Chapter 3
Demographic and Biochemistry Profile of Kidney Transplant Recipients in the UK in 2009: national and centre-specific analyses

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

Summary

- In 2009, renal transplant failure rates in prevalent patients remained stable at 2.9% per annum and transplant patient death rates remained stable at 2.5 per 100 patient years.
- The median age of incident and prevalent renal transplant patients in the UK was 48.4 and 50.8 years respectively.
- The median eGFR of prevalent renal transplant recipients was 49.9 ml/min/1.73 m^2.
- The median eGFR of patients one year post-live donor transplant was 54.1 ml/min/1.73 m^2.
- The median eGFR of patients one year post-deceased donor transplant was 50.1 ml/min/1.73 m^2.
- Of prevalent transplant patients, 14.3% had moderate to advanced renal impairment with an eGFR <30 ml/min/1.73 m^2.
- The median one year post-transplant haemoglobin for patients transplanted between 2002–2008 was 13.0 g/dl.
- In prevalent renal transplant patients the percentage with BP $<130/80$ (systolic BP <130 **and** diastolic BP <80 mmHg) was higher (29.6% vs. 24.2%) in those with better renal function (eGFR $\geqslant 45$ ml/min/1.73 m^2).
- In 2009, infection (28%), malignancy (23%) and cardiac disease (18%) were the commonest causes of death of prevalent transplant patients.

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 5 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; and (5) causes of death in transplant recipients. Methodology, results and conclusions of these analyses are discussed in detail for all five 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 2009.

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. Patients whose clinical management subsequently transfers back to a dialysis centre may be lost to NHSBT follow-up, but since all dialysis and transplant renal centres in the UK return data to the UKRR or Scottish Renal Registry, follow-up data are available for such patients.

Method

There are 23 UK adult renal transplant centres with 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 cardiac death), living kidney donors, patient survival and graft survival is available on the NHSBT website (www.uktransplant.org.uk/ukt/statistics/statistics.jsp).

Results

During 2009, 2,600 kidney or kidney plus other organ transplants were performed. The absolute numbers of live donor and donor after cardiac death transplants continued to increase and comprised 37.8% and 19.1% of all kidney transplants performed respectively (table 3.1).

There are 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 in some countries).

Using data from the UKRR on prevalent renal-only transplant patients on 1st January 2009, the death rate during 2009 was 2.5/100 patient years (CI 2.3–2.7) when censored for return to dialysis and 2.6/100 patient years (CI 2.4–2.9) without censoring for dialysis. These death rates are similar to those observed over the last few years.

During 2009, 2.9% of prevalent transplant patients experienced graft failure (excluding death as a cause of graft failure). This figure has remained almost constant since 2003.

Table 3.1. Kidney and kidney plus other organ transplant numbers in the UK, 1/1/2007–31/12/2009

Organ	2007	2008	2009	% change 2008–2009
Donor after brainstem death[a]	907	944	945	0
Donor after cardiac death[b]	300	439	496	13
Living donor kidney	804	924	983	6
Kidney and liver	9	17	15	−12
Kidney and heart	1	0	1	
Kidney and pancreas[c]	197	162	160	−1
Total kidney transplants	**2,218**	**2,486**	**2,600**	**5**

[a] Includes en bloc kidney transplants (6 in 2007, 3 in 2008, 3 in 2009) and double kidney transplants (5 in 2007, 1 in 2008, 6 in 2009)
[b] Includes en bloc kidney transplants (2 in 2008, 1 in 2009) and double kidney transplants (5 in 2007, 3 in 2008, 4 in 2009)
[c] Includes donor after cardiac death transplants (13 in 2007, 16 in 2008, 19 in 2009) and transplant including liver (1 in 2007, 1 in 2009)

Conclusions

The increased number of kidney transplants performed in 2009 was mostly due to the growing use of organs from donors after cardiac death and living kidney donors. There were small differences in graft survival between UK centres. Graft failure rates remained stable at 2.9% per annum and transplant patient death rates remained similar at 2.5 per 100 patient years.

Transplant demographics

Introduction

Since 2008, all 72 UK renal centres have established electronic linkage to the UKRR or Scottish Renal Registry, giving the UKRR complete coverage of individual

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

	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
Belfast	94	96	83	92	95	100	96	96
B QEH	90	97	83	90	95	98	88	99
Bristol	94	96	87	85	98	99	95	99
Camb	93	97	86	88	98	100	91	97
Cardff	94	97	85	90	94	98	84	97
Covnt	97	97	88	91	95	100	93	97
Edin	91	95	85	85	96	98	93	94
Glasgw	94	97	81	84	96	97	94	97
L Guy's	93	95	82	89	97	97	92	94
Leeds	94	96	83	87	97	100	90	95
Leic	91	87	82	82	96	97	92	93
Liv RI	88	97	80	92	95	98	86	93
M Hope	95	95	82	89	97	98	87	97
Newc	93	94	82	85	98	100	93	94
Nottm	87	96	80	86	92	97	89	98
Oxford	97	96	87	86	99	97	92	94
Plymth	92	97	80	88	95	99	69	89
Ports	93	94	81	89	93	98	84	94
L Rfree	95	97	83	90	97	100	88	93
L Barts	95	94	84	89	98	99	80	89
Sheff	91	100	82	91	99	100	85	100
L St.G	93	98	87	91	99	100	90	98
L West	95	98	88	90	96	99	88	97
All centres	**93**	**96**	**84**	**88**	**97**	**99**	**90**	**96**

[a] 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.jsp)
Cohorts for survival rate estimation: 1 year survival: 1/1/2005–31/12/2009; 5 year survival: 1/1/2001–31/12/2005; 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

patient level data across the UK. The UKRR is now able to obtain, analyse and report on a complete national cohort.

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.

Methods

Four centres (Bangor, Colchester, Liverpool Aintree, Wirral) 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. The nine Scottish centres do not currently submit 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, four centres (Cambridge, London Royal Free, Liverpool RI, Wirral) 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 aetiology codes).

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 2009. 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 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 regrouping of the PAS codes into the above ethnic categories are provided in appendix H: Coding http://www.renalreg.com/Report-Area/Report 2010/Appendix-H.pdf. 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 (called Health and Social Care Trust Areas), Scotland (called Health Board) and Wales (called Local Health Board) 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. Access to renal transplantation in the UK is examined in greater detail in chapter 13.

The proportion of prevalent RRT patients with a transplant relative to the number on dialysis has been stable since at least 2000. Whilst the proportion of patients on HD has been increasing, the proportion on PD has been falling.

Until 2009, the number of patients awaiting kidney-only transplantation had been increasing annually. However, NHSBT statistics for 2010 suggest the number of patients awaiting kidney-only transplantation has stabilised, with very little increase from the previous year.

Age and gender

The gender ratio amongst incident and prevalent transplant patients has remained stable since 2004 (table 3.6 and figure 3.1). Note absolute patient numbers differ from those published in previous reports as a result

Table 3.3. The prevalence per million population (pmp) of renal transplants in adults in the UK on 31/12/2009

	England	Wales	Scotland	N Ireland	UK
All UK centres	19,418	1,198	2,038	630	23,284
Total population, mid-2009 (millions)[a]	51.8	3.0	5.2	1.8	61.8
Prevalence pmp transplant	375	399	392	352	377

[a] Estimates from the 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 2005–2009

[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 2009 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 2009		
			2005	2006	2007	2008	2009	O/E[c]	LCL	UCL
North East	County Durham	506,600	353	353	383	397	405	1.04	0.91	1.19
	Darlington	100,600	298	298	318	348	318	0.83	0.59	1.18
	Gateshead	190,500	420	394	388	394	409	1.07	0.85	1.33
	Hartlepool	90,800	374	396	407	374	363	0.96	0.68	1.35
	Middlesbrough	**140,300**	**399**	**392**	**399**	**428**	**463**	**1.30**	**1.02**	**1.66**
	Newcastle	284,300	310	327	359	362	376	1.10	0.91	1.33
	North Tyneside	**197,000**	**452**	**437**	**487**	**492**	**528**	**1.36**	**1.12**	**1.65**
	Northumberland	311,200	366	363	379	389	395	0.97	0.81	1.15
	Redcar and Cleveland	**137,600**	**443**	**465**	**480**	**516**	**538**	**1.39**	**1.10**	**1.74**
	South Tyneside	152,600	374	393	433	426	426	1.12	0.87	1.42
	Stockton-on-Tees Teaching	191,100	324	372	351	392	403	1.06	0.85	1.33
	Sunderland Teaching	281,700	366	369	387	401	383	1.00	0.83	1.21
North West	Ashton, Leigh and Wigan	306,400	157	196	359	369	346	0.89	0.73	1.08
	Blackburn with Darwen Teaching	139,900	172	186	322	329	315	0.91	0.68	1.22
	Blackpool	140,000	207	229	314	364	371	0.96	0.73	1.26
	Bolton	265,600	211	222	392	433	433	1.17	0.97	1.40
	Bury	182,800	98	109	356	345	394	1.04	0.83	1.32
	Central and Eastern Cheshire	*456,000*			*307*	*303*	*303*	*0.76*	*0.65*	*0.90*
	Central Lancashire	*457,800*	*205*	*223*	*286*	*306*	*310*	*0.81*	*0.69*	*0.95*
	Cumbria Teaching	494,900	267	291	315	335	372	0.92	0.80	1.06
	East Lancashire Teaching	380,900	278	286	394	407	383	1.01	0.86	1.19
	Halton and St Helens	295,900	250	257	291	321	335	0.87	0.72	1.06
	Heywood, Middleton and Rochdale	204,900			390	410	425	1.15	0.93	1.42
	Knowsley	149,300	308	308	322	328	355	0.97	0.74	1.27
	Liverpool	442,400	298	296	303	325	348	0.98	0.84	1.15
	Manchester Teaching	483,500			250	263	271	0.85	0.72	1.01
	North Lancashire Teaching	*327,000*	*239*	*266*	*327*	*318*	*312*	*0.81*	*0.67*	*0.98*
	Oldham	219,200	114	151	347	365	379	1.04	0.84	1.30
	Salford	225,300	142	151	266	293	311	0.87	0.68	1.09
	Sefton	273,400	278	296	318	300	315	0.81	0.66	1.00
	Stockport	283,600			335	356	381	0.98	0.81	1.19
	Tameside and Glossop	249,100			397	393	401	1.05	0.87	1.28
	Trafford	215,400			292	325	306	0.81	0.64	1.03
	Warrington	197,900	268	308	384	384	414	1.06	0.85	1.32
	Western Cheshire	232,900	322	301	331	322	348	0.89	0.72	1.11
	Wirral	308,600	295	311	301	327	343	0.91	0.75	1.10
Yorkshire and the Humber	Barnsley	226,500	327	353	358	384	393	1.01	0.82	1.25
	Bradford and Airedale Teaching	**506,900**	**327**	**335**	**369**	**377**	**400**	**1.16**	**1.01**	**1.33**
	Calderdale	201,500	377	387	407	437	437	1.14	0.93	1.41
	Doncaster	290,200	269	307	300	317	341	0.89	0.73	1.09
	East Riding of Yorkshire	337,100	249	252	297	326	344	0.85	0.71	1.02
	Hull Teaching	262,700	259	297	324	343	362	1.01	0.83	1.24
	Kirklees	406,800	386	408	411	411	425	1.16	1.00	1.35

Table 3.4. Continued

UK Area	PCT/HB[a]	Population covered[b]	Rate pmp					Age and gender standardised rate ratio 2009		
			2005	2006	2007	2008	2009	O/E[c]	LCL	UCL
Yorkshire and the Humber	Leeds	787,600	256	286	297	315	325	0.93	0.83	1.06
	North East Lincolnshire	158,600	227	271	290	315	347	0.92	0.71	1.20
	North Lincolnshire	*157,100*	*280*	*299*	*306*	*312*	*280*	*0.71*	*0.53*	*0.95*
	North Yorkshire and York	*796,300*	*273*	*295*	*310*	*352*	*320*	*0.82*	*0.73*	*0.93*
	Rotherham	253,900	264	295	327	362	386	1.01	0.83	1.23
	Sheffield	547,100	236	254	265	300	316	0.89	0.76	1.03
	Wakefield District	323,800	287	296	303	327	334	0.86	0.71	1.04
East Midlands	*Bassetlaw*	*111,900*	*232*	*241*	*295*	*286*	*277*	*0.69*	*0.49*	*0.99*
	Derby City	244,300	192	217	229	250	299	0.84	0.66	1.05
	Derbyshire County	*726,400*	*223*	*237*	*278*	*297*	*297*	*0.75*	*0.65*	*0.85*
	Leicester City	**304,800**	**413**	**456**	**479**	**509**	**577**	**1.72**	**1.49**	**2.00**
	Leicestershire County and Rutland	683,200	329	341	366	395	403	1.04	0.92	1.17
	Lincolnshire Teaching	*700,200*	*278*	*277*	*280*	*294*	*300*	*0.76*	*0.66*	*0.87*
	Northamptonshire Teaching	684,000	278	281	300	346	358	0.94	0.83	1.06
	Nottingham City	300,800	233	239	249	256	263	0.81	0.65	1.01
	Nottinghamshire County Teaching	*665,000*	*293*	*307*	*316*	*326*	*337*	*0.86*	*0.76*	*0.98*
West Midlands	Birmingham East and North	407,400	287	319	326	349	361	1.07	0.91	1.26
	Coventry Teaching	312,600	310	320	342	358	381	1.10	0.92	1.32
	Dudley	*306,500*	*241*	*248*	*274*	*277*	*287*	*0.75*	*0.60*	*0.92*
	Heart of Birmingham Teaching	**280,500**	**328**	**360**	**378**	**396**	**403**	**1.35**	**1.12**	**1.62**
	Herefordshire	*179,000*	*285*	*291*	*285*	*274*	*291*	*0.72*	*0.55*	*0.94*
	North Staffordshire	211,500			298	312	345	0.87	0.69	1.10
	Sandwell	291,100	319	330	347	368	385	1.07	0.89	1.29
	Shropshire County	*291,900*	*212*	*223*	*274*	*295*	*322*	*0.81*	*0.66*	*0.99*
	Solihull	205,200	249	288	288	297	302	0.79	0.62	1.01
	South Birmingham	341,200	287	284	311	340	340	0.98	0.82	1.18
	South Staffordshire	*609,300*			*297*	*322*	*328*	*0.83*	*0.72*	*0.95*
	Stoke on Trent	246,900			324	369	389	1.05	0.86	1.28
	Telford and Wrekin	*162,300*	*129*	*173*	*216*	*240*	*265*	*0.70*	*0.52*	*0.95*
	Walsall Teaching	255,800	297	313	348	367	395	1.08	0.89	1.31
	Warwickshire	535,100	335	342	349	355	376	0.96	0.83	1.10
	Wolverhampton City	238,500	231	226	268	289	302	0.83	0.66	1.05
	Worcestershire	*556,600*	*246*	*259*	*277*	*289*	*311*	*0.78*	*0.67*	*0.91*
East of England	Bedfordshire	411,100	246	272	304	328	343	0.89	0.75	1.05
	Cambridgeshire	607,200	262	277	298	328	369	0.97	0.85	1.11
	East and North Hertfordshire	*545,600*	*236*	*246*	*279*	*312*	*323*	*0.86*	*0.74*	*1.00*
	Great Yarmouth and Waveney	*214,000*	*126*	*145*	*159*	*220*	*266*	*0.68*	*0.53*	*0.89*
	Luton	194,600	298	334	380	396	406	1.19	0.95	1.48
	Mid Essex	371,300	248	283	310	329	358	0.92	0.78	1.09
	Norfolk	*757,200*	*243*	*275*	*296*	*295*	*317*	*0.81*	*0.72*	*0.92*
	North East Essex	*324,800*	*231*	*243*	*252*	*262*	*283*	*0.75*	*0.61*	*0.92*
	Peterborough	171,000	193	240	269	269	316	0.87	0.67	1.14
	South East Essex	336,500	208	232	276	309	339	0.88	0.74	1.06
	South West Essex	405,000	230	235	286	294	333	0.90	0.76	1.06
	Suffolk	*596,200*	*236*	*267*	*287*	*304*	*334*	*0.86*	*0.75*	*0.99*
	West Essex	*282,400*	*251*	*266*	*266*	*269*	*308*	*0.81*	*0.65*	*0.99*
	West Hertfordshire	549,900	175	189	273	360	380	1.01	0.88	1.16
London	Barking and Dagenham	176,000	222	233	267	273	341	1.04	0.81	1.34
	Barnet	**343,200**	**288**	**312**	**414**	**440**	**498**	**1.38**	**1.19**	**1.60**
	Bexley	**225,800**	**381**	**390**	**438**	**465**	**469**	**1.27**	**1.05**	**1.53**
	Brent Teaching	**255,200**		**157**	**470**	**670**	**745**	**2.08**	**1.80**	**2.39**

