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UK Renal Registry 18th Annual Report: Chapter 3 Demographic and Biochemistry Profile of Kidney Transplant Recipients in the UK in 2014: National and Centre-specific Analyses

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Key Words

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

Summary

- There was a 2% fall in overall renal transplant numbers in 2014, with a significant fall in kidney donation from donors after circulatory death (10%).
- In 2014, death-censored renal transplant failure rates in prevalent patients were similar to previous years at 2.4% per annum. Transplant patient death rates remained stable at 2.3 per 100 patient years.
- The median age of incident and prevalent renal transplant patients in the UK was 50.6 and 53.3 years respectively.
- The median eGFR of prevalent renal transplant recipients was 52.5 ml/min/1.73 m^2.
- The median eGFR of patients one year after transplantation was 57.4 ml/min/1.73 m^2 post live transplant, 53.6 ml/min/1.73 m^2 post brainstem death transplant and 50.1 ml/min/1.73 m^2 post circulatory death transplant.
- In 2014, 13% of prevalent transplant patients had eGFR $<$30 ml/min/1.73 m^2.
- The median decline in eGFR slope beyond the first year after transplantation was −0.48 ml/min/1.73 m^2/year.
- In 2014, malignancy (26%) and infection (24%) remained the commonest causes of death in patients with a functioning renal transplant.

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Introduction

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

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

The UKRR 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 2014.

A list of the recommended audit measures from the Renal Association which are relevant to the transplant population are given in appendix 1 of this chapter. Several of the audit measures are not currently reported by the UKRR in the annual report; the reasons behind this are varied, but predominantly relate to a high proportion of incomplete data or that the relevant variable is not currently within the specified UKRR dataset. Over time it is hoped to work with the renal community to improve reporting across the range of recommended standards.

Transplant activity, waiting list activity and survival data

Introduction

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

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

Methods

In 2014, there were 23 UK adult renal transplant centres, 19 in England, two in Scotland and one each in Northern Ireland and Wales.

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

Results

During 2014, 3,200 kidney or kidney plus other organ transplants were performed. The absolute number of living kidney donors showed little change in 2014 representing 34.3% of all transplants performed whilst donor after brainstem death transplants continued to increase and comprised 37.7% of all kidney transplants performed. A 10% fall in the number of transplants from donors after circulatory death was also noted in 2014 (table 3.1).

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

Using data from the UKRR on prevalent renal transplant patients on 1st January 2014, the death rate during 2014 was 2.3 per 100 patient years (CI 2.1–2.5) when censored for return to dialysis and 2.4 per 100 patient years (CI 2.2–2.6) without censoring for dialysis. These death rates are similar to those observed over the last few years and have not shown any impact of the increasing age of the transplanted cohort.

Table 3.1. UK kidney and kidney plus other organ transplant numbers in the UK (including paediatric), 1/1/2012–31/12/2014

Organ	2012	2013	2014	% change 2013–2014
Donor after brainstem death[a]	967	1,160	1,205	4
Donor after circulatory death[b]	708	794	713	−10
Living donor kidney	1,034	1,104	1,097	−1
Kidney and liver[c]	17	11	12	9
Kidney and heart	3	1	1	0
Kidney and pancreas[d]	172	190	171	−10
Kidney and lung	0	0	1	
Small bowel (inc kidney)	0	1	0	
Total kidney transplants	**2,901**	**3,261**	**3,200**	**−2**

[a]Includes en bloc kidney transplants (4 in 2012, 4 in 2013, 3 in 2014) and double kidney transplants (7 in 2012, 18 in 2013, 22 in 2014)
[b]Includes en bloc kidney transplants (4 in 2012, 6 in 2013, 4 in 2014) and double kidney transplants (52 in 2012, 53 in 2013, 51 in 2014)
[c]Includes DCD transplants (2 in 2013)
[d]Includes DCD transplants (35 in 2012, 36 in 2013, 47 in 2014)

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

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

Cohorts for survival rate estimation: 1 year survival: 1/4/2009 – 31/03/2013; 5 year survival: 1/4/2004 – 31/03/2009; 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
*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.odt.nhs.uk/pdf/organ_specific_report_kidney_2014.pdf)

During 2014, 2.4% of prevalent transplant patients experienced graft failure (excluding death as a cause of graft failure) maintaining the fall in graft failure rates noted over the last couple of years. Whilst it might be premature to assume that graft failure rates are falling in the UK the 0.5% fall noted in the last five years is certainly encouraging.

Conclusions

In 2014, there was a 2% fall in overall renal transplant numbers, with a significant fall in kidney donation from donors after circulatory death (10%). The graft failure rate of 2.4% per annum and patient death rate of 2.3 per 100 patient years were similar to those noted in 2013.

Transplant demographics

Introduction

Since 2008, all UK renal centres have established electronic linkage to the UKRR or Scottish Renal Registry, giving the UKRR complete coverage of individual patient level data across the UK.

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 usually attributed to the referring centre (see appendix B2 for allocation procedure). This process may result in some discrepancies in transplant numbers particularly in Oxford/Reading and Clywd/Liverpool Royal.

Methods

As Colchester did not have any transplant patients they were excluded from some of the analyses, though their dialysis patients were included in the relevant dialysis population denominators.

For the analysis of primary renal diagnosis (PRD) in transplant recipients, a few centres were excluded from some of the take-on years because of concerns relating to the reliability of PRD coding (with these centres submitting a high percentage of uncertain or missing aetiology codes).

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 2014. The prevalence of transplant patients in areas covered by individual Clinical Commissioning Groups (CCG) or Health Board/Social Care Areas (HB) was estimated based on the postcode of the registered address for patients on renal replacement therapy (RRT). Data on ethnic origin, supplied as Patient Administration System (PAS) codes, were retrieved from fields within renal centre IT systems. For the purpose of this analysis, patients were grouped into Whites, South Asians, Blacks, Others and Unknown. The details of ethnicity regrouping into the above categories are provided in appendix H: Coding https://www.renalreg.org/publications-reports/.

Results and Conclusions

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

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

Table 3.3. The prevalence per million population (pmp) of renal transplants in adults in the UK on 31/12/2014, by country

	England	N Ireland	Scotland	Wales	UK
Number of prevalent transplant patients	26,108	912	2,610	1,534	31,164
Total population, mid-2014 estimates from ONS* (millions)	54.3	1.8	5.3	3.1	64.6
Prevalence pmp transplant	481	496	488	496	482

*Office of National Statistics, UK

Table 3.4 Prevalence per million population of patients with a renal transplant and age/gender standardised rate ratio in the UK, as on 31st December 2010–2014, by CCG/HB

CCG/HB – CCG in England, Health and Social Care Areas in Northern Ireland, Local Health Boards in Wales and Health Boards in Scotland
O/E – age and gender standardised transplant prevalence rate ratio
LCL – lower 95% confidence limit
UCL – upper 95% confidence limit
pmp – per million population
CCG/HBs with significantly high average rate ratios are bold in greyed areas
CCG/HBs with significantly low average rate ratios are italicised in greyed areas
Mid-2013 population data from the Office for National Statistics, National Records of Scotland and the Northern Ireland Statistics and Research Agency – based on the 2011 census
% non-White – percentage of the CCG/HB population that is non-White, from 2011 Census

UK area	CCG/HB	Total population	Crude rate pmp					Age and gender standardised rate ratio 2014			% non-White
			2010	2011	2012	2013	2014	O/E	95% LCL	95% UCL	
Cheshire, Warrington and Wirral	NHS Eastern Cheshire	195,500	358	389	414	445	465	0.88	0.72	1.08	3.7
	NHS South Cheshire	177,200	389	389	401	446	502	0.98	0.80	1.21	2.9
	NHS Vale Royal	*102,000*	*274*	*284*	*314*	*363*	*372*	*0.72*	*0.53*	*0.99*	*2.1*
	NHS Warrington	205,100	361	380	405	463	483	0.96	0.79	1.17	4.1
	NHS West Cheshire	229,000	384	406	428	463	493	0.97	0.80	1.16	2.8
	NHS Wirral	*320,300*	*343*	*350*	*347*	*362*	*368*	*0.73*	*0.61*	*0.88*	*3.0*
Durham, Darlington and Tees	NHS Darlington	105,400	332	389	398	446	493	0.99	0.76	1.30	3.8
	NHS Durham Dales, Easington and Sedgefield	272,900	410	451	462	506	550	1.06	0.90	1.25	1.2
	NHS Hartlepool and Stockton-on-Tees	285,900	430	413	437	469	497	1.01	0.86	1.19	4.4
	NHS North Durham	243,100	399	395	411	424	432	0.86	0.71	1.04	2.5
	NHS South Tees	**273,900**	**526**	**566**	**577**	**577**	**595**	**1.23**	**1.05**	**1.43**	**6.7**
Greater Manchester	**NHS Bolton**	**280,100**	**453**	**500**	**532**	**546**	**575**	**1.21**	**1.03**	**1.41**	**18.1**
	NHS Bury	186,500	391	407	440	445	493	1.01	0.82	1.23	10.8
	NHS Central Manchester	**182,200**	**329**	**351**	**368**	**428**	**466**	**1.26**	**1.02**	**1.56**	**48.0**
	NHS Heywood, Middleton & Rochdale	212,100	401	438	462	490	467	0.98	0.81	1.20	18.3
	NHS North Manchester	170,700	270	305	340	375	404	0.98	0.78	1.25	30.8
	NHS Oldham	227,300	383	400	409	466	462	1.00	0.83	1.21	22.5
	NHS Salford	239,000	339	360	410	414	443	0.97	0.80	1.17	9.9
	NHS South Manchester	161,500	235	279	316	340	378	0.89	0.69	1.14	19.6
	NHS Stockport	285,000	403	414	432	460	467	0.93	0.78	1.10	7.9
	NHS Tameside and Glossop	253,700	410	449	457	477	512	1.03	0.87	1.22	8.2
	NHS Trafford	230,200	326	348	378	404	456	0.94	0.78	1.14	14.5
	NHS Wigan Borough	319,700	394	460	491	544	557	1.10	0.95	1.27	2.7
Lancashire	NHS Blackburn with Darwen	147,400	332	380	407	455	495	1.09	0.87	1.37	30.8
	NHS Blackpool	141,400	347	347	403	481	523	1.04	0.83	1.30	3.3
	NHS Chorley and South Ribble	169,500	354	407	407	448	472	0.93	0.74	1.15	2.9
	NHS East Lancashire	372,300	408	440	446	475	491	0.99	0.86	1.15	11.9
	NHS Fylde & Wyre	165,800	332	344	386	416	422	0.79	0.63	1.00	2.1
	NHS Greater Preston	201,700	317	327	372	392	421	0.88	0.72	1.09	14.7
	NHS Lancashire North	*159,500*	*326*	*332*	*332*	*345*	*364*	*0.75*	*0.58*	*0.97*	*4.0*
	NHS West Lancashire	111,300	341	359	386	386	395	0.78	0.58	1.05	1.9
Merseyside	NHS Halton	126,000	389	413	452	460	500	1.01	0.79	1.29	2.2
	NHS Knowsley	146,100	383	376	397	418	424	0.88	0.68	1.12	2.8
	NHS Liverpool	470,800	346	374	391	416	444	0.96	0.84	1.10	11.1
	NHS South Sefton	158,900	359	378	422	453	459	0.90	0.72	1.14	2.2
	NHS Southport and Formby	*114,300*	*306*	*315*	*289*	*350*	*359*	*0.69*	*0.51*	*0.94*	*3.1*
	NHS St Helens	176,200	335	358	363	409	465	0.91	0.74	1.14	2.0

Table 3.4 Continued

UK area	CCG/HB	Total population	Crude rate pmp					Age and gender standardised rate ratio 2014			% non-White
			2010	2011	2012	2013	2014	O/E	95% LCL	95% UCL	
Cumbria, Northumberland, Tyne and Wear	NHS Cumbria	504,100	391	399	423	450	472	0.89	0.78	1.01	1.5
	NHS Gateshead	200,000	385	420	440	435	440	0.88	0.71	1.08	3.7
	NHS Newcastle North and East	143,900	424	466	438	452	486	1.14	0.90	1.44	10.7
	NHS Newcastle West	142,900	308	322	336	357	364	0.81	0.62	1.06	18.3
	NHS North Tyneside	202,200	564	579	579	579	549	1.08	0.90	1.30	3.4
	NHS Northumberland	315,800	383	427	437	475	494	0.92	0.79	1.08	1.6
	NHS South Tyneside	148,500	471	505	512	559	518	1.02	0.82	1.28	4.1
	NHS Sunderland	276,100	431	467	493	514	522	1.04	0.88	1.22	4.1
North Yorkshire and Humber	NHS East Riding of Yorkshire	314,600	388	404	426	490	493	0.92	0.78	1.07	1.9
	NHS Hambleton, Richmondshire and Whitby	153,600	286	319	332	371	449	0.85	0.67	1.08	2.7
	NHS Harrogate and Rural District	158,200	461	468	524	531	562	1.09	0.88	1.34	3.7
	NHS Hull	257,600	373	392	419	458	478	1.03	0.87	1.23	5.9
	NHS North East Lincolnshire	159,800	369	419	444	463	457	0.93	0.74	1.17	2.6
	NHS North Lincolnshire	*168,800*	*273*	*290*	*290*	*314*	*356*	*0.70*	*0.54*	*0.90*	*4.0*
	NHS Scarborough and Ryedale	110,100	436	463	445	427	463	0.88	0.67	1.16	2.5
	NHS Vale of York	349,100	401	427	481	516	544	1.10	0.95	1.26	4.0
South Yorkshire and Bassetlaw	NHS Barnsley	235,800	399	403	411	433	475	0.94	0.78	1.13	2.1
	NHS Bassetlaw	*113,700*	*308*	*308*	*317*	*326*	*387*	*0.74*	*0.55*	*0.99*	*2.6*
	NHS Doncaster	303,600	343	379	402	405	448	0.90	0.76	1.07	4.7
	NHS Rotherham	258,700	394	429	452	487	541	1.08	0.91	1.27	6.4
	NHS Sheffield	560,100	355	380	393	416	429	0.95	0.83	1.07	16.3
West Yorkshire	NHS Airedale, Wharfedale and Craven	158,500	454	435	448	473	492	0.97	0.78	1.22	11.1
	NHS Bradford City	**82,700**	**387**	**399**	**483**	**544**	**556**	**1.58**	**1.18**	**2.11**	**72.2**
	NHS Bradford Districts	**334,600**	**457**	**469**	**520**	**562**	**583**	**1.29**	**1.12**	**1.49**	**28.7**
	NHS Calderdale	206,400	470	504	538	533	514	1.03	0.85	1.24	10.3
	NHS Greater Huddersfield	240,400	399	433	462	474	507	1.04	0.87	1.24	17.4
	NHS Leeds North	199,900	380	420	435	445	490	1.00	0.82	1.22	17.4
	NHS Leeds South and East	241,000	382	402	419	465	469	1.05	0.87	1.26	18.3
	NHS Leeds West	320,500	318	340	390	427	468	1.07	0.91	1.25	10.8
	NHS North Kirklees	**187,900**	**474**	**495**	**500**	**580**	**649**	**1.39**	**1.17**	**1.66**	**25.3**
	NHS Wakefield	*329,700*	*334*	*349*	*370*	*388*	*403*	*0.80*	*0.67*	*0.94*	*4.6*
Arden, Herefordshire and Worcestershire	NHS Coventry and Rugby	431,200	387	410	431	448	499	1.11	0.97	1.26	22.2
	NHS Herefordshire	*186,100*	*285*	*301*	*333*	*339*	*365*	*0.70*	*0.55*	*0.88*	*1.8*
	NHS Redditch and Bromsgrove	179,300	351	357	390	402	435	0.86	0.69	1.07	6.0
	NHS South Warwickshire	259,200	405	409	463	482	494	0.97	0.81	1.15	7.0
	NHS South Worcestershire	*294,500*	*323*	*336*	*346*	*374*	*391*	*0.76*	*0.63*	*0.91*	*3.7*
	NHS Warwickshire North	188,100	409	452	447	457	457	0.90	0.73	1.11	6.5
	NHS Wyre Forest	98,400	356	356	376	406	386	0.73	0.53	1.01	2.8
Birmingham and the Black Country	NHS Birmingham CrossCity	725,400	358	378	403	425	458	1.07	0.96	1.19	35.2
	NHS Birmingham South and Central	201,200	368	358	353	418	482	1.17	0.96	1.43	40.4
	NHS Dudley	*314,400*	*299*	*302*	*283*	*318*	*337*	*0.68*	*0.56*	*0.82*	*10.0*
	NHS Sandwell and West Birmingham	480,100	354	362	385	444	452	1.05	0.92	1.20	45.3
	NHS Solihull	*208,900*	*297*	*316*	*335*	*345*	*373*	*0.75*	*0.60*	*0.93*	*10.9*
	NHS Walsall	272,200	378	408	430	474	511	1.09	0.92	1.28	21.1
	NHS Wolverhampton	251,600	302	294	314	382	409	0.88	0.73	1.07	32.0

Table 3.4 Continued

UK area	CCG/HB	Total population	Crude rate pmp					Age and gender standardised rate ratio 2014			% non-White
			2010	2011	2012	2013	2014	O/E	95% LCL	95% UCL	
Derbyshire and Nottingham-shire	NHS Erewash	94,900	284	284	295	400	432	0.86	0.64	1.17	3.2
	NHS Hardwick	*109,300*	*284*	*275*	*275*	*265*	*320*	*0.62*	*0.44*	*0.86*	*1.8*
	NHS Mansfield & Ashfield	193,900	356	402	454	474	505	1.00	0.82	1.22	2.5
	NHS Newark & Sherwood	117,000	453	462	513	564	607	1.17	0.93	1.48	2.4
	NHS North Derbyshire	*272,200*	*331*	*356*	*401*	*401*	*408*	*0.77*	*0.64*	*0.92*	*2.5*
	NHS Nottingham City	310,800	306	322	344	380	396	0.96	0.80	1.15	28.5
	NHS Nottingham North & East	147,600	345	386	413	440	400	0.79	0.61	1.01	6.2
	NHS Nottