent transplant patients*

Transplant patients fall under the remit of the UK Renal Association chronic kidney disease (CKD) guidelines **that all patients should have a haemoglobin concentration >10 g/dl.**

A number of factors including immunosuppressive medication, graft function, ACE inhibitors for BP control, erythropoietin (EPO) use, intravenous or oral iron use, as well as centre practices and protocols for management of anaemia, affect haemoglobin levels in transplant patients. Figure 5.7 shows the median haemoglobin from UK centres whilst figure 5.8 shows the percentage of transplant patients with a haemoglobin <10 g/dl. Centres with <20 patients or <50% completeness of haemoglobin data returns are not shown in these figures.



**Fig. 5.7.** Median haemoglobin for prevalent transplant patients by centre on 31/12/2007



**Fig. 5.8.** Percentage of prevalent transplant patients by centre on 31/12/2007 with haemoglobin <10 g/dl

The percentage of prevalent transplant patients with a haemoglobin <10 g/dl were analysed using a funnel plot, the solid lines showing the 2 standard deviation limit (95% limits) and the dotted lines the limits for 3 standard deviations (99.9% limits). With over 50 centres included, it would be expected by chance that 2–3 centres would fall outside the 95% (1 in 20) confidence intervals (1 above and 1 below) and no centres outside 3 sd limits.

Figure 5.9 shows 5 centres between the 2–3 sd upper limits indicating a higher than predicted prevalence of anaemia amongst prevalent transplant patients in these centres and table 5.13 shows the data for these centres. Interestingly all 5 of these centres (Cambridge, London Barts, Leicester, Liverpool, Oxford) are transplant centres. Three centres fall between the lower 2–3 sd limits (Carshalton, Sheffield, Newcastle) and 4 centres below the 3 sd limits (Wrexham, Basildon, Norwich, Cardiff) possibly indicating better than expected management of anaemia.

*Haemoglobin in patients one year post-transplantation*

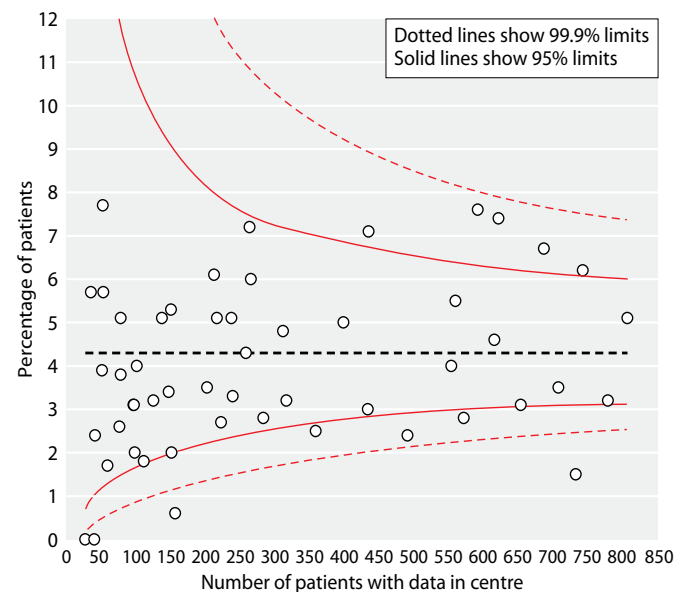
The median one year post-transplant haemoglobin continued to remain stable at 13.0 g/dl (figure 5.10).

*Blood pressure in prevalent transplant patients*

In the absence of controlled trial data, opinion based recommendation from the UK Renal Association (RA) states that **BP targets for transplant patients should be similar to the targets for patients with CKD i.e. systolic BP <130 mmHg and diastolic BP <80 mmHg.**

As indicated in table 5.10a, 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).

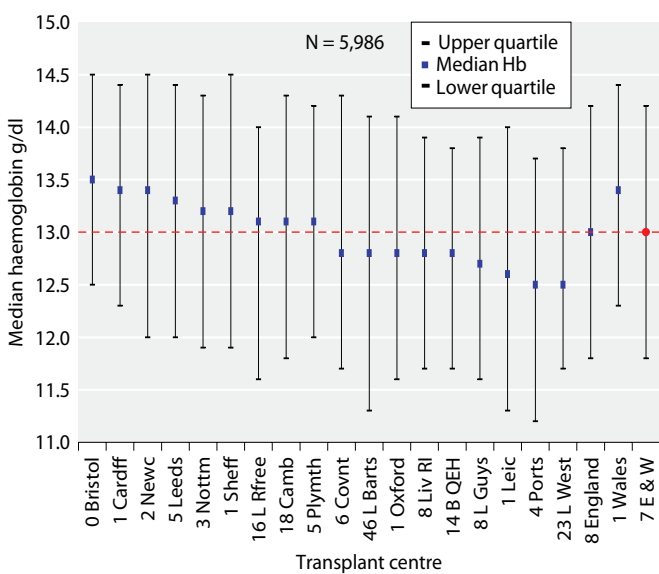
Median systolic (figure 5.11), diastolic (figure 5.12) and percentage of patients achieving RA targets (figure 5.13) are shown.



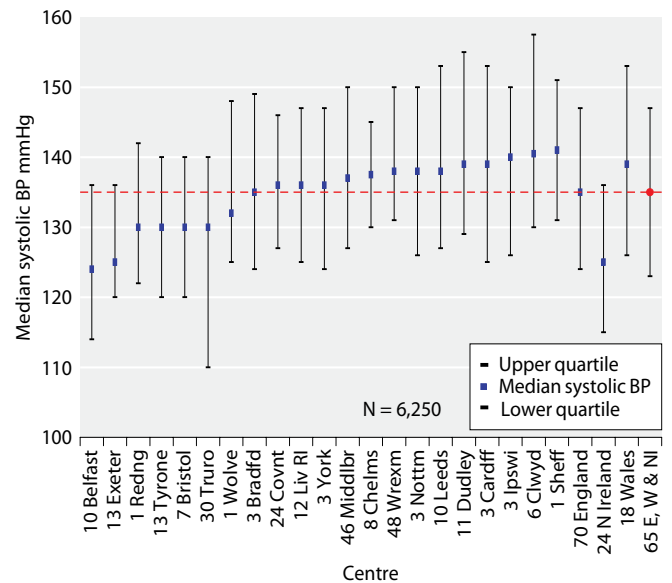
**Fig. 5.9.** Funnel plot of percentage of prevalent transplant patients with haemoglobin <10 g/dl by centre size on 31/12/2007

**Table 5.13.** Proportion of prevalent transplant patients with Hb <10 g/dl

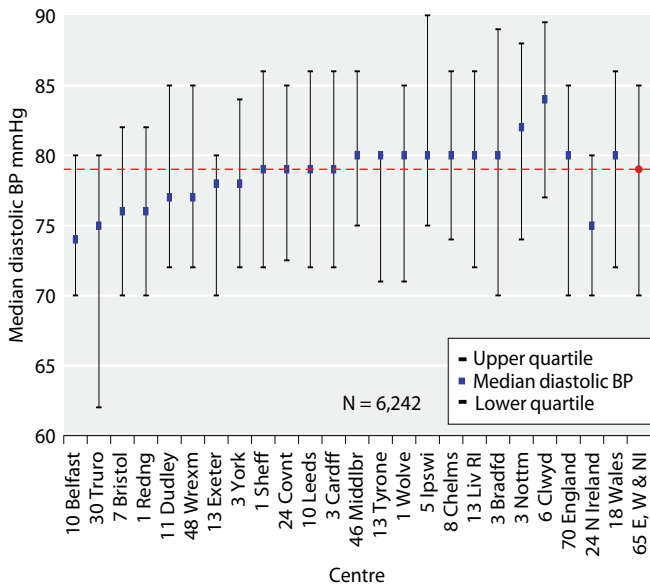
Centre	Number of patients with Hb data	Patients with Hb <10 g/dl (%)	Centre	Number of patients with Hb data	Patients with Hb <10 g/dl (%)
Wrexm	27	0.0	Brightn	237	5.1
Chelms	35	5.7	Hull	239	3.3
Basldn	40	0.0	L Kings	258	4.3
Newry	41	2.4	Exeter	263	7.2
Antrim	51	3.9	M Hope	265	6.0
Tyrone	52	7.7	Covnt	283	2.8
Sthend	53	5.7	Prestn	311	4.8
Clwyd	59	1.7	Middlbr	316	3.2
Dudley	76	2.6	Carsh	358	2.5
York	78	5.1	Belfast	398	5.0
Shrew	78	3.8	Nottm	433	3.0
Carlis	96	3.1	Camb	434	7.1
Sund	97	3.1	Sheff	490	2.4
Truro	98	2.0	L Rfree	553	4.0
Wolve	101	4.0	Ports	559	5.5
Glouc	111	1.8	Newc	571	2.8
Ipswi	125	3.2	L Barts	591	7.6
B Heart	137	5.1	B QEH	615	4.6
Stevng	147	3.4	Leic	621	7.4
Swanse	150	5.3	Bristol	653	3.1
Bradfd	151	2.0	Liv RI	686	6.7
Norwch	156	0.6	Leeds	707	3.5
Dorset	202	3.5	Cardff	732	1.5
Redng	212	6.1	Oxford	742	6.2
Plymth	216	5.1	L Guys	778	3.2
Stoke	222	2.7	M RI	806	5.1



**Fig. 5.10.** Median haemoglobin one year post-transplant by transplant centre for transplant patients between 2000–2006



**Fig. 5.11.** Median systolic BP for prevalent transplant patients by centre on 31/12/2007

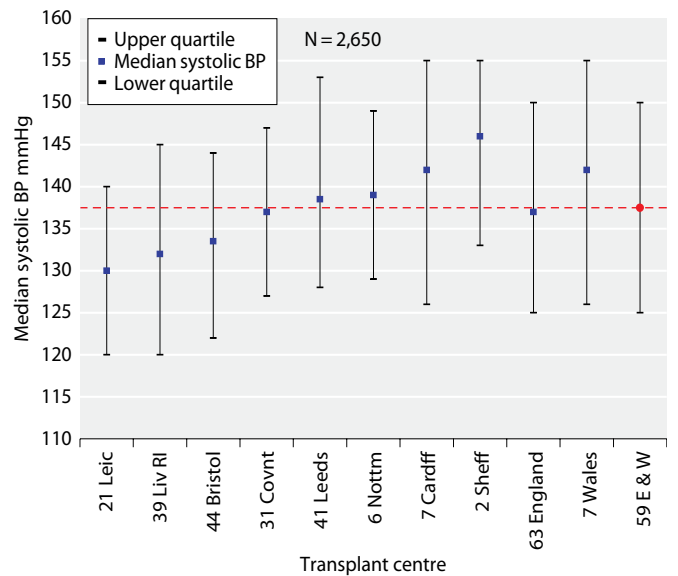


**Fig. 5.12.** Median diastolic BP for prevalent transplant patients by centre on 31/12/2007

*Blood pressure in patients one year after transplantation*

Median systolic and diastolic blood pressure in patients one year after transplantation are shown in figures 5.14 and 5.15 respectively.

The current policy is to consider renal transplant recipients as a sub-group of the native kidney disease population and there is no current evidence to suggest otherwise that the knowledge gained from native kidney disease literature is not applicable to transplant recipients. Less than 30% of prevalent transplant patients

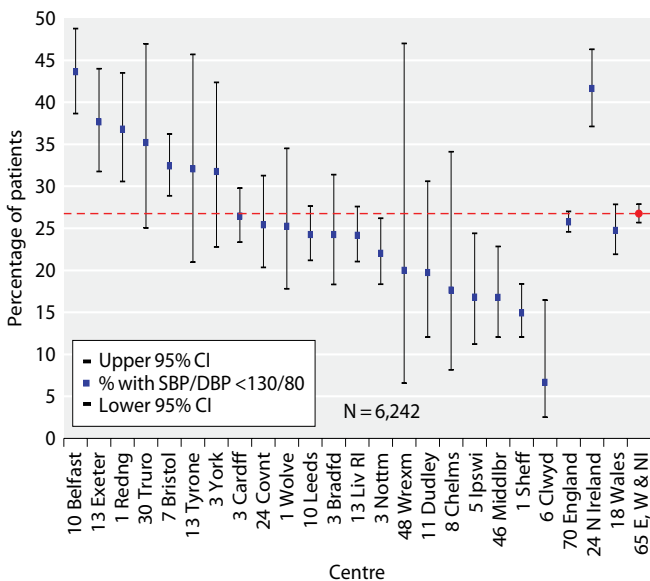


**Fig. 5.14.** Median systolic blood pressure one year post-transplant for patients transplanted between 2000 and 2006

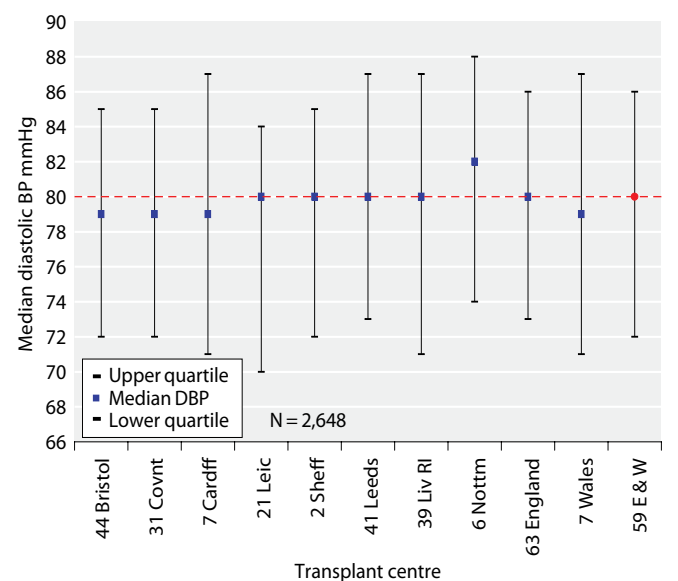
across the UK achieved a BP of <130/80 mm Hg, and it is necessary to evaluate new ways to achieve this goal or assess whether this is realistically achievable in the majority of patients. Northern Ireland managed to attain a BP <130/80 mm Hg in 41.6% of patients and the policies used to achieve this need to be investigated.

*Cholesterol in transplant patients*

UK guidelines pertaining to patients at risk of cardiovascular disease recommend a target total cholesterol of <5 mmol/L. In the absence of definitive evidence,

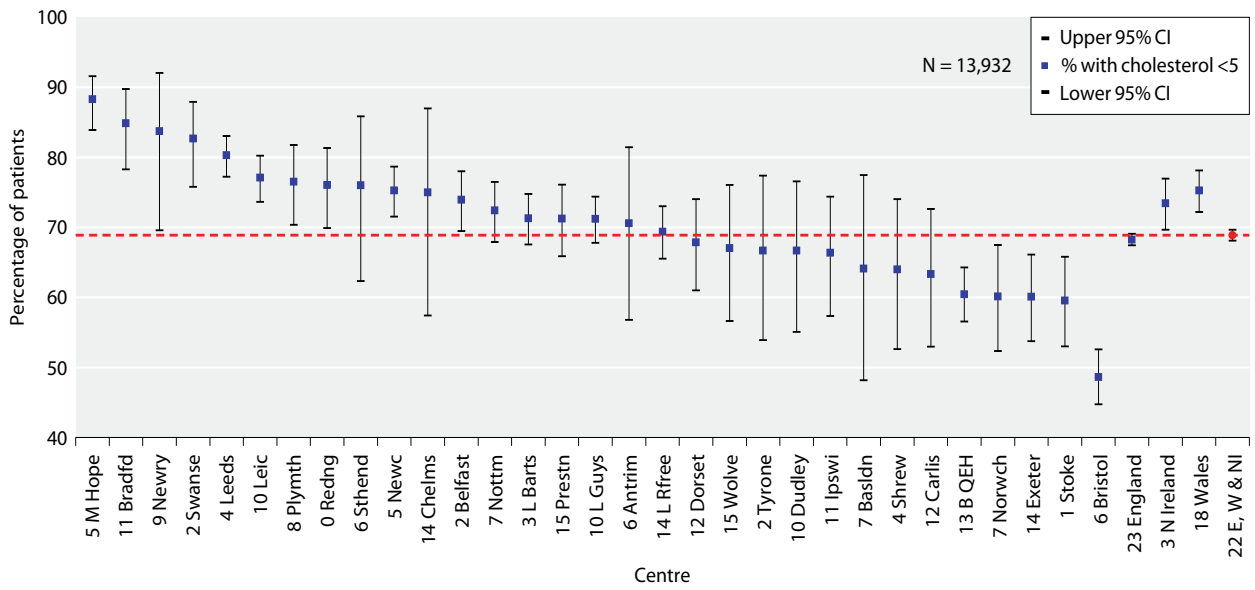


**Fig. 5.13.** Percentage of prevalent transplant patients by centre on 31/12/2007 achieving BP target of <130/80



**Fig. 5.15.** Median diastolic blood pressure one year post-transplant for patients transplanted between 2000 and 2006





**Fig. 5.16.** Percentage of prevalent transplant patients by centre on 31/12/2007 achieving total cholesterol level of <5 mmol/L

opinion based RA recommendations suggest that transplant patients should be treated as having chronic kidney disease and hence at risk of cardio-vascular events and therefore by extension should achieve the same cholesterol levels.

The primary analysis of data from the ALERT study of fluvastatin in renal transplantation showed no difference in major cardiac events compared with placebo ( $p = 0.139$ ) although secondary endpoints showed a 35 percent reduction in the cumulative incidence of cardiac death or first non-fatal MI ( $p = 0.005$ ) [3, 4].

Analysis which included renal transplant function as a risk factor for cardiovascular disease and extending the 5 year study by 2 years suggested that patients with better control of hyperlipidaemia may suffer fewer adverse endpoints (major cardiac adverse events ( $p < 0.0007$ ), cardiac death ( $p < 0.00005$ ) and non-CV death ( $p < 0.0005$ ), but not for stroke or non-fatal heart attack alone) compared to patients treated with placebo [5].

The percentage of prevalent transplant recipients achieving a cholesterol level <5 mmol/L by centre and median cholesterol level one year after transplantation are described in figures 5.16 and 5.17 respectively.

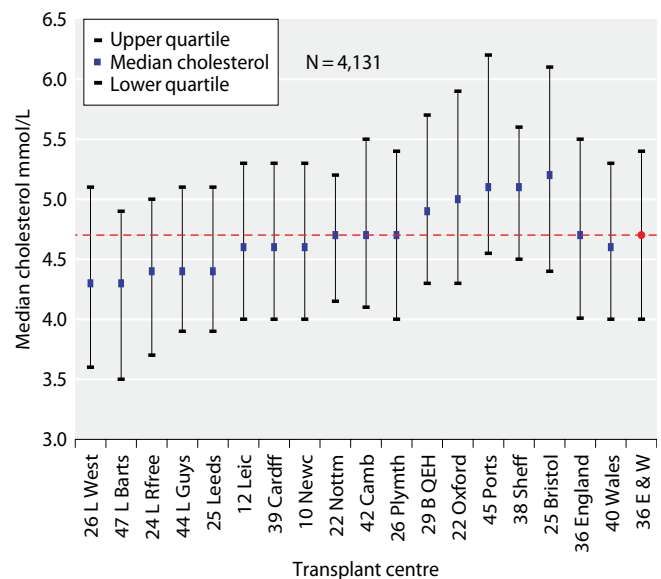
*Bone metabolism in transplant patients*

In the absence of definitive literature concerning evaluation and management of renal bone disease in transplant recipients, guidelines derived from chronic native kidney disease are commonly used as a surrogate. It is beyond the scope of this commentary to discuss the appropriateness or otherwise of this strategy. Since there

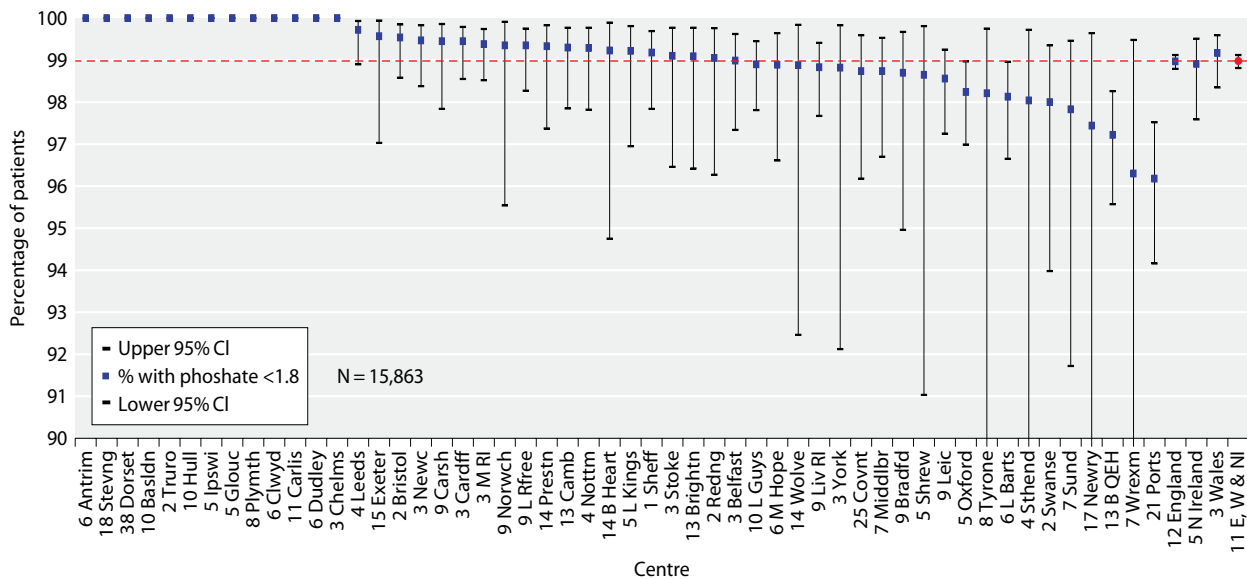
are no other widely accepted guidelines on target biochemical values concerning bone disease in transplant patients the chronic kidney disease audit measure has been adopted.

*Serum phosphate*

The percentage of prevalent patients achieving a phosphate level <1.8 mmol/L and the median phosphate in patients one year after transplantation are described in figures 5.18 and 5.19 respectively.



**Fig. 5.17.** Median total cholesterol one year post transplant for patients transplanted between 2000 and 2006



**Fig. 5.18.** Percentage of prevalent transplant patients by centre on 31/12/2007 with serum phosphate <1.8 mmol/L

With nearly 99% of prevalent patients achieving a phosphate level <1.8 mmol/L with achievement ranging from 96%–100%, this is probably not a useful clinical performance indicator and may also mask a more important problem of hypophosphataemia caused by phosphate loss post-transplantation.

*Serum calcium*

The percentage of prevalent transplant patients with a serum calcium level within the target range of

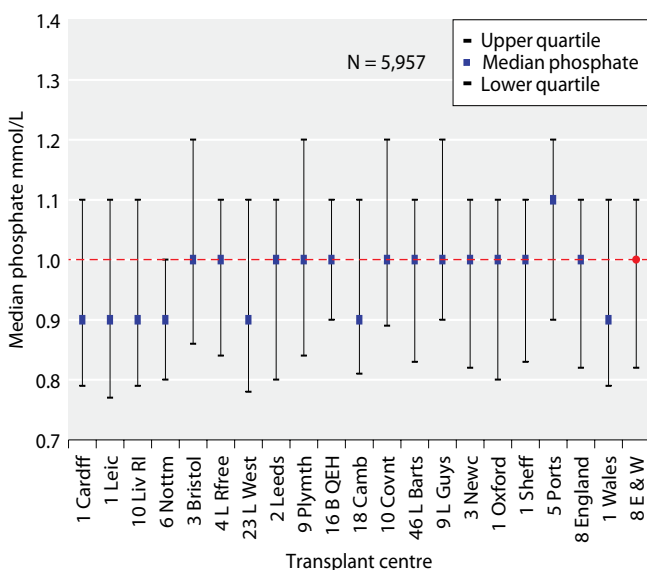
2.2–2.6 mmol/L and median serum calcium one year post-transplant are shown in figures 5.20 and 5.21.

The achievement of calcium within the Standard varied from 95% to 60%. It is possible that late repatriation of patients with failing grafts from transplant centres may result in some selective enrichment of non-transplanting renal centres with patients who were less likely to conform to target biochemical results. However, figure 5.20 shows both transplanting and non-transplanting renal centres are represented at both ends of the graph suggesting centre practices and possibly also laboratory measurement factors may be more relevant than repatriation policies in achieving target calcium levels in transplant patients.

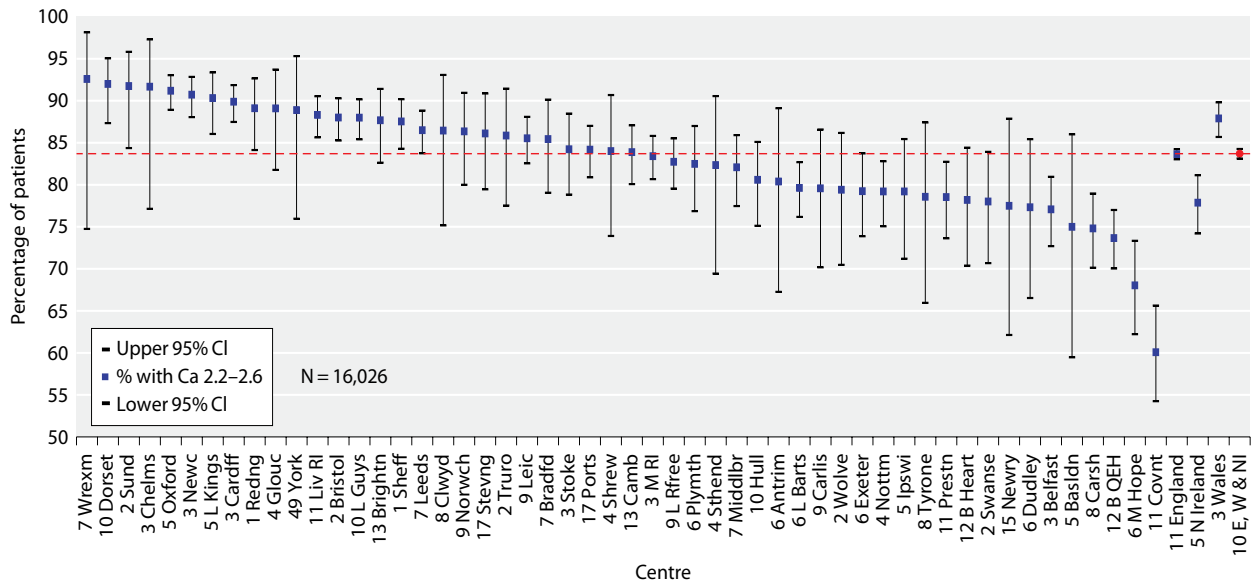
*Serum parathyroid hormone concentration*

There are no definitive guidelines on the frequency with which serum iPTH should be measured in stable transplant recipients. Consequently there was very wide variability in data completeness across the UK with less than 50% of centres having iPTH measurements for the transplant patients under their care.

Analysis of data from 20 centres with measurements showed that over 50% of patients had an iPTH above the upper limit of normal (7–8 pmol/L) and the median iPTH was 10 pmol/L. The UK does not have a variable CKD stage related Standard compared with KDOQI, and more than 90% of patients achieved the target of <32 pmol/L (data not shown). However, given the extent of missing information extreme caution needs to be exercised when interpreting these data.



**Fig. 5.19.** Median serum phosphate one year post transplant for patients transplanted 2000–2006



**Figure 5.20.** Percentage of prevalent renal transplant recipients by centre on 31/12/2007 with adjusted serum calcium between 2.2–2.6 mmol/L

**Analysis of prevalent transplant patients by CKD stage**

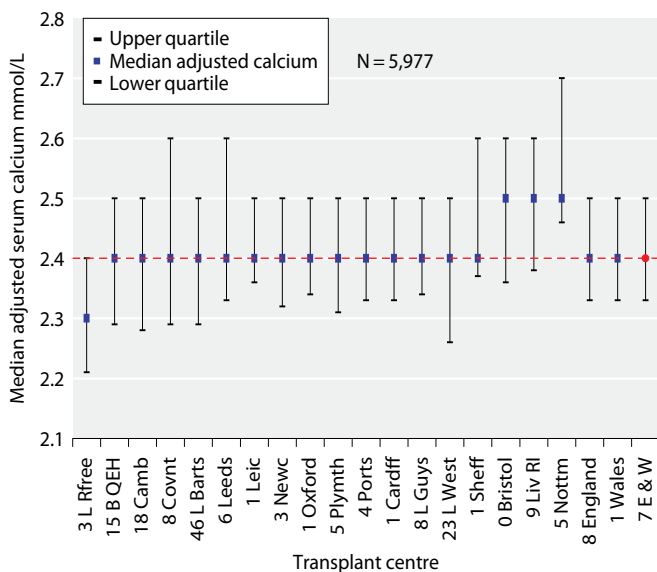
*Introduction*

About 3% of prevalent transplant patients returned to dialysis in 2007 and this was a similar percentage to the last 7 years. Patients presenting with native chronic kidney disease can have reasonable variability in timing of presentation to specialist care after disease initiation. This in turn can result in poorer outcomes as has been documented for late-presenters on dialysis therapies. Lack of specialist care resulting in lack of amelioration

of modifiable risk factors like anaemia of CKD etc. is commonly quoted as the reason for poorer outcomes in late-presenters. 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 31/12/2007 (n = 16,469) and where 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 2006, comprised the comparison dialysis cohort (n = 16,252). This included 2,743 peritoneal dialysis patients. For both cohorts, the analysis used the most recent available value from the last two quarters of the 2007 laboratory data.



**Fig. 5.21.** Median adjusted serum calcium one year post-transplant for patients transplanted 2000–2006

**Results and Discussion**

Table 5.14 shows that 16% of the prevalent transplant population, or nearly 2,600 patients, had moderate to advanced renal impairment of eGFR <30 mls/min/1.73 m<sup>2</sup>. The table also demonstrates that patients with

**Table 5.14.** Analysis by CKD stage for prevalent transplant patients compared with prevalent dialysis patients

eGFR	Stage 1–2T (≥60)	Stage 3T (30–59)	Stage 4T (15–29)	Stage 5T (<15)	Stage 5D <sup>a</sup>
Number of patients	4,437	9,373	2,302	357	16,252
% of patients	26.9	56.9	14.0	2.2	
<b>eGFR ml/min/1.73 m<sup>2</sup> <sup>b</sup></b>					
mean ± SD	74.5 ± 13.8	45.1 ± 8.3	23.9 ± 4.2	11.8 ± 2.5	
median	70.7	45.2	24.6	12.3	
<b>Systolic BP mmHg</b>					
mean ± SD	133.6 ± 17.9	136.3 ± 18.7	140.3 ± 20.1	142.3 ± 23.6	129.8 ± 24.4
% ≥ 130	60.2	63.6	70.2	71.9	48.1
<b>Diastolic BP mmHg</b>					
mean ± SD	77.7 ± 10.4	78.2 ± 10.6	78.9 ± 11.3	79.3 ± 13.1	69.5 ± 14.1
% ≥ 80	47.4	48.9	51.2	57.8	23.7
<b>Cholesterol mmol/L</b>					
mean ± SD	4.5 ± 1.0	4.6 ± 1.0	4.7 ± 1.2	4.5 ± 1.2	4.0 ± 1.1
% ≥ 5	28.5	31.9	35.3	33.9	16.1
<b>Haemoglobin g/dl</b>					
mean ± SD	13.7 ± 1.5	12.8 ± 1.6	11.7 ± 1.5	10.9 ± 1.7	11.7 ± 1.5
% < 10	1.2	2.9	12.7	26.3	12.5
<b>Phosphate mmol/L<sup>c</sup></b>					
mean ± SD	1.0 ± 0.2	1.0 ± 0.2	1.2 ± 0.3	1.6 ± 0.4	1.6 ± 0.4
% ≥ 1.8	0.1	0.2	2.4	26.9	28.1
<b>Adjusted calcium mmol/L</b>					
mean ± SD	2.4 ± 0.2	2.4 ± 0.2	2.4 ± 0.2	2.3 ± 0.2	2.4 ± 0.2
% > 2.6	7.5	7.4	5.3	5.6	7.9
% < 2.2	7.8	8.2	14.9	25.8	18.4
<b>iPTH pmol/L</b>					
median	8.2	9.7	16.1	32.3	26.3
% ≥ 32	3.9	5.4	21.5	50.4	42.7

<sup>a</sup> For stage 5D, prevalent dialysis patients in 2007 were excluded

<sup>b</sup> Prevalent transplant patients with no ethnicity data were classed as White

<sup>c</sup> Only PD patients included in stage 5D, n = 2,743

failing grafts do not achieve UK RA standards for key biochemical and clinical outcome variables with the same frequency as patients already on dialysis. This substantial group of patients represents a not inconsiderable challenge as resources need to be channelled not only to improve key outcome variables but also to achieve a safe and timely modality switch to another form of renal replacement therapy.

## Causes of death in transplant recipients

### Introduction

Differences in causes of death between dialysis and transplant patients may be expected and may reflect the

different priorities required in management of these two groups of patients. A more detailed discussion on causes of death in dialysis patients can be found in chapter 7.

## Methods

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

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

Adult patients aged 18 years and over, were included in the analyses on cause of death. Previous analysis was limited to data

**Table 5.15.** Cause of death by modality in prevalent RRT patients on 1/1/2007

Cause of death	All modalities		Dialysis		Transplant	
	Number of deaths	%	Number of deaths	%	Number of deaths	%
Cardiac disease	316	23	294	24	22	16
Cerebrovascular disease	67	5	57	5	10	7
Infection	252	18	223	18	29	21
Malignancy	118	9	89	7	29	21
Treatment withdrawal	179	13	173	14	6	4
Other	119	9	104	8	15	11
Uncertain	314	23	287	23	27	20
<b>Total</b>	<b>1,365</b>		<b>1,227</b>		<b>138</b>	
N with no cause of death data	2,296		1,948		348	

**Table 5.16.** Cause of death in prevalent transplant patients on 1/1/2007 by age

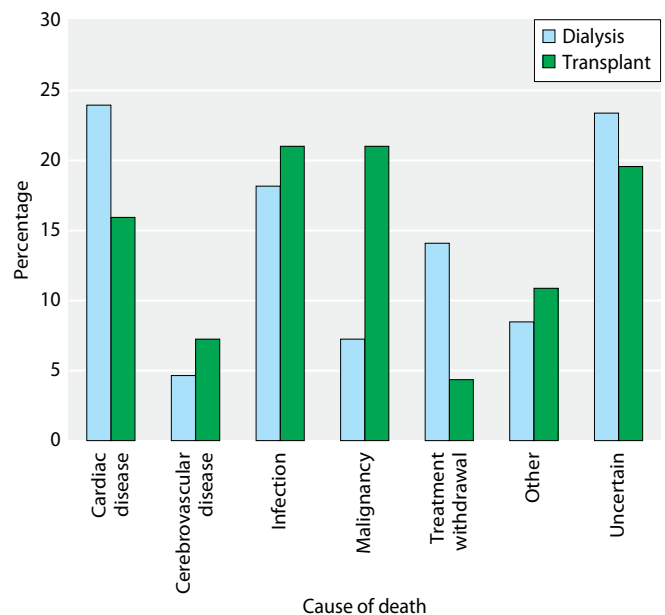
Cause of death in transplanted patients	All age groups		<55 years		≥55 years	
	Number of deaths	%	Number of deaths	%	Number of deaths	%
Cardiac disease	22	16	6	17	16	16
Cerebrovascular disease	10	7	1	3	9	9
Infection	29	21	7	19	22	22
Malignancy	29	21	8	22	21	21
Treatment withdrawal	6	4	2	6	4	4
Other	15	11	6	17	9	9
Uncertain	27	20	6	17	21	21
<b>Total</b>	<b>138</b>		<b>36</b>		<b>102</b>	
N with no cause of death data	348		100		248	

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 EDTA categories remained unchanged so the latter data were therefore included. The analysis of prevalent patients included all patients receiving RRT on 1/1/2007.

**Results and Discussion**

*Causes of death in prevalent RRT patients in 2007 by modality and age*

Tables 5.15 and 5.16 and figure 5.22 show the differences in the causes of death between prevalent dialysis and transplant patients. These data are neither age adjusted nor adjusted for differences in the comorbidity between the 2 groups. As expected, cardiac disease as a cause of death is less common in the transplanted patients as these are a pre-selected low risk group of patients. Treatment withdrawal still occurs in the



**Fig. 5.22.** Cause of death by modality for prevalent patients on 1/1/2007

transplanted group, in patients who choose not to restart dialysis when their renal transplant fails.

In Table 5.16, there were no differences in the causes of death between transplanted patients aged <55 or  $\geq$ 55

years with malignancy accounting for 21% of deaths with a functioning transplant in both age groups.

Conflict of interest: none

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