Table 3.4. Continued

UK Area	PCT/HB[a]	Population covered[b]	Rate pmp					Age and gender standardised rate ratio 2009		
			2005	2006	2007	2008	2009	O/E[c]	LCL	UCL
London	Bromley	310,200	322	355	400	422	416	1.10	0.93	1.31
	Camden	231,600	229	268	289	358	406	1.16	0.95	1.42
	City and Hackney Teaching	227,100		238	295	326	348	1.03	0.82	1.28
	Croydon	342,800	225	271	318	324	350	0.95	0.80	1.14
	Ealing	**316,300**	**291**	**300**	**370**	**560**	**579**	**1.59**	**1.38**	**1.84**
	Enfield	**291,400**	**357**	**388**	**426**	**480**	**494**	**1.37**	**1.17**	**1.62**
	Greenwich Teaching	226,200	243	274	314	318	340	0.98	0.79	1.23
	Hammersmith and Fulham	**169,800**	**224**	**259**	**247**	**389**	**459**	**1.29**	**1.03**	**1.61**
	Haringey Teaching	**225,400**	**302**	**333**	**359**	**421**	**484**	**1.35**	**1.12**	**1.63**
	Harrow	**228,600**			**455**	**591**	**669**	**1.81**	**1.55**	**2.13**
	Havering	*234,500*			*260*	*273*	*294*	*0.78*	*0.62*	*0.99*
	Hillingdon	**262,500**	**255**	**270**	**305**	**442**	**488**	**1.37**	**1.15**	**1.63**
	Hounslow	**234,200**	**260**	**278**	**286**	**508**	**576**	**1.60**	**1.35**	**1.89**
	Islington	**192,100**	**312**	**344**	**401**	**453**	**500**	**1.43**	**1.17**	**1.75**
	Kensington and Chelsea	169,900			224	294	318	0.84	0.64	1.09
	Kingston	166,900			359	371	389	1.07	0.84	1.37
	Lambeth	283,400	205	208	279	314	339	0.96	0.78	1.17
	Lewisham	**264,300**	**344**	**375**	**428**	**443**	**454**	**1.26**	**1.06**	**1.51**
	Newham	241,200	261	269	290	315	377	1.17	0.96	1.44
	Redbridge	267,700	280	310	336	396	426	1.20	1.00	1.44
	Richmond and Twickenham	*189,400*			*185*	*259*	*290*	*0.75*	*0.58*	*0.98*
	Southwark	**285,600**	**368**	**389**	**438**	**445**	**501**	**1.42**	**1.21**	**1.68**
	Sutton and Merton	398,900			371	381	411	1.11	0.96	1.30
	Tower Hamlets	234,800	183	213	226	230	264	0.83	0.65	1.06
	Waltham Forest	**224,500**		**330**	**379**	**405**	**437**	**1.25**	**1.03**	**1.53**
	Wandsworth	286,900			349	380	387	1.11	0.92	1.34
	Westminster	249,200			253	337	393	1.07	0.88	1.31
South East Coast	Brighton and Hove City	256,200	199	234	265	289	316	0.88	0.71	1.09
	East Sussex Downs and Weald	*333,700*	*222*	*216*	*267*	*297*	*300*	*0.77*	*0.63*	*0.93*
	Eastern and Coastal Kent	732,100			299	347	376	1.00	0.88	1.12
	Hastings and Rother	178,400	252	252	286	308	308	0.79	0.61	1.03
	Medway	254,900			322	373	408	1.09	0.90	1.33
	Surrey	1,100,500	236	275	328	354	365	0.95	0.86	1.05
	West Kent	678,600			360	386	398	1.04	0.92	1.17
	West Sussex	792,900	250	272	318	339	343	0.89	0.79	1.00
South Central	**Berkshire East**	**399,600**	**250**	**270**	**368**	**435**	**460**	**1.26**	**1.09**	**1.45**
	Berkshire West	**466,600**	**264**	**274**	**375**	**426**	**435**	**1.18**	**1.02**	**1.35**
	Buckinghamshire	508,700	336	387	409	411	411	1.07	0.93	1.23
	Hampshire	1,289,100	286	312	330	355	366	0.94	0.86	1.03
	Isle of Wight National Health Service	140,200	285	278	264	307	314	0.78	0.58	1.05
	Milton Keynes	242,300	268	289	322	334	351	0.93	0.76	1.16
	Oxfordshire	**615,900**	**362**	**390**	**401**	**421**	**425**	**1.15**	**1.02**	**1.30**
	Portsmouth City Teaching	203,400	300	310	324	364	359	1.05	0.83	1.32
	Southampton City	237,000	295	316	338	346	359	1.07	0.86	1.32
South West	Bath and North East Somerset	177,500	248	259	270	276	315	0.86	0.66	1.12
	Bournemouth and Poole Teaching	306,000	307	324	359	346	346	0.94	0.78	1.14
	Bristol	**433,000**	**365**	**386**	**402**	**436**	**453**	**1.31**	**1.14**	**1.51**
	Cornwall and Isles of Scilly	532,900	308	327	357	394	422	1.06	0.93	1.21
	Devon	747,500	276	298	337	361	391	0.99	0.88	1.11
	Dorset	404,200	312	336	383	401	411	1.03	0.88	1.20
	Gloucestershire	*588,700*	*321*	*323*	*328*	*338*	*328*	*0.85*	*0.73*	*0.97*

Table 3.4. Continued

UK Area	PCT/HB[a]	Population covered[b]	Rate pmp					Age and gender standardised rate ratio 2009		
			2005	2006	2007	2008	2009	O/E[c]	LCL	UCL
South West	North Somerset	209,400	382	382	349	372	392	1.00	0.80	1.24
	Plymouth Teaching	**256,700**	**374**	**401**	**417**	**464**	**499**	**1.40**	**1.18**	**1.66**
	Somerset	523,600	325	338	353	359	376	0.96	0.83	1.10
	South Gloucestershire	262,300	377	389	423	427	431	1.13	0.94	1.36
	Swindon	203,700	299	304	314	344	363	0.96	0.77	1.21
	Torbay	133,900	299	306	351	411	463	1.18	0.92	1.52
	Wiltshire	*456,000*	*259*	*276*	*300*	*311*	*316*	*0.82*	*0.69*	*0.96*
Wales	Betsi Cadwaladr University	679,000	287	295	312	334	343	0.88	0.78	1.01
	Powys Teaching	131,700	258	304	342	357	372	0.92	0.69	1.21
	Hywel Dda	374,800	334	339	358	379	390	1.00	0.85	1.18
	Abertawe Bro Morgannwg University	**502,300**	**370**	**400**	**418**	**434**	**450**	**1.19**	**1.04**	**1.35**
	Cwm Taf	**290,500**	**451**	**489**	**516**	**540**	**578**	**1.55**	**1.33**	**1.80**
	Aneurin Bevan	**560,600**	**398**	**403**	**437**	**453**	**476**	**1.25**	**1.11**	**1.41**
	Cardiff and Vale University	**461,000**	**345**	**364**	**382**	**401**	**406**	**1.16**	**1.00**	**1.34**
Scotland	Ayrshire & Arran	367,000	341	365	379	409	401	1.01	0.86	1.19
	Borders	113,100	283	283	309	354	363	0.89	0.65	1.21
	Dumfries and Galloway	148,200	304	317	344	391	412	1.00	0.78	1.29
	Fife	363,400	281	292	297	322	336	0.87	0.73	1.04
	Forth Valley	*291,400*	*285*	*264*	*288*	*302*	*302*	*0.78*	*0.63*	*0.96*
	Grampian	545,400	328	339	352	359	389	0.99	0.87	1.13
	Greater Glasgow & Clyde	**1,199,000**	**383**	**392**	**413**	**426**	**435**	**1.15**	**1.06**	**1.26**
	Highland	311,000	309	350	370	421	463	1.13	0.96	1.33
	Lanarkshire	562,500	343	352	363	386	404	1.05	0.92	1.19
	Lothian	826,200	306	287	311	330	338	0.90	0.80	1.01
	Orkney	20,000	550	550	450	550	450	1.09	0.57	2.10
	Shetland	22,000	273	273	273	227	318	0.79	0.38	1.67
	Tayside	399,600	390	415	423	440	438	1.14	0.98	1.32
	Western Isles	26,100	268	268	345	307	307	0.74	0.37	1.49
Northern Ireland	Belfast	334,600	332	359	371	374	400	1.15	0.97	1.37
	Northern	458,300	299	329	334	353	362	0.99	0.85	1.15
	Southern	354,000	280	285	297	297	299	0.86	0.71	1.04
	South Eastern	344,200	302	320	340	357	366	0.99	0.83	1.18
	Western	297,900	262	295	302	309	322	0.91	0.74	1.11

of additional data cleaning and reallocation of patients. The average age of incident transplant patients has steadily increased since 2004. 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 has increased from 14,881 patients in 2004 to 23,284 patients at the end of 2009. With the rapid expansion of this patient group there is a need for careful planning by renal centres for future service provision and resource allocation.

Primary renal diagnosis

The primary renal diagnosis of patients receiving kidney transplants in the UK has remained stable over the last 5 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

Table 3.5. Distribution of prevalent patients on RRT by centre and modality on 31/12/2009

Centre	N	% HD	% PD	% transplant
Transplant centres				
B QEH	1,821	48	9	44
Belfast	680	36	5	59
Bristol	1,223	36	6	58
Camb	940	37	4	59
Cardff	1,440	35	7	58
Covnt	794	44	10	46
Edinb	700	39	9	52
Glasgw	1,468	43	4	53
L Barts	1,638	43	11	45
L Guys	1,511	38	3	58
L Rfree	1,546	42	5	53
L St. G	661	40	10	51
L West	2,725	47	1	52
Leeds	1,348	37	8	55
Leic	1,735	43	10	47
Liv RI	1,223	33	7	60
Man RI	1,436	30	7	63
Newc	897	31	6	63
Nottm	956	43	12	46
Oxford	1,320	29	8	63
Plymth	454	28	9	63
Ports	1,301	37	7	56
Sheff	1,216	49	6	45
Dialysis centres				
Abrdn	452	44	7	50
Airdrie	310	54	4	42
Antrim	215	58	7	35
B Heart	622	69	5	25
Bangor	110	72	28	0
Basldn	214	67	13	20
Bradfd	422	45	8	47
Brightn	737	45	12	44
Carlis	203	33	7	60
Carsh	1,302	51	9	39
Chelms	225	52	16	31
Clwyd	144	53	5	42
Colchester	116	100	0	0
D & Gall	118	44	10	46
Derby	419	59	21	20
Derry	115	57	3	40
Donc	196	62	17	21
Dorset	552	41	11	48
Dudley	292	53	19	27
Dundee	395	46	7	47
Dunfn	233	49	10	41
Exeter	731	46	10	45
Glouc	366	51	12	38
Hull	725	46	10	44
Inverns	224	40	10	50
Ipswi	308	36	14	50
Kent	744	45	9	45
Klmarnk	273	54	14	32
L Kings	786	50	11	39
Liv Ain	146	95	5	0
M Hope	784	44	15	41

Table 3.5. Continued

Centre	N	% HD	% PD	% transplant
Middlbr	707	42	3	55
Newry	167	62	7	31
Norwch	591	53	10	37
Prestn	939	51	8	41
Redng	618	44	14	43
Shrew	337	58	9	34
Stevng	580	65	5	30
Sthend	207	61	10	29
Stoke	640	47	11	42
Sund	368	48	8	44
Swanse	598	58	10	32
Truro	320	48	9	43
Tyrone	143	63	8	30
Ulster	114	83	2	15
Wirral	222	84	16	0
Wolve	477	63	11	26
Wrexm	219	33	12	54
York	321	59	5	36
England	**40,962**	**44**	**8**	**47**
Northern Ireland	**1,434**	**50**	**5**	**44**
Scotland	**4,173**	**44**	**7**	**49**
Wales	**2,511**	**43**	**9**	**48**
UK	**49,080**	**45**	**8**	**47**

ethnicity between 2004 and 2008 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 continues to be marked variation in the completeness of data (tables 3.9a and b) reported by each renal centre, particularly for blood pressure. Better data records (or possibly better extraction of data held within renal IT systems) would facilitate more meaningful comparisons between centres and help to determine the causes of between-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 performance between centres.

The 72 renal centres in the UK comprise 52 centres in England, 5 in Wales, 6 in Northern Ireland and 9 in Scotland. Centres in Scotland only provide summary

Table 3.6. Median age and gender ratio of incident and prevalent transplant patients 2004–2009

	Incident transplants			Prevalent transplants[a]		
Year	N	Median age	M:F ratio	N	Median age	M:F ratio
2004	1,726	45.3	1.7	14,881	49.7	1.6
2005	1,771	45.4	1.5	16,686	49.7	1.6
2006	2,004	45.3	1.6	17,690	49.9	1.5
2007	2,151	45.6	1.5	20,678	50.1	1.5
2008	2,385	46.4	1.5	22,247	50.4	1.5
2009	2,497	48.4	1.6	23,284	50.8	1.5

[a] As on 31st December for given year

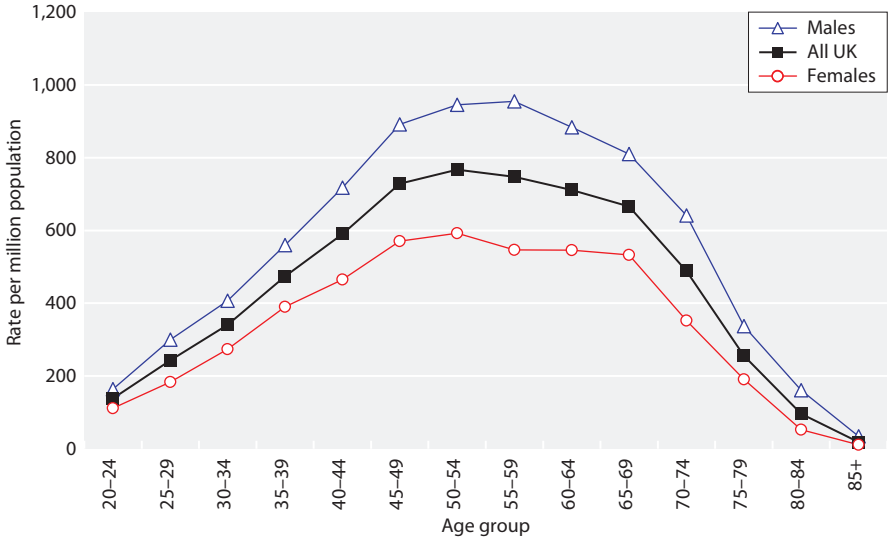

Fig. 3.1. Transplant prevalence rate per million population by age and gender on 31/12/2009

information and therefore laboratory outcome data for comparisons were not available for the Scottish renal centres. Four centres (Bangor, Colchester, Liverpool Aintree, Wirral) were reported as having no transplanted patients and were therefore excluded. After exclusion of these 13 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

Table 3.7. Primary renal disease in renal transplant recipients 2005–2009

	New transplants by year						Established transplants on 1/1/2009	
Primary diagnosis	2005 %	2006 %	2007 %	2008 %	2009 %	2009 N	%	N
Aetiology uncertain/GN[a] not biopsy proven	18.9	17.5	16.9	16.4	16.1	388	20.3	4480
Diabetes	13.4	13.2	14.4	13.0	12.5	302	8.6	1901
Glomerulonephritis	19.6	19.6	20.7	19.4	20.6	498	19.8	4380
Polycystic kidney disease	11.9	12.6	13.4	13.1	13.0	314	12.2	2695
Pyelonephritis	12.4	12.3	11.6	12.4	11.0	265	15.0	3318
Renovascular disease	6.5	6.2	5.4	6.9	5.9	143	5.8	1287
Other	14.9	16.0	15.5	16.2	14.5	349	16.0	3531
Not available	2.4	2.4	2.0	2.8	6.3	153	2.4	524

[a] GN = glomerulonephritis

Table 3.8. Ethnicity of patients who received a transplant in the years 2004–2009

Year	% White	% South Asian	% Black	% Other	% Unknown
2004	74.0	6.9	5.2	1.9	12.1
2005	75.5	7.0	5.4	1.2	10.9
2006	73.5	7.9	6.5	2.2	9.9
2007	73.5	7.8	6.0	2.1	10.6
2008	70.0	8.1	6.4	2.2	13.3
2009	66.1	9.1	6.4	2.3	16.1

Northern Ireland centres included from 2005 onwards

Table 3.9a. Percentage completeness by centre for prevalent transplant patients on 31/12/2009[a]

Centre	N	Ethnicity	eGFR[b]	Blood pressure	Centre	N	Ethnicity	eGFR[b]	Blood pressure
Antrim	75	100	99	99	Leic	801	93	93	51
B Heart	155	100	91	2	Liv RI	710	94	92	84
B QEH	769	100	88	2	M Hope	311	99	96	0
Basldn	43	100	98	2	M RI	858	97	98	0
Belfast	391	99	97	76	Middlbr	384	99	94	57
Bradfd	194	100	88	91	Newc	557	100	97	0
Brightn	295	60	89	0	Newry	49	100	100	100
Bristol	680	99	99	90	Norwch	216	95	94	81
Camb	513	95	99	98	Nottm	424	100	98	97
Cardff	804	72	98	98	Oxford	795	90	99	21
Carlis	115	99	94	0	Plymth	268	76	98	0
Carsh	503	97	95	1	Ports	707	99	88	13
Chelms	68	93	96	96	Prestn	372	93	94	0
Clwyd	61	72	95	95	Redng	258	100	100	99
Covnt	352	97	88	84	Sheff	531	94	99	99
Derby	79	99	87	99	Shrew	112	99	100	31
Derry	46	100	94	94	Stevng	166	100	72	3
Donc	39	100	100	100	Sthend	58	93	98	86
Dorset	262	100	90	96	Stoke	258	49	97	0
Dudley	77	100	96	52	Sund	157	99	99	99
Exeter	321	94	96	91	Swanse	187	100	2	99
Glouc	132	98	97	99	Truro	135	83	99	98
Hull	313	66	96	0	Tyrone	41	100	100	98
Ipswi	151	99	99	99	Ulster	13	100	100	100
Kent	323	84	94	12	Wolve	121	100	96	97
L Barts	707	99	96	0	Wrexm	117	100	97	4
L Guys	846	84	97	0	York	112	79	99	90
L Kings	291	97	94	0	**England**	**18,744**	**92**	**95**	**36**
L RFree	804	98	94	0	**N Ireland**	**615**	**99**	**98**	**84**
L St.G	324	83	94	0	**Wales**	**1,169**	**79**	**82**	**89**
L West	1,355	84	98	0	**E, W & NI**	**20,528**	**92**	**94**	**41**
Leeds	722	89	96	88					

[a] Scottish centres are not shown as they do not provide biochemical data to the UKRR
[b] Patients with missing ethnicity were classed as White for eGFR calculation

were excluded as they do not submit biochemical data to the UKRR. After excluding these 2 transplant centres, one year outcomes are described for 21 transplant centres across the UK.

Compared with data published in the previous annual report [2], 7 centres (Brighton, Cardiff, Coventry, Newcastle, Preston, Sunderland, Swansea) are shown to have had a significant fall in data completeness for corrected calcium levels. This reflects these centres only submitting unadjusted calcium measurements, which in previous years the UKRR has used to calculate adjusted calcium levels. Due to concerns regarding accuracy, this has not been done for the 2010 annual report and hence the apparent fall in data completeness for these centres.

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 2002–2008, 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 in patients. 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

Table 3.9b. Percentage completeness by centre for prevalent transplant patients on 31/12/2009[a]

Centre	N	Haemoglobin	Total serum cholesterol	Adjusted serum calcium[b]	Serum phosphate	Serum PTH
Antrim	75	99	96	96	97	21
B Heart	155	90	66	86	87	19
B QEH	769	88	84	88	87	63
Basldn	43	98	95	95	74	58
Belfast	391	97	99	96	96	16
Bradfd	194	81	75	85	82	27
Brightn	295	89	27	0	85	30
Bristol	680	99	94	99	99	98
Camb	513	99	94	99	99	88
Cardff	804	97	89	0	97	12
Carlis	115	93	73	94	89	3
Carsh	503	95	69	94	94	3
Chelms	68	96	88	96	87	21
Clwyd	61	93	89	95	95	59
Covnt	352	86	0	0	44	25
Derby	79	87	62	85	84	57
Derry	46	93	96	91	91	43
Donc	39	100	95	100	100	33
Dorset	262	90	87	60	67	17
Dudley	77	96	87	57	96	74
Exeter	321	96	89	96	85	20
Glouc	132	97	72	95	94	41
Hull	313	94	37	94	94	22
Ipswi	151	98	83	99	99	57
Kent	323	100	88	96	95	0
L Barts	707	96	100	96	96	70
L Guys	846	98	84	93	93	26
L Kings	291	94	80	94	94	21
L RFree	804	58	89	93	93	68
L St.G	324	94	84	94	94	56
L West	1,355	99	94	69	69	0
Leeds	722	94	95	95	95	67
Leic	801	93	91	92	92	41
Liv RI	710	92	6	88	92	42
M Hope	311	84	97	96	96	77
M RI	858	98	71	98	98	59
Middlbr	384	93	63	92	91	19
Newc	557	96	93	0	96	50
Newry	49	100	100	98	98	55
Norwch	216	94	94	93	93	24
Nottm	424	98	86	96	94	88
Oxford	795	99	74	98	98	34
Plymth	268	89	69	97	96	15
Ports	707	89	50	84	87	6
Prestn	372	92	87	1	91	60
Redng	258	99	100	99	98	88
Sheff	531	99	77	99	99	34
Shrew	112	100	99	95	94	64
Stevng	166	95	90	93	90	68
Sthend	58	98	53	98	97	7
Stoke	258	100	100	100	99	35
Sund	157	99	99	0	99	96
Swanse	187	95	94	0	2	10
Truro	135	99	89	99	99	61
Tyrone	41	95	98	100	100	44

Table 3.9b. Percentage completeness by centre for prevalent transplant patients on 31/12/2009[a]

Centre	N	Haemoglobin	Total serum cholesterol	Adjusted serum calcium[b]	Serum phosphate	Serum PTH
Ulster	13	100	100	100	100	62
Wolve	121	96	89	95	86	64
Wrexm	117	95	94	97	97	94
York	112	95	91	86	97	24
England	**18,744**	**93**	**78**	**83**	**91**	**43**
N Ireland	**615**	**97**	**98**	**96**	**96**	**24**
Wales	**1,169**	**96**	**90**	**15**	**82**	**22**
E, W & NI	**20,528**	**94**	**80**	**79**	**90**	**41**

[a] Scottish centres are not shown as they do not provide biochemical data to the UKRR
[b] Serum calcium corrected for serum albumin

comparison of outcomes between centres are 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 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 2009. Patients were considered as having a functioning transplant if 'transplant' was listed as the last mode of RRT in the last quarter of 2009. 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 of less than 3 months duration were excluded from analyses. For haemoglobin, estimated glomerular filtration rate (eGFR), corrected calcium and phosphate, the latest value in quarter 3 or quarter 4 of 2009 was used. For blood pressure (BP) and cholesterol, the latest value from 2009 was used. For parathyroid hormone (PTH), the latest value in the last 3 quarters of 2009 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. 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 2009. 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 2002 and 31st December 2008 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. For patients with more than one transplant during 2002–2008, 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 (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 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 49.9 ml/min/1.73 m^2, with 14.2% 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 of patients with failing transplants from transplant centres to referring centres might explain some of the differences, it is notable that both transplanting

Table 3.10. Number of patients reallocated to transplanting centre

Transplant centre	Total number of patients per transplant centre	Non-transplant centre	Number of patients reallocated to transplant centre
B QEH	566	Shrew	2
		Stoke	4
Belfast	147	Antrim	1
		Derry	5
		Newry	1
		Tyrone	1
Bristol	657	Glouc	6
Camb	746	Norwch	3
		Stevng	15
Cardff	590		n/a
Covnt	272		n/a
L Barts	393		n/a
L Guys	1,072	Kent	28
		L Kings	181
L Rfree	293	Sthend	3
L St.G	185	Brightn	9
		Carsh	7
L West	911		n/a
Leeds	896	Hull	21
Leic	389		n/a
Liv RI	637	Prestn	125
		Wrexm	1
M RI	303	M Hope	2
Newc	658	Carlis	9
		Middlbr	24
		Sund	12
Nottm	260		n/a
Oxford	757		n/a
Plymth	341		n/a
Ports	385		n/a
Sheff	336		n/a
Total	**10,794**		**460**

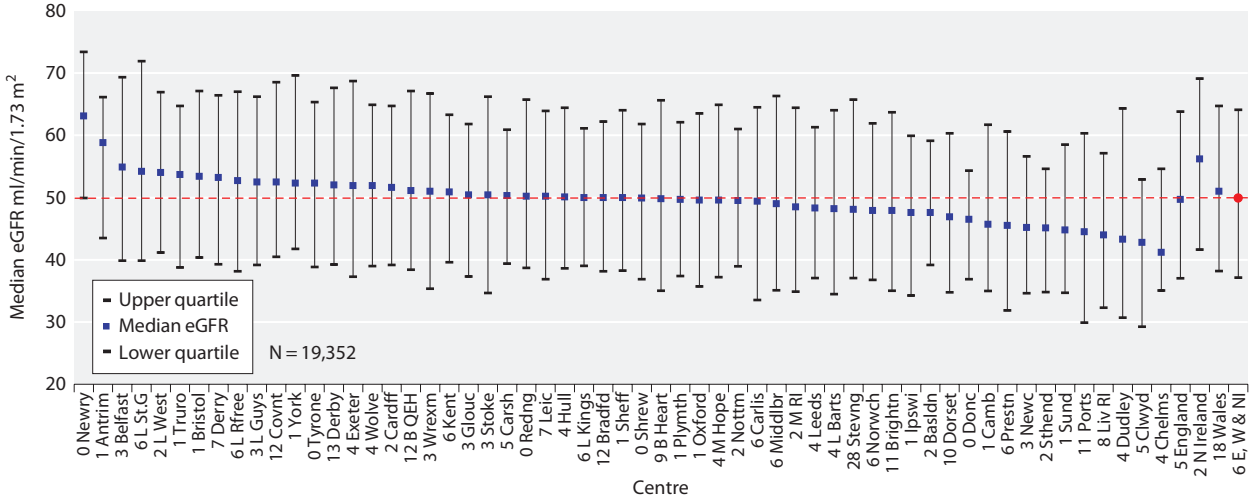

Fig. 3.2. Median eGFR in prevalent transplant patients by centre on 31/12/2009

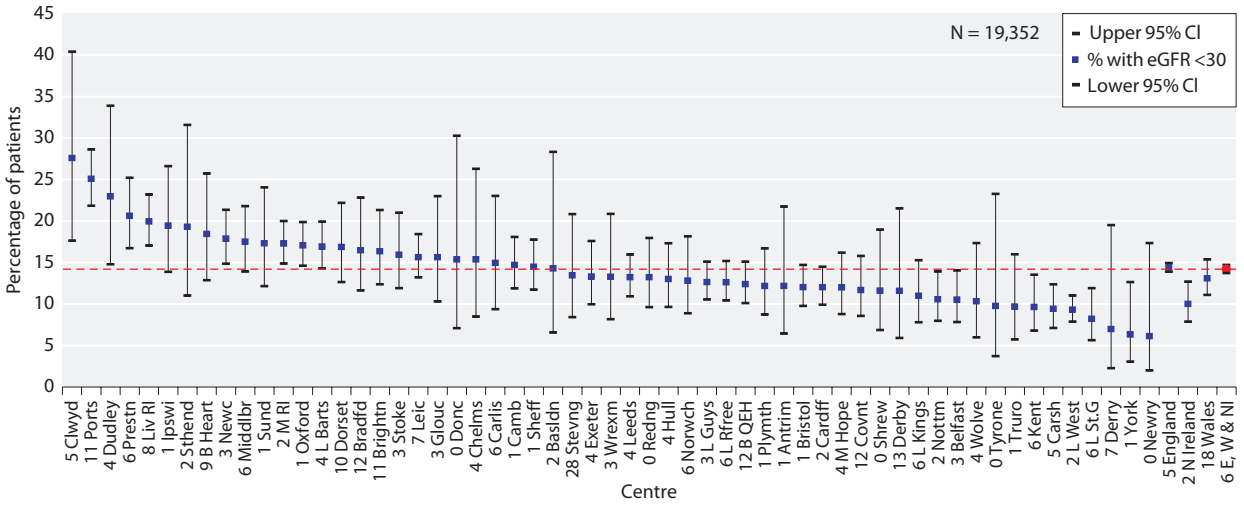

Fig. 3.3. Percentage of prevalent transplant patients by centre on 31/12/2009 with eGFR <30 ml/min/1.73 m^2

Table 3.11. Proportion of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 on 31/12/08

Centre	Number of patients with eGFR data	Patients with eGFR <30
Swansea	3	0
Ulster	12	8.3
Donc	39	15.4
Tyrone	41	9.8
Basldn	42	14.3
Derry	43	7.0
Newry	49	6.1
Sthend	57	19.3
Clwyd	58	27.6
Chelms	65	15.4
Derby	69	11.6
Antrim	74	12.2
Dudley	74	23.0
Carlis	107	15.0
York	111	6.3
Shrew	112	11.6
Wrexm	113	13.3
Wolve	116	10.3
Stevng	119	13.4
Glouc	128	15.6
Truro	134	9.7
B Heart	141	18.4
Ipswi	149	19.5
Sund	156	17.3
Bradfd	170	16.5
Norwch	203	12.8
Dorset	237	16.9
Stoke	251	15.9
Redng	257	13.2
Brightn	263	16.3
Plymth	263	12.2
L Kings	273	11.0
Hull	300	13.0
M Hope	300	12.0
Kent	301	9.6
L St.G	304	8.2
Exeter	308	13.3
Covnt	308	11.7
Prestn	349	20.6
Middlbr	360	17.5
Belfast	380	10.5
Nottm	416	10.6
Carsh	478	9.4
Camb	503	14.7
Sheff	525	14.5
Newc	537	17.9
Ports	626	25.1
Liv RI	652	19.9
Bristol	674	12.0
B QEH	678	12.4
L Barts	680	16.9
Leeds	695	13.2
Leic	748	15.6
L Rfree	753	12.6
Cardff	782	12.0
Oxford	785	17.1
L Guys	822	12.7
M RI	839	17.3
L West	1320	9.3

and non-transplant centres feature at both ends of the scale. The accuracy of the 4v MDRD equation in estimating GFR $\geqslant 60$ ml/min/1.73 m^2 is questionable [4], therefore a figure describing this is not included in this chapter. It is likely that centres with a high prevalence of patients with eGFR <30 ml/min/1.73 m^2 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 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 57 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.

Although there was less variation between centres than in 2008, these data continue to show over-dispersion with 15 centres falling outside the 95% CI of which 5 centres were outside the 99.9% CI. Three centres (Carshalton, London St George's, London West) fall 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 and Portsmouth fall outside the upper 99.9% CI suggesting a higher than expected proportion of patients with eGFR <30 ml/min/1.73 m^2.

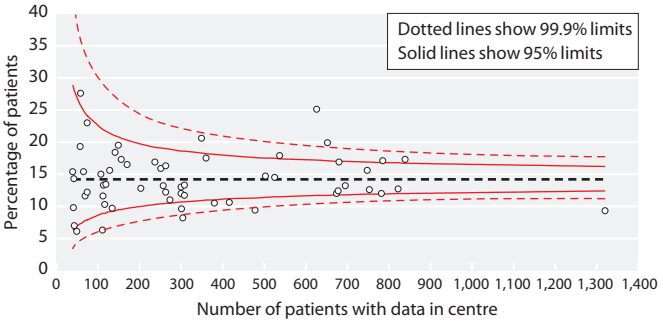

Fig. 3.4. Funnel plot of percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 by centre size on 31/12/2009

eGFR in patients one year after transplantation

Graft function at one year post-transplantation may predict subsequent long-term graft outcome [5]. Figure 3.5 shows that the median one year post-transplant eGFR for patients transplanted 2002–2008 was 51.5 ml/min/1.73 m^2. Figures 3.6a and 3.6b provide the same information divided according to source of organ as live donor and deceased donor respectively.

Regression analysis (least squares) indicated a small but significant upward trend (+0.99 ml/min change in eGFR/year) ($p < 0.001$) in the one year post-transplant median eGFR between 2002 and 2008 (figure 3.7). 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 [6].

Figures 3.8a and 3.8b show one year post-transplant eGFR by donor type. An upward trend in eGFR ($p < 0.001$) over the time period is noticed with both live and deceased donor transplants and the rate of

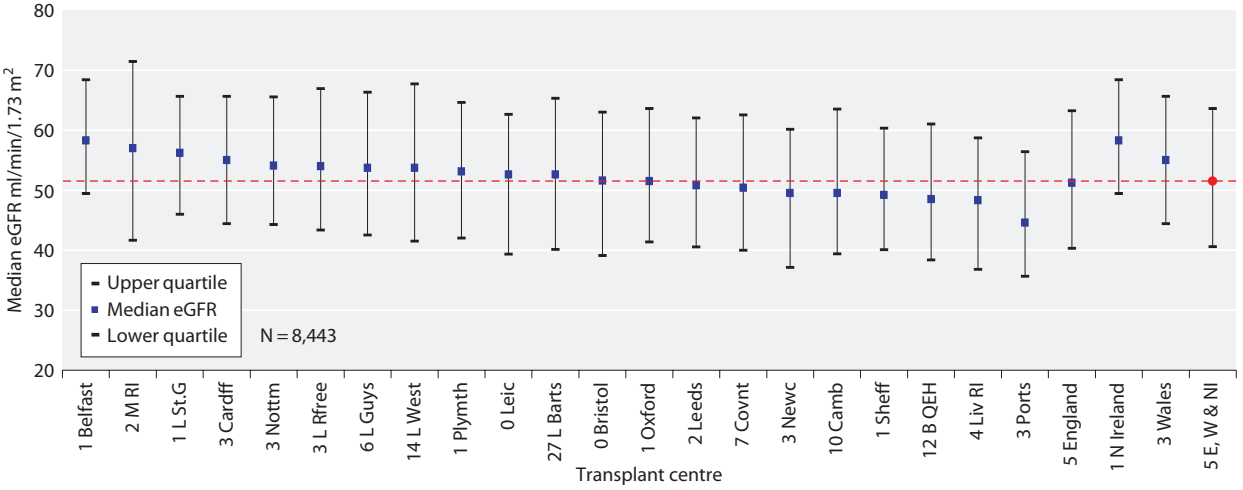

Fig. 3.5. Median eGFR one year post-transplant by transplant centre for patients transplanted between 2002–2008

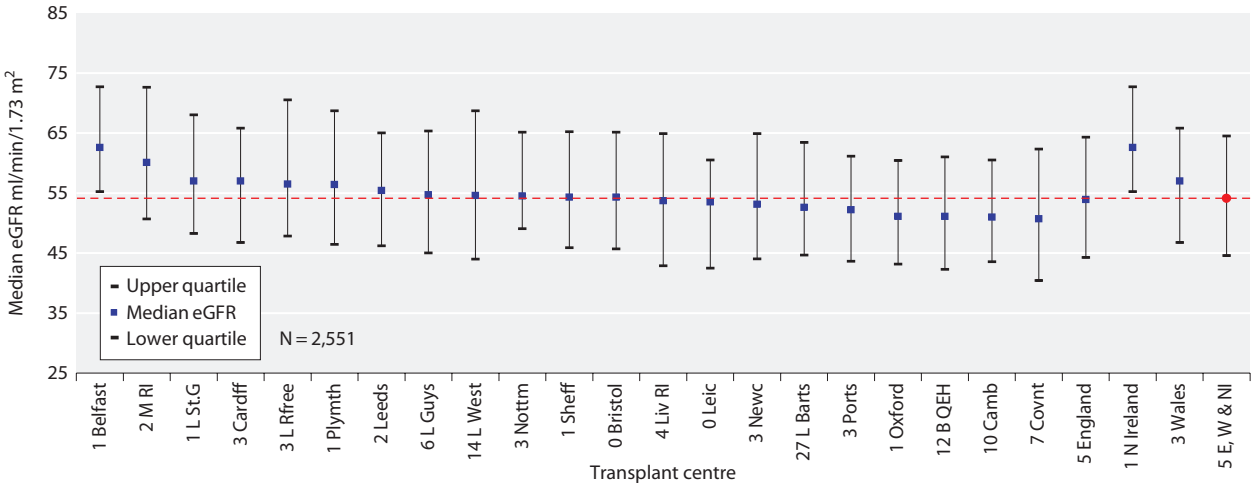

Fig. 3.6a. Median eGFR one year post-live donor transplant by transplant centre 2002–2008

change in slope of eGFR per year between the donor types (+0.85 ml/min/year for live donor transplants and +0.96 ml/min/year for deceased donor transplants) are also similar. Therefore changing donor demographics, with a higher proportion of live donor transplants more recently, does not explain the upward trend in one year post-transplant eGFR.

Haemoglobin in prevalent transplant patients

Transplant patients have previously fallen under the remit of the UK Renal Association Complications of Chronic Kidney Disease (CKD) guidelines. Updated guidelines regarding the management of anaemia in CKD were published by the association in 2010 [7]. However, the data presented in this chapter pre-dates this and therefore the previous standards are referred to. These state that ***'Patients with CKD should achieve a haemoglobin between 10.5–12.5 g/dl'*** [8]. However, many transplant patients with good transplant function will have haemoglobin concentrations >12.5 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. Figures 3.9, 3.10a and 3.10b report centre results stratified according to graft function as estimated by eGFR. The percentage of prevalent transplant patients achieving Hb >10.5 g/dl in each

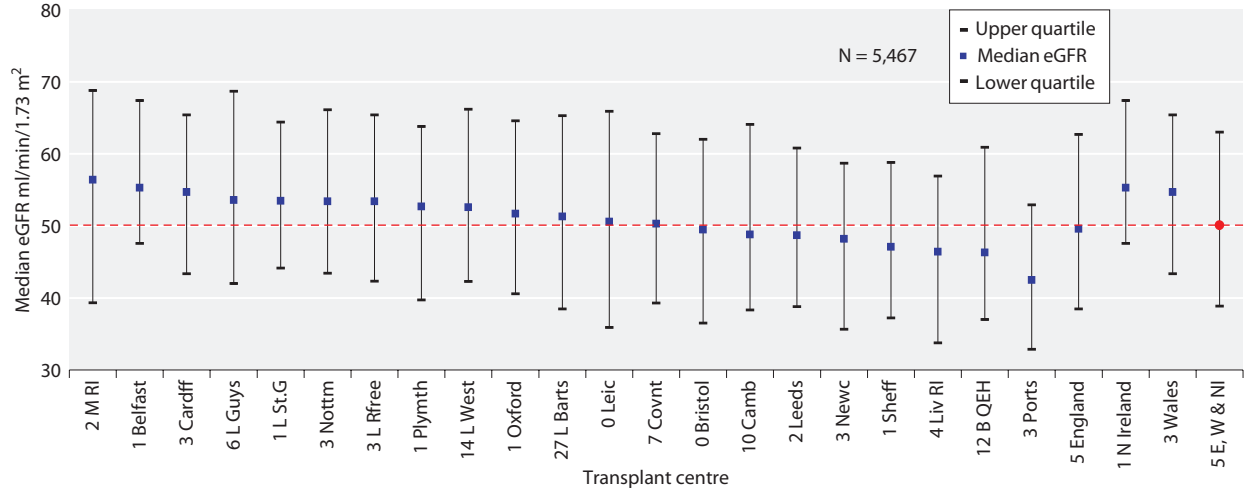

Fig. 3.6b. Median eGFR one year post-deceased donor transplant by transplant centre 2002–2008

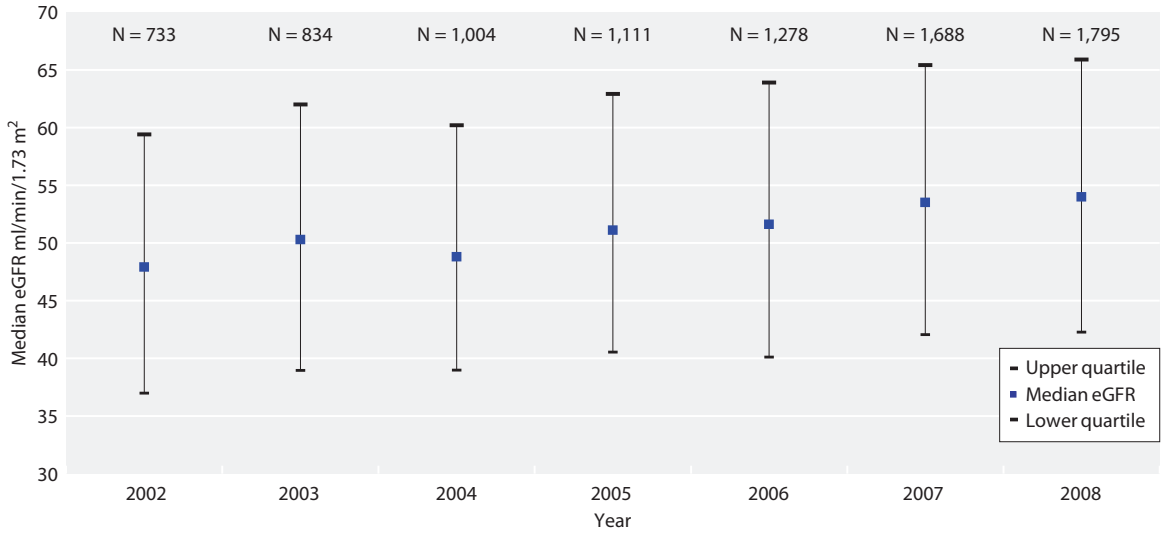

Fig. 3.7. Median eGFR one year post-transplant by year of transplantation 2002–2008

centre, stratified by eGFR, is displayed in figures 3.11a and 3.11b.

Figure 3.12 describes the percentage of prevalent patients by centre with haemoglobin <10.5 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.

Two centres (Leeds, London Royal Free) fall outside the upper 99.9% CI and 4 further centres, (Leicester, London Guy's, Manchester Royal Infirmary, Portsmouth) fall outside the upper 95% CI indicating a higher than predicted proportion of transplant patients not achieving the haemoglobin target. Six centres (Antrim, Cardiff, Newcastle, Sheffield, Shrewsbury, Truro) perform better than expected with fewer than predicted patients having a haemoglobin <10.5 g/dl.

Haemoglobin in patients one year post-transplantation

The one year post-transplant haemoglobin for patients transplanted between 2002–2008 continued to be stable at 13.0 g/dl (figure 3.13).

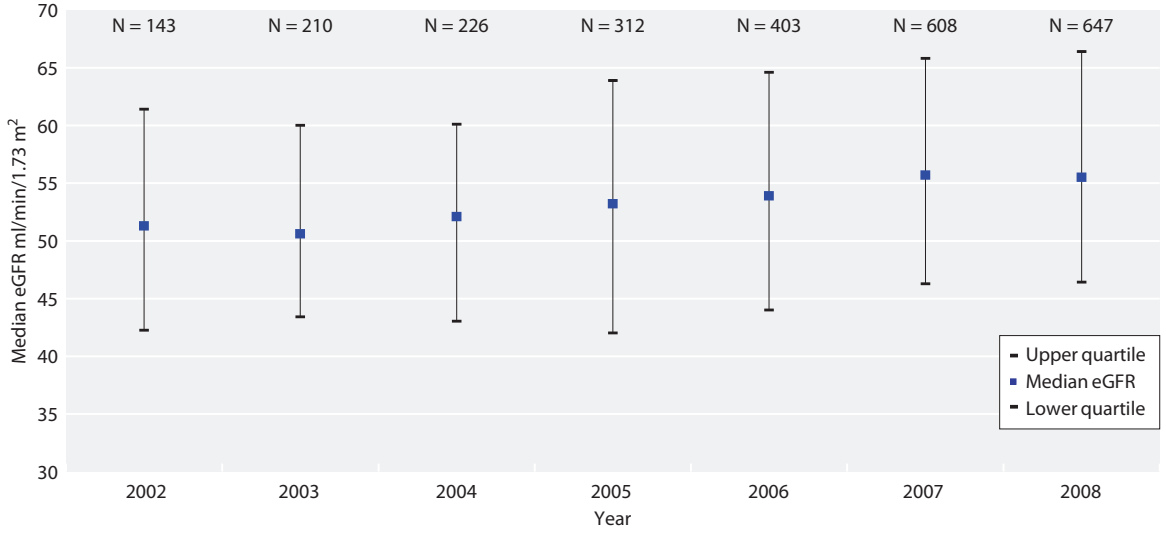

Fig. 3.8a. Median eGFR one year post-live donor transplant by year of transplantation 2002–2008

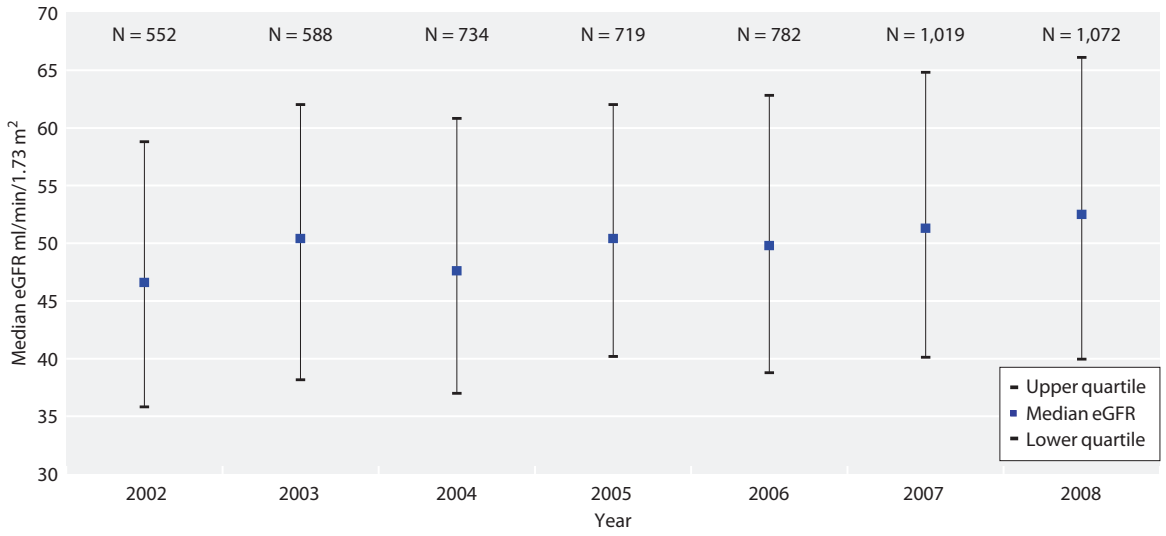

Fig. 3.8b. Median eGFR one year post-deceased donor transplant by year of transplantation 2002–2008

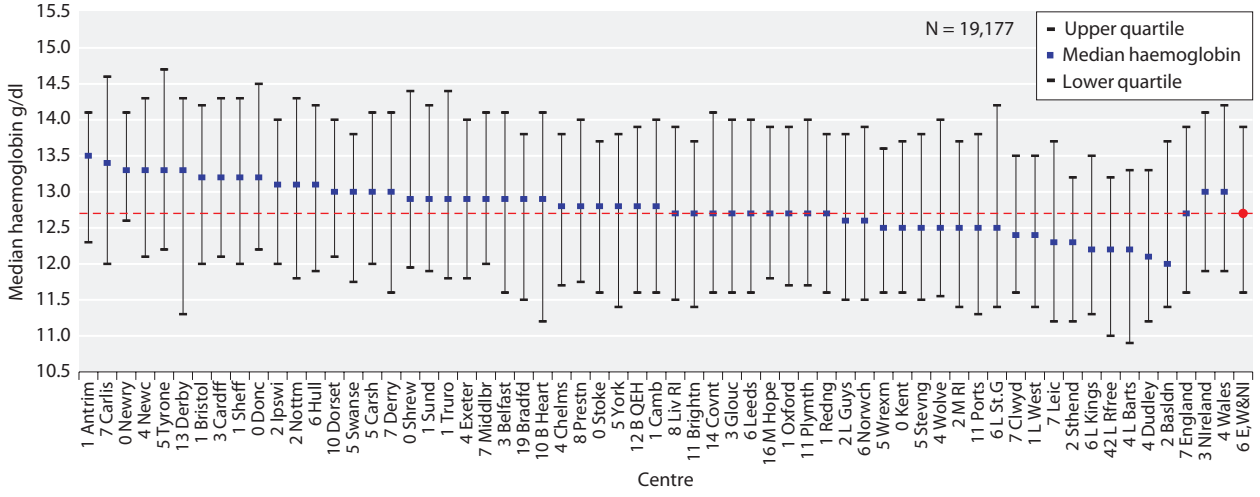

Fig. 3.9. Median haemoglobin for prevalent transplant patients by centre on 31/12/2009

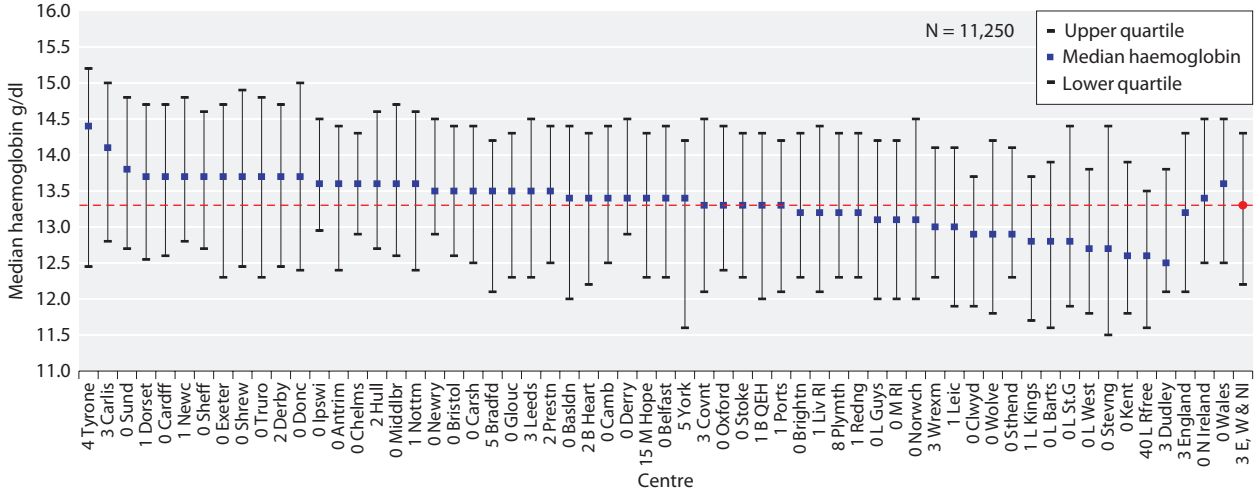

Fig. 3.10a. Median haemoglobin for prevalent transplant patients with eGFR $\geqslant 45$ ml/min/1.73 m^2 by centre on 31/12/2009

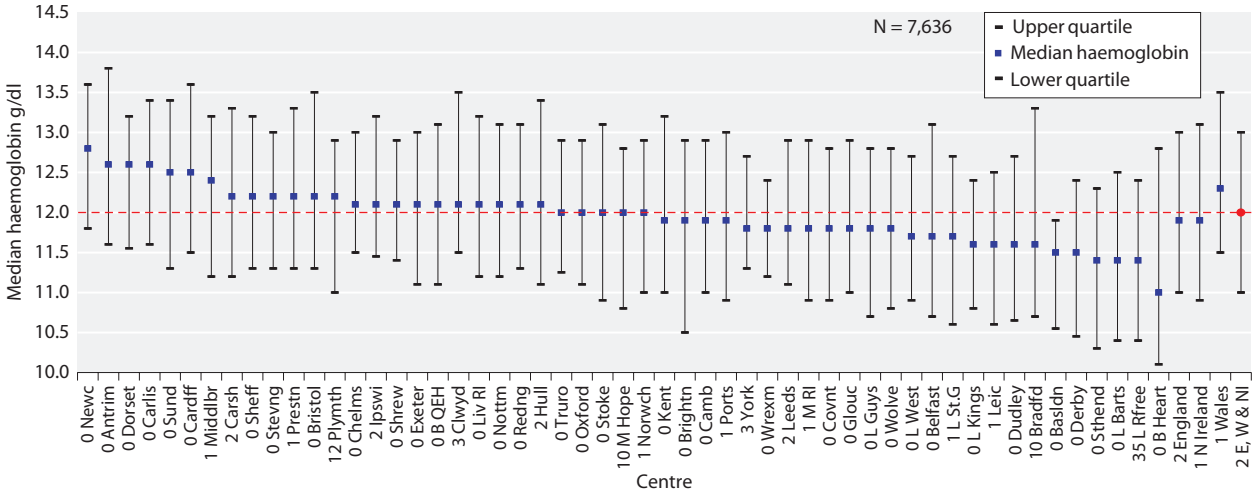

Fig. 3.10b. Median haemoglobin for prevalent transplant patients with eGFR <45 ml/min/1.73 m^2 by centre on 31/12/2009

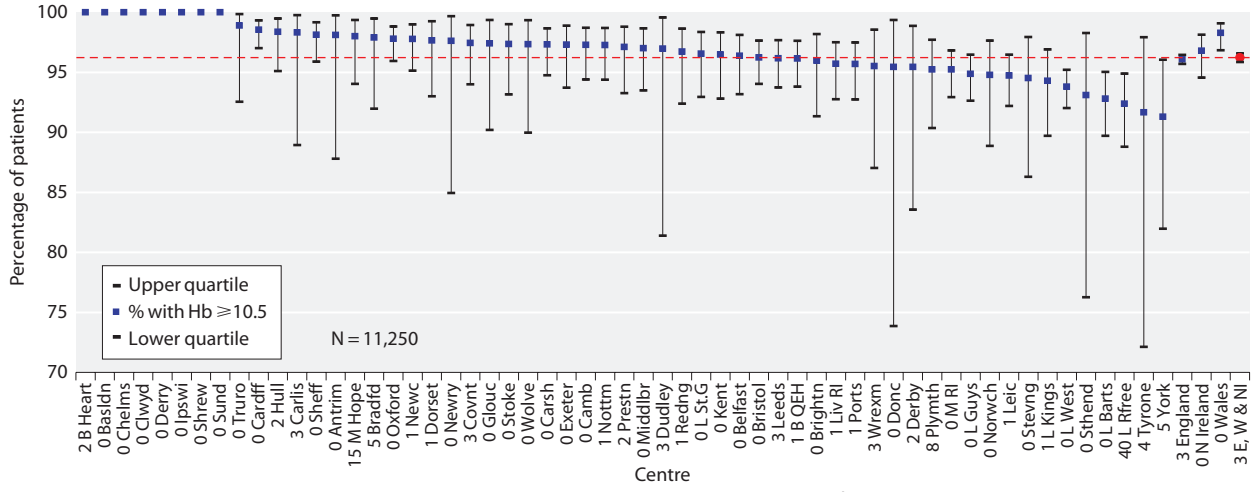

Fig. 3.11a. Percentage of prevalent transplant patients with eGFR ⩾45 ml/min/1.73 m^2 achieving haemoglobin ⩾10.5 g/dl by centre on 31/12/2009

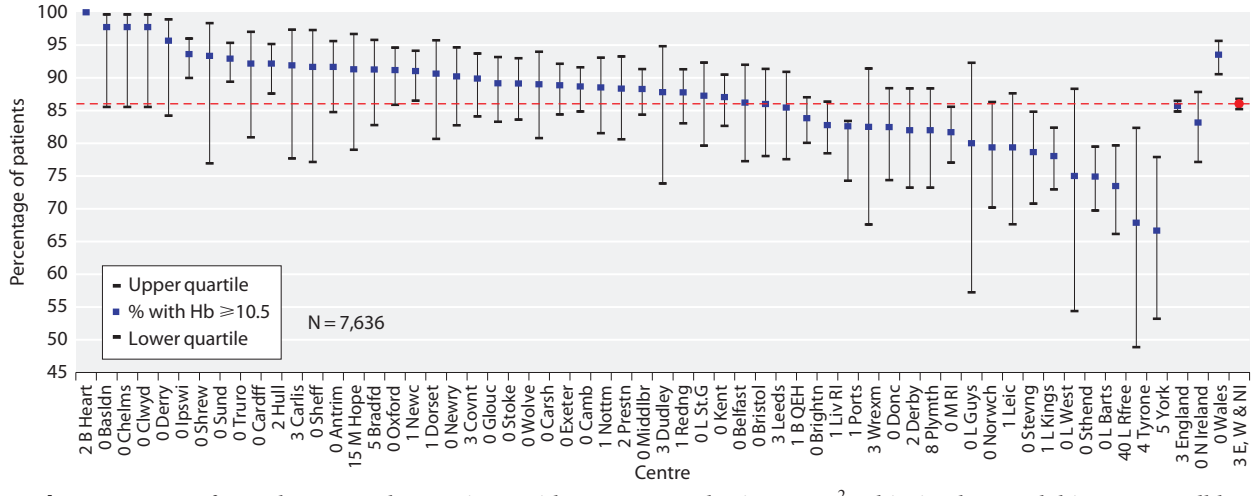

Fig. 3.11b. Percentage of prevalent transplant patients with eGFR <45 ml/min/1.73 m^2 achieving haemoglobin ⩾10.5 g/dl by centre on 31/12/2009

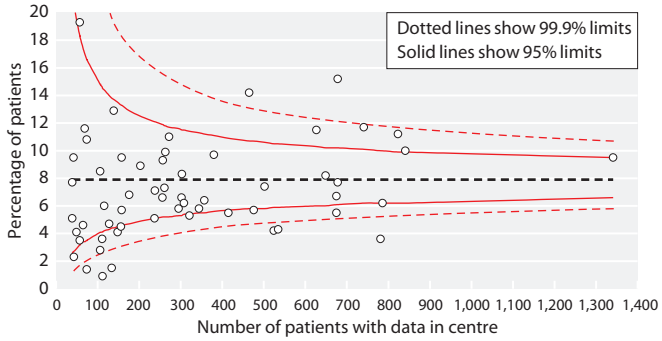

Fig. 3.12. Funnel plot of percentage of prevalent transplant patients with haemoglobin <10.5 g/dl by centre size on 31/12/2009

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 the kidney transplant recipient is that ***'Blood pressure should be <130/80 mmHg (or <125/75 mmHg if proteinuria)'*** [9]. This blood pressure target is the same as that used in previous annual reports [10].

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).

Median systolic BP (figure 3.14), diastolic BP (figure 3.15) and percentage of patients achieving RA targets (figure 3.16) are shown. Higher blood pressure may have a cause or effect association with degree of graft function. Figures 3.17a and 3.17b demonstrate the association of transplant eGFR (stratified as ⩾ or <45 ml/min/1.73 m^2) with blood pressure. The percentage of patients with BP <130/80 (systolic BP <130 **and** diastolic BP <80 mmHg) was higher (29.6% vs. 24.2%) in those with better renal function (eGFR⩾45 ml/min/1.73 m^2).

Blood pressure in patients one year after transplantation

Figures 3.18 and 3.19 show median systolic and diastolic blood pressures in patients one year after transplantation, respectively.

At present, renal transplant recipients are considered as a sub-group of the native kidney disease population. There is no current evidence that suggests the knowledge gained from native kidney disease literature is not applicable to transplant recipients. Less than 27.5% of prevalent transplant patients across the UK achieved a BP of <130/80 mmHg, and it is necessary to evaluate new ways to achieve this goal or assess whether this is realistically achievable in the majority of patients.

Cholesterol in transplant patients

The Renal Association guidelines [10] state that ***'Three hydroxy-3 methylglutaryl-Co-enzyme A reductase inhibitors (statins) should be considered for primary prevention in all CKD including dialysis patients with a 10-year risk of cardiovascular disease, calculated as >20% according to the Joint British Societies' Guidelines***

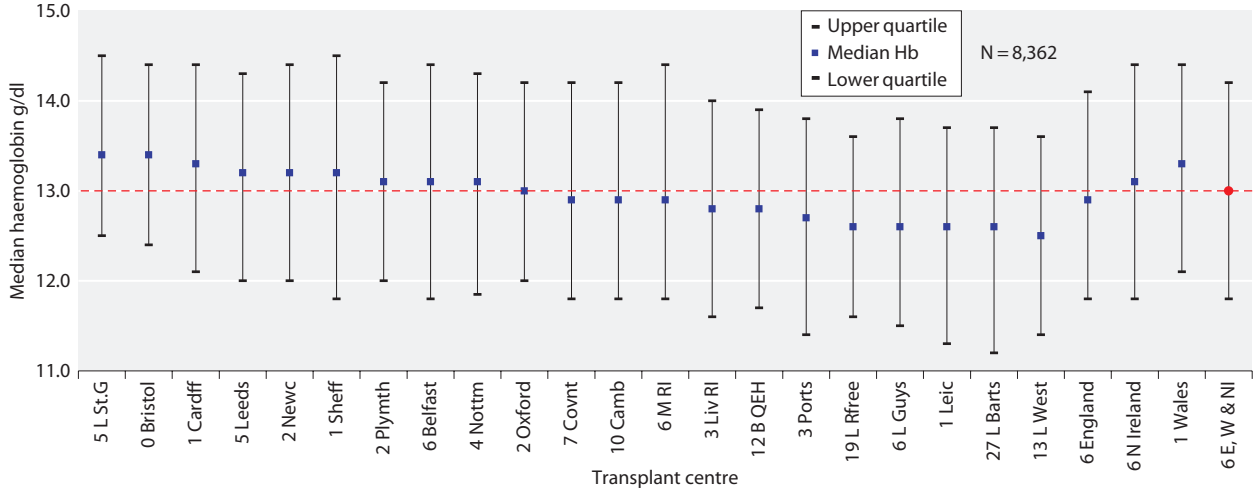

Fig. 3.13. Median haemoglobin one year post-transplant by transplant centre for patients transplanted between 2002–2008

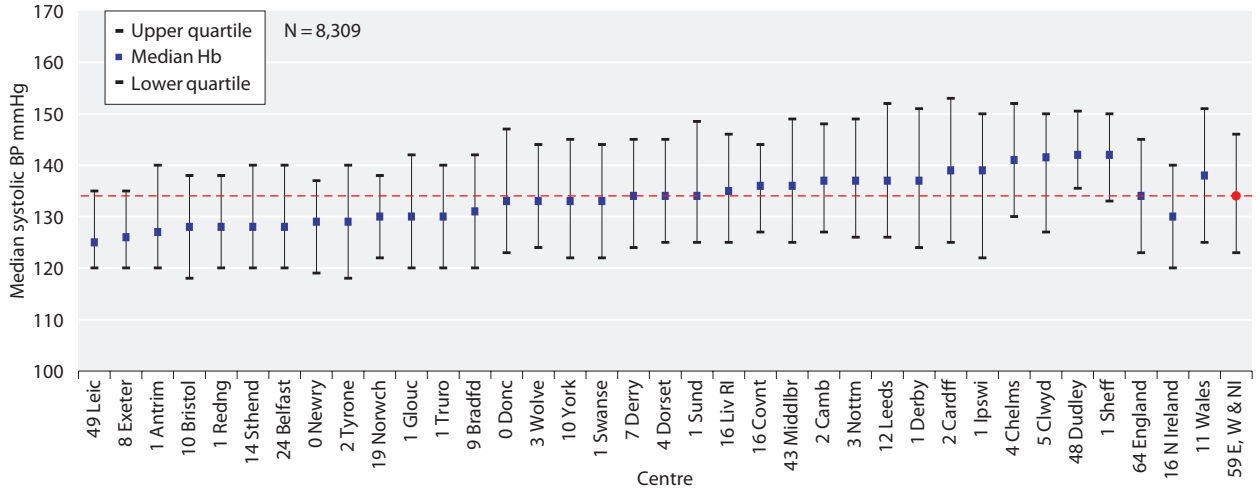

Fig. 3.14. Median systolic blood pressure for prevalent transplant patients by transplant centre on 31/12/2009

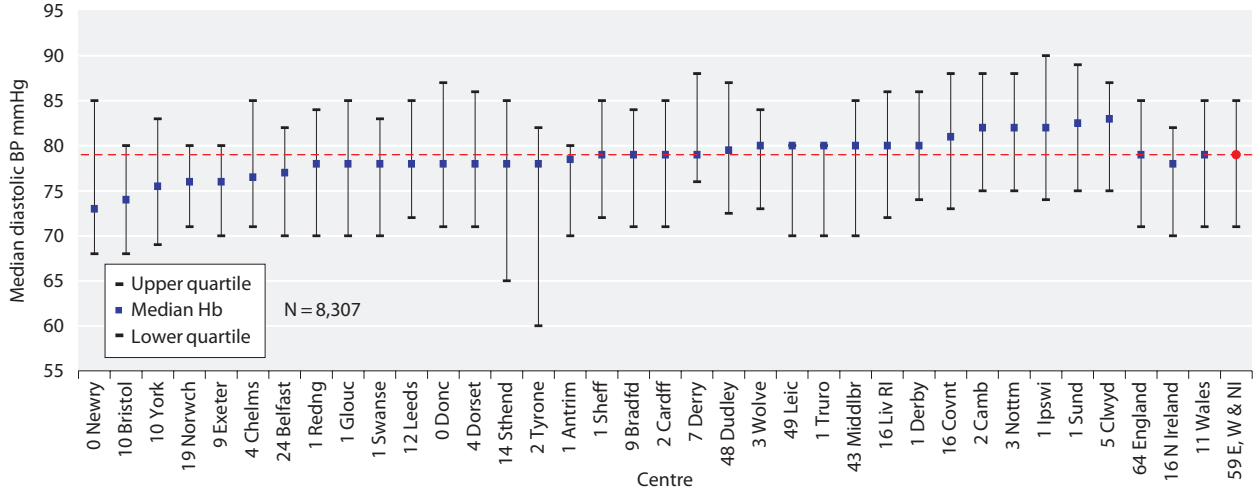

Fig. 3.15. Median diastolic blood pressure for prevalent transplant patients by transplant centre on 31/12/2009

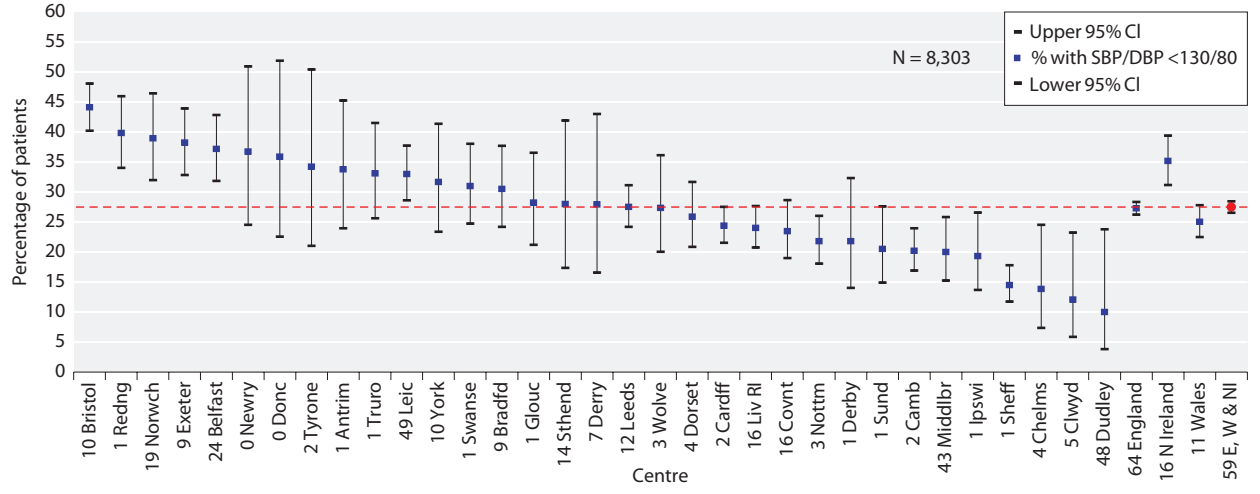

Fig. 3.16. Percentage of prevalent transplant patients achieving blood pressure target of <130/80 mmHg by centre on 31/12/2009

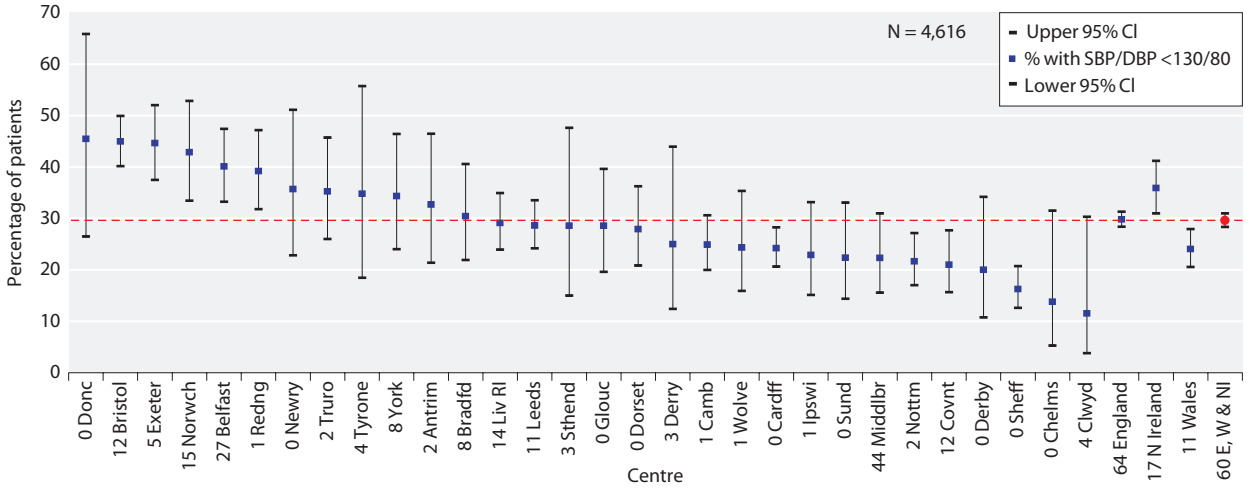

Fig. 3.17a. Percentage of prevalent transplant patients with eGFR $\geqslant$45 ml/min/1.73 m^2 achieving blood pressure of <130/80 mmHg by centre on 31/12/2009

(JBS 2), despite the fact that these calculations have not been validated in patients with renal disease. A total cholesterol of <4 mmol/l or a 25% reduction from baseline, or a fasting low density lipoprotein (LDL)-cholesterol of <2 mmol/l or a 30% reduction from baseline, should be achieved, whichever is the greatest reduction in all patients'. The updated guidelines 2010 [11] are less specific regarding the management of dyslipidaemia, and therefore the older guideline is used for this report. Audit against this standard is not currently possible using data returned to the UKRR, because such an audit would require categorisation of 10-year risk in each patient, data for which are not available. There is at present no consensus amongst UK clinicians that all transplant patients should be treated as though they have a 10-year risk of cardiovascular disease of >20%, although further guidelines on the medical management of transplant patients and on the management of cardiovascular disease in CKD are in preparation. However previous UKRR reports have contained analyses of total cholesterol, and these are repeated here for comparison.

The percentage of prevalent transplant recipients achieving a cholesterol concentration <5 mmol/L by centre and stratified according to eGFR ($\geqslant$ or <45 ml/min/1.73 m^2) and median cholesterol concentration one year after transplantation are described in figures

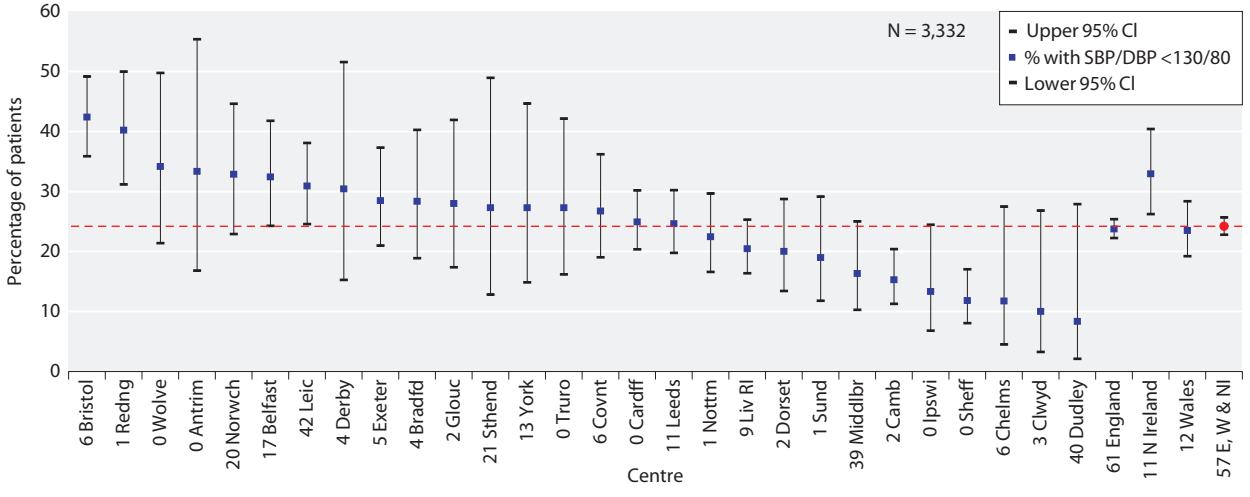

Fig. 3.17b. Percentage of prevalent transplant patients with eGFR <45 ml/min/1.73 m^2 achieving blood pressure of <130/80 mmHg by centre on 31/12/2009

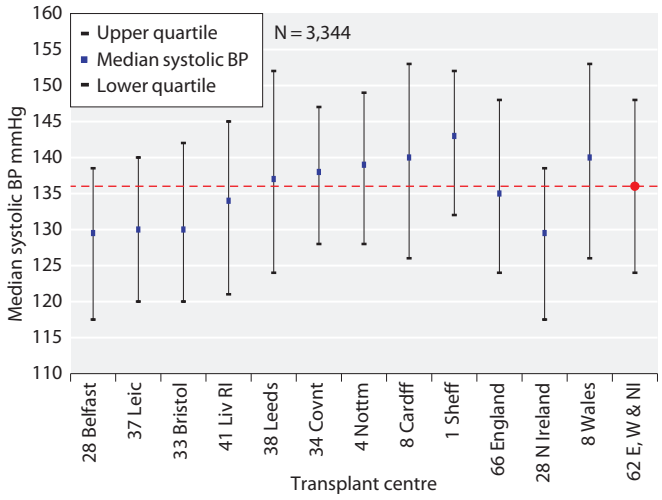

Fig. 3.18. Median systolic blood pressure one year post-transplant by transplant centre for patients transplanted between 2002–2008

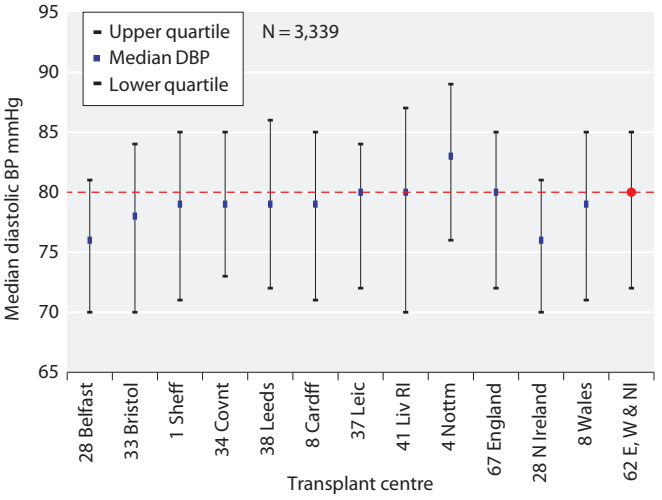

Fig. 3.19. Median diastolic blood pressure one year post-transplant by transplant centre for patients transplanted between 2002–2008

3.20a, 3.20b and 3.21 respectively. The median cholesterol concentration in the UK was 4.5 mmol/L. At the end of 2009, 69.9% of prevalent transplant patients had a total cholesterol concentration <5 mmol/L. The major between-centre differences in total cholesterol concentrations are likely to reflect the effects of significant differences in the clinical approach to the management of hypercholesterolaemia.

Bone mineral metabolism in transplant patients

In the absence of definitive literature concerning evaluation and management of bone mineral disorder in transplant recipients, guidelines derived from chronic native kidney disease are commonly adopted. It is beyond the scope of this commentary to discuss the appropriateness or otherwise of this strategy. Since there were no accepted guidelines on target biochemical values concerning bone disease in transplant patients in 2009 the CKD audit measures then extant have been applied.

Serum phosphate

The percentage of prevalent patients achieving a phosphate concentration <1.8 mmol/L are described in

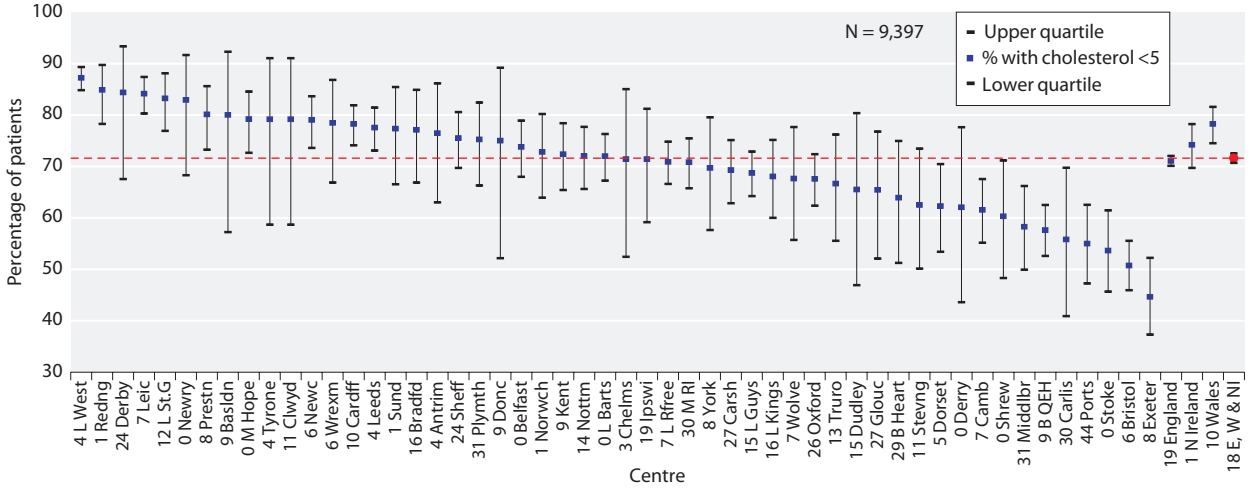

Fig. 3.20a. Percentage of prevalent transplant patients with eGFR ⩾45 ml/min/1.73 m^2 achieving total cholesterol <5 mmol/L by centre on 31/12/2009

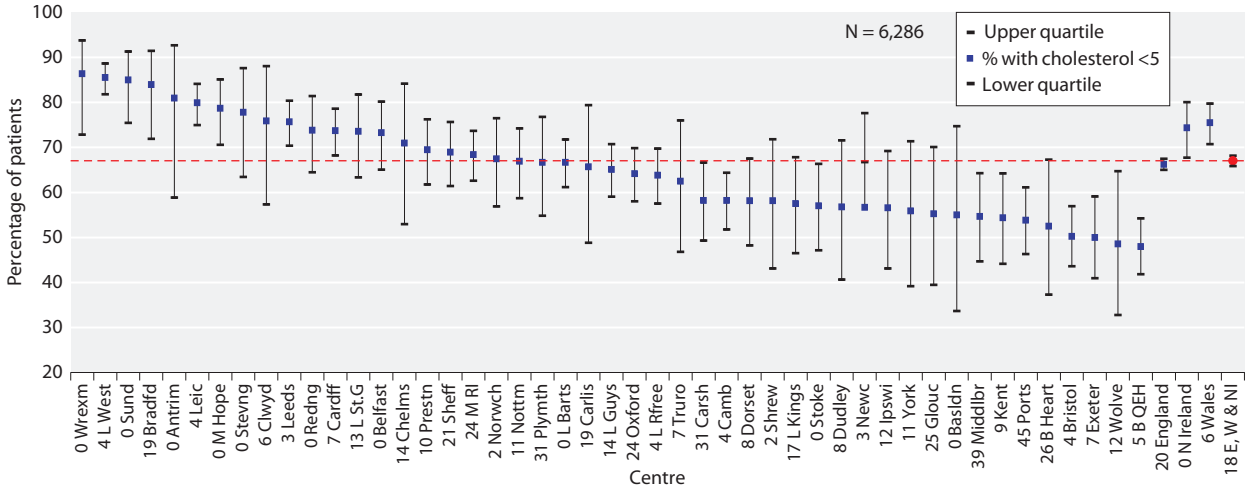

Fig. 3.20b. Percentage of prevalent transplant patients with eGFR <45 ml/min/1.73 m^2 achieving total cholesterol <5 mmol/L by centre on 31/12/2009

figure 3.22 with further stratification based on eGFR ($\geqslant$ or <45 ml/min/1.73 m^2) in figures 3.23a and 3.23b. With 99% of prevalent patients achieving a phosphate concentration <1.8 mmol/L and achievement ranging from 95%–100%, this is probably not a useful clinical performance indicator.

Figure 3.24 describes median phosphate concentrations one year after transplantation. One year post-transplant, 34.4% of kidney recipients have phosphate concentrations in the range of 1.1–1.8 mmol/L. This low percentage mainly reflects patients having serum phosphate concentrations <1.1 mmol/L because of post-transplant phosphate losses.

Serum calcium

The percentage of prevalent transplant patients with a serum calcium concentration within the target range of 2.2–2.6 mmol/L are shown in figure 3.25 with further stratification based on eGFR ($\geqslant$ or <45 ml/min/1.73 m^2) in figures 3.26a and 3.26b.

In contrast to the phosphate results, there is wide inter-centre variation in achievement of in-range serum calcium concentrations (60.9% to 92.5%), with both transplanting and non-transplanting renal centres at either end of the performance spectrum. This spread is not explained by differences in graft function as estimated by eGFR. Further work to understand the

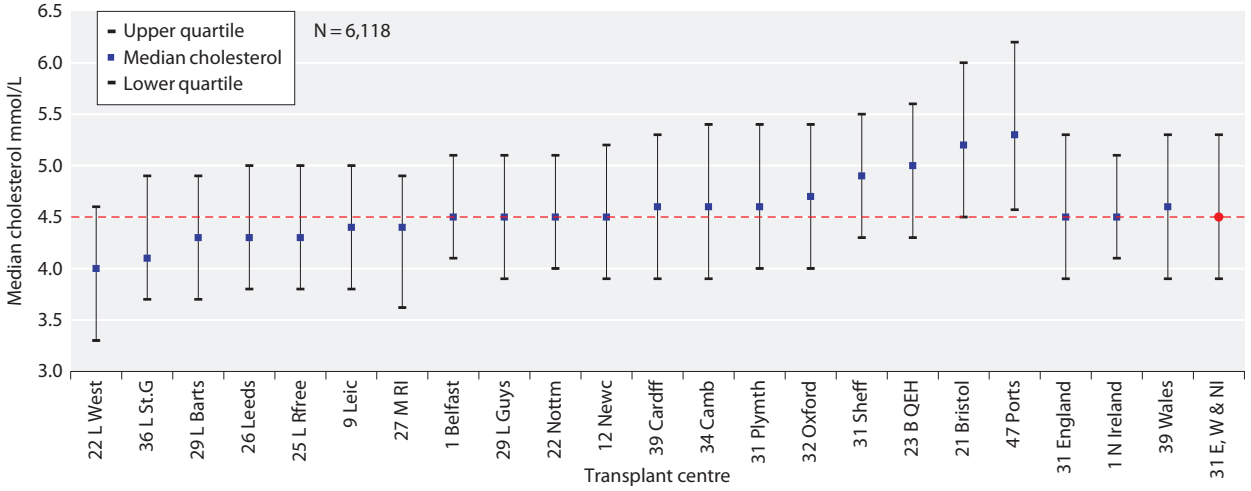

Fig. 3.21. Median total cholesterol one year post-transplant by transplant centre for patients transplanted between 2002–2008

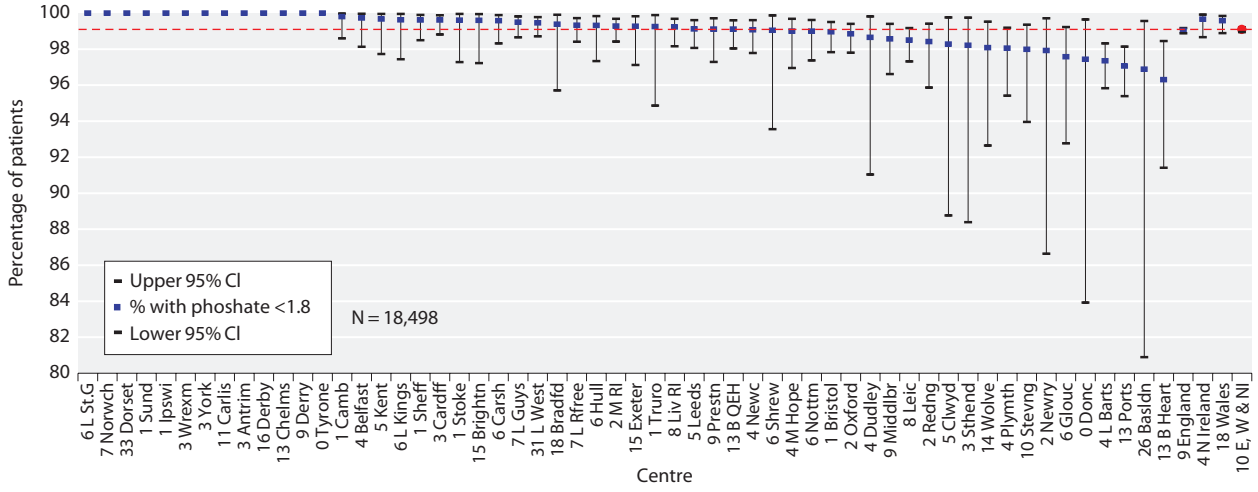

Fig. 3.22. Percentage of prevalent transplant patients with serum phosphate <1.8 mmol/L by centre on 31/12/2009

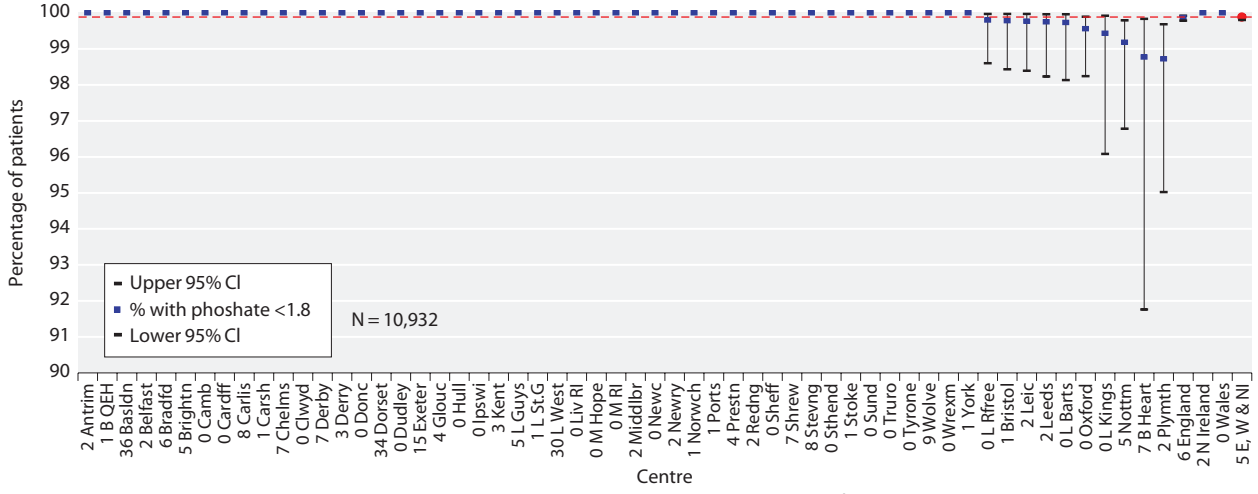

Fig. 3.23a. Percentage of prevalent transplant patients with eGFR ⩾45 ml/min/1.73 m^2 achieving serum phosphate <1.8 mmol/L by centre on the 31/12/2009

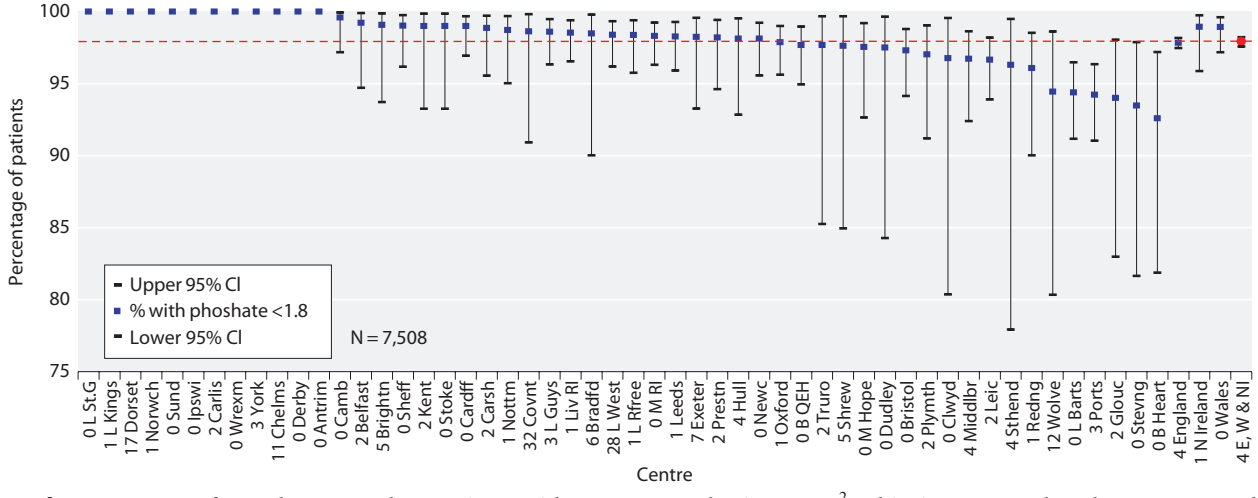

Fig. 3.23b. Percentage of prevalent transplant patients with eGFR <45 ml/min/1.73 m^2 achieving serum phosphate <1.8 mmol/L by centre on the 31/12/2009

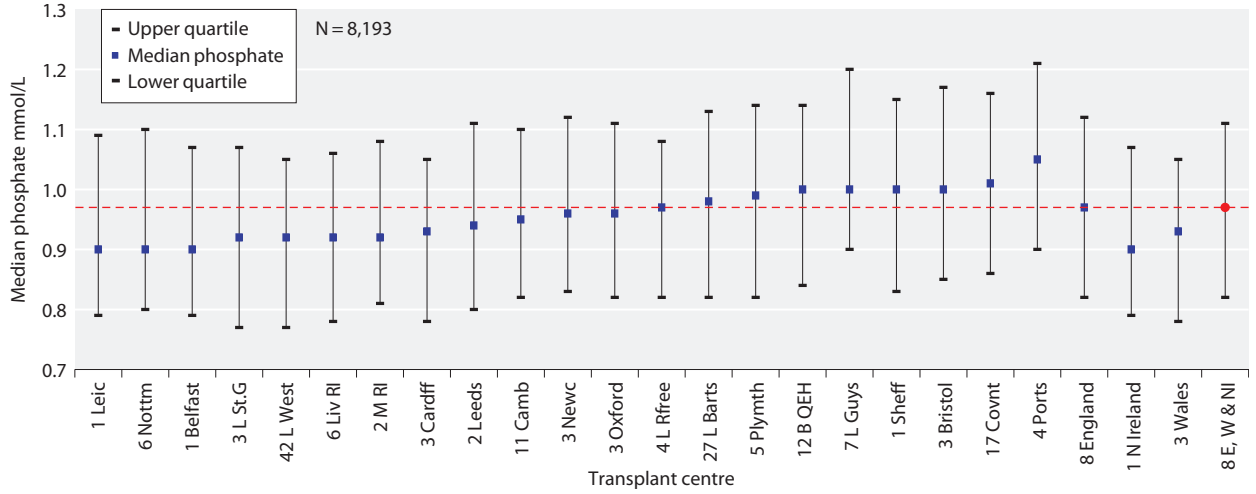

Fig. 3.24. Median serum phosphate one year post-transplant by centre for patients transplanted 2002–2008

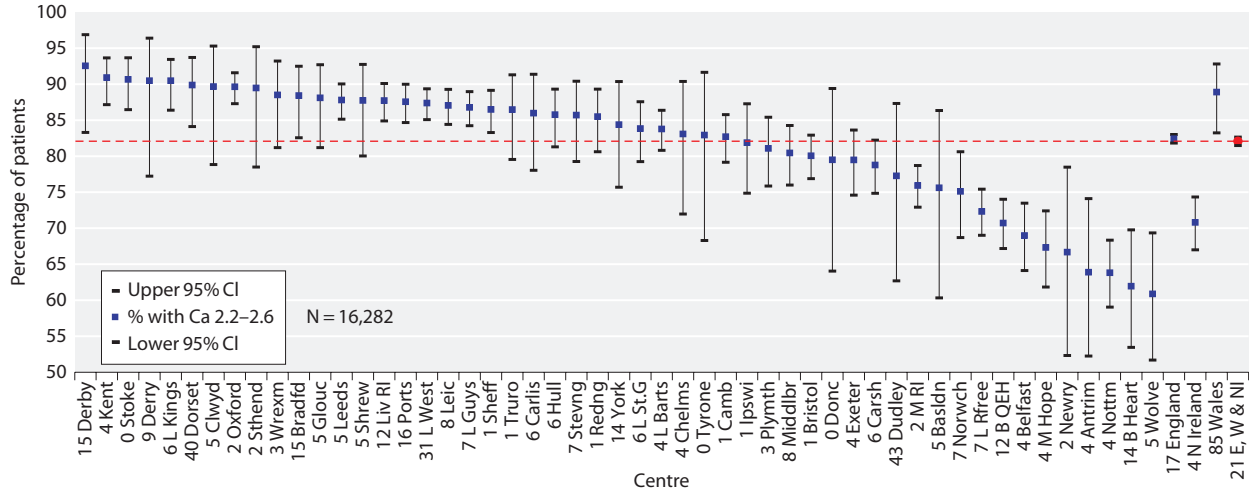

Fig. 3.25. Percentage of prevalent transplant patients with adjusted serum calcium between 2.2–2.6 mmol/L by centre on 31/12/2009

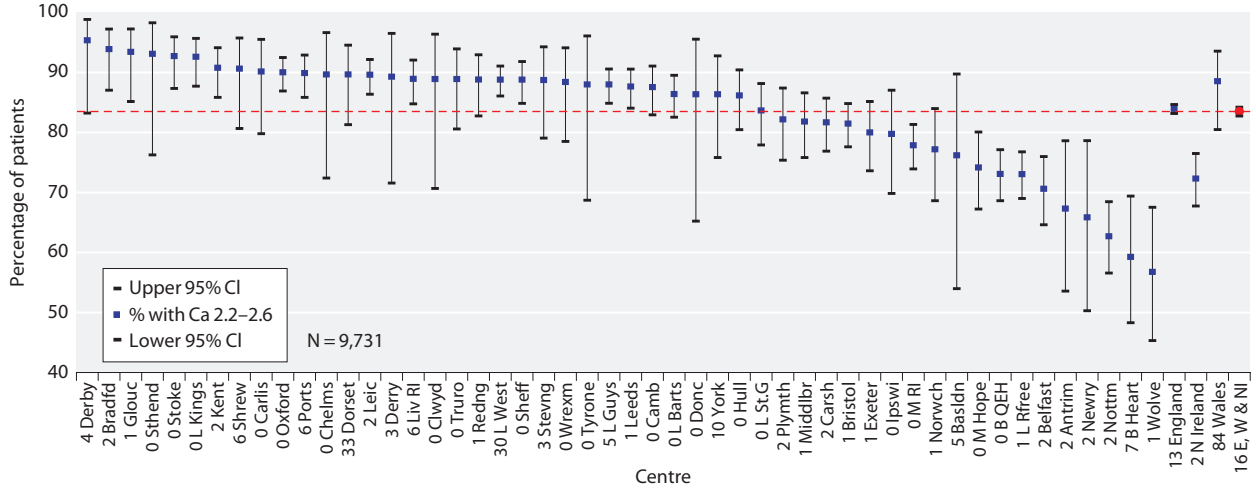

Fig. 3.26a. Percentage of prevalent transplant patients with eGFR $\geqslant$45 ml/min/1.73 m^2 with adjusted serum calcium between 2.2–2.6 mmol/L by centre on 31/12/2009

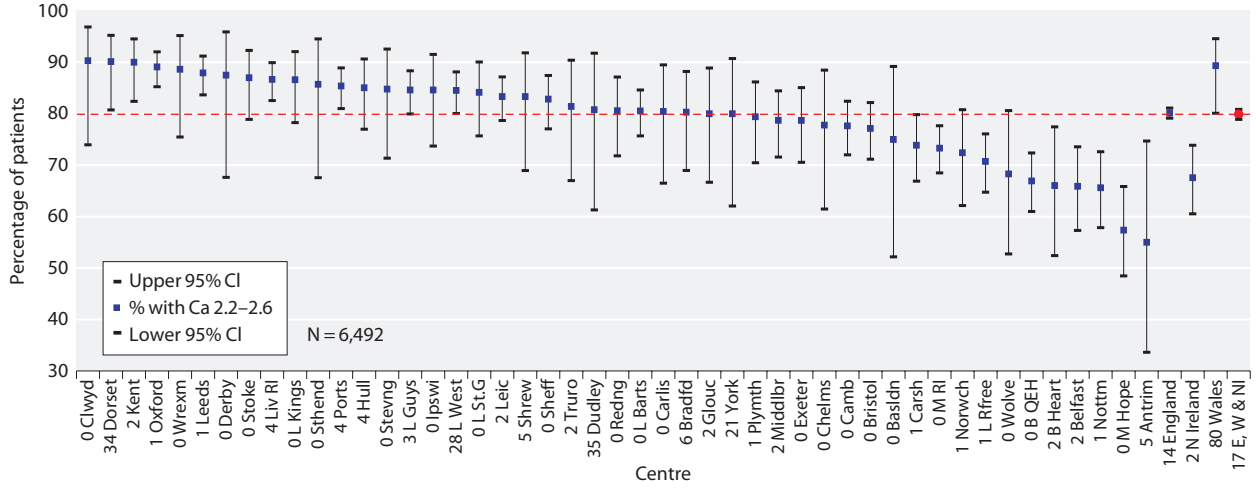

Fig. 3.26b. Percentage of prevalent transplant patients with eGFR <45 ml/min/1.73 m^2 with adjusted serum calcium between 2.2–2.6 mmol/L by centre on 31/12/2009

differences in laboratory measurement practices and albumin correction equations behind these variations is necessary.

Figure 3.27 demonstrates median serum calcium one year post-transplant.

Serum parathyroid hormone concentration

There are no definitive guidelines on the frequency with which serum PTH should be measured in stable transplant recipients. Consequently, there was very wide variability in data completeness across the UK and therefore centre specific outcomes for this biochemical variable have not been analysed.

Analysis of prevalent patients by CKD stage

Introduction

About 3% of prevalent transplant patients returned to dialysis in 2009, a similar percentage to that seen over the last 8 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

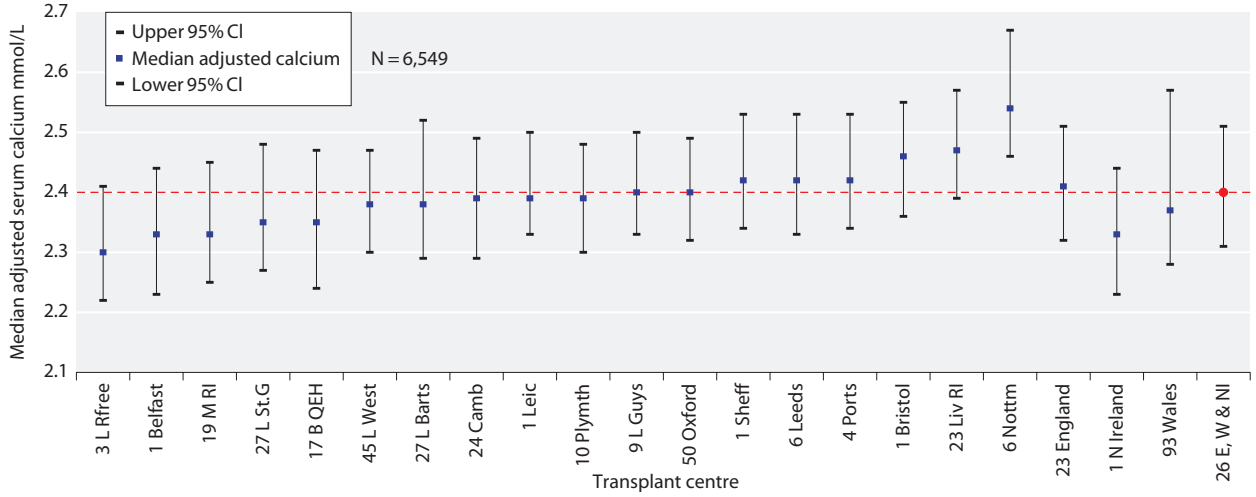

Fig. 3.27. Median adjusted serum calcium in patients one year post-transplant for patients transplanted 2002–2008

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 2009 (n = 19,379) 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 2009, comprised the comparison dialysis cohort (n = 18,280) including 2,438 peritoneal dialysis patients. For both cohorts, the analysis used the most recent available value from the last two quarters of the 2009 laboratory data.

Results and discussion

Table 3.12 shows that 14.3% of the prevalent transplant population, or about 2,750 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 achieve UK Renal Association standards for key biochemical and clinical outcome variables less often than dialysis patients. This substantial group of patients represents a considerable challenge, as resources

Table 3.12. Analysis by CKD stage for prevalent transplant patients compared with prevalent dialysis patients on 21/12/2009

	Stage 1–2T (⩾60)	Stage 3T (30–59)	Stage 4T (15–29)	Stage 5T (<15)	Stage 5D
Number of patients	6,068	10,558	2,394	359	18,280
% of patients	31.3	54.5	12.4	1.9	
eGFR ml/min/1.73 m^2 [a]					
mean ± SD	75.6 ± 14.7	45.5 ± 8.3	23.9 ± 4.1	11.8 ± 2.4	
Median	71.6	45.7	24.3	12.3	
Systolic BP mmHg					
mean ± SD	133.5 ± 16.4	135.8 ± 17.7	138.9 ± 19.0	144.5 ± 20.0	131.2 ± 25.1
% ⩾130	59.3	62.9	68.4	83.0	49.8
Diastolic BP mmHg					
mean ± SD	77.8 ± 10.0	78.4 ± 11.0	78.7 ± 11.4	81.8 ± 12.5	70.0 ± 14.6
% ⩾80	48.0	49.2	53.1	58.5	24.4
Cholesterol mmol/L					
mean ± SD	4.5 ± 1.0	4.6 ± 1.1	4.7 ± 1.2	4.7 ± 1.2	4.0 ± 1.1
% ⩾5	27.6	31.1	34.6	37.5	16.6
Haemoglobin g/dl					
mean ± SD	13.5 ± 1.6	12.7 ± 1.6	11.6 ± 1.5	11.1 ± 1.5	11.5 ± 1.5
% <10.5	2.8	7.3	19.8	33.3	21.5
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	0.1	0.3	2.3	22.4	27.5
Corrected calcium mmol/L					
mean ± SD	2.4 ± 0.2	2.4 ± 0.2	2.4 ± 0.2	2.3 ± 0.2	2.4 ± 0.2
% >2.6	7.8	8.2	5.9	7.7	7.4
% <2.2	8.9	9.3	16.9	25.8	18.4
PTH pmol/L					
median	8.3	10.0	15.2	26.6	26.3
% ⩾32	2.7	5.1	17.9	41.9	42.1

[a] Prevalent transplant patients with no ethnicity data were classed as White
[b] Only PD patients included in stage 5D, n = 2,438

need to be channelled to improve key outcome variables and 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 due to selection for transplantation and use of immunosuppression. Chapter 6 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.

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 1st December 2009.

Results and discussion

Causes of death in prevalent RRT patients in 2009 by modality and age

Tables 3.13, 3.14 and figure 3.28 show the differences in the causes of death between prevalent dialysis and transplant patients. These data were not adjusted for age or differences in comorbidity between the two groups. Death due to cardiovascular disease is less common in transplanted patients than in dialysis

Table 3.13. Cause of death by modality in prevalent RRT patients on 1/1/2009

	All modalities		Dialysis		Transplant	
Cause of death	Number of deaths	%	Number of deaths	%	Number of deaths	%
Cardiac disease	381	23	341	24	40	18
Cerebrovascular disease	76	5	68	5	8	4
Infection	339	21	279	19	60	28
Malignancy	150	9	101	7	49	23
Treatment withdrawal	208	13	207	14	1	0.5
Other	150	9	127	9	23	11
Uncertain	348	21	312	22	36	17
Total	**1,652**		**1,435**		**217**	
No cause of death data	2,352		1,965		387	

Table 3.14. Cause of death in prevalent transplant patients on 1/1/2009 by age

	All age groups		<55 years		⩾55 years	
Cause of death	Number of deaths	%	Number of deaths	%	Number of deaths	%
Cardiac disease	40	18	10	16.4	30	19
Cerebrovascular disease	8	4	3	5	5	3
Infection	60	28	19	31	41	26
Malignancy	49	23	10	16	39	25
Treatment withdrawal	1	0.5	0	0.0	1	1
Other	23	11	9	15	14	9
Uncertain	36	17	10	16	26	17
Total	**217**		**61**		**156**	
No cause of death data	387		106		281	

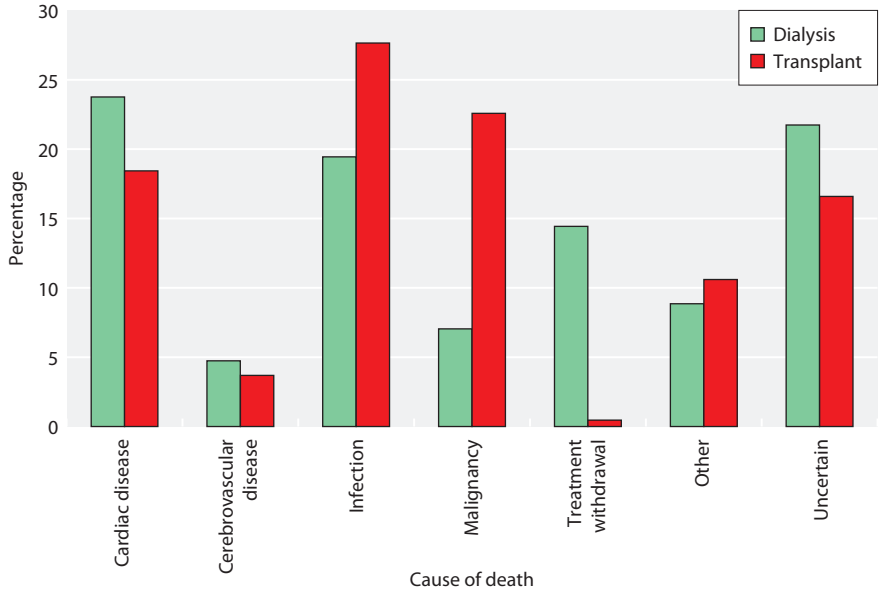

Fig. 3.28. Cause of death by modality for prevalent patients on 1/1/2009

patients, perhaps reflecting the cardiovascular screening undertaken as transplant work-up; transplant recipients are a pre-selected lower risk group of patients. Infection is the commonest reported cause of death in transplant recipients (28%) and presumably relates to the immunocompromised state of these individuals. In keeping with current literature regarding post-transplantation malignancy [12], cancer is also a frequent cause of death within the transplant population (23% of all deaths); this is also likely to reflect long-term immunosuppressive therapy.

In table 3.14 there are differences in the percentage of patients dying due to cardiac disease, infection and malignancy between patients aged <55 or $\geqslant 55$ years; this most likely reflects the small number of patients dying in the <55 age group.

Conflicts of interest: none

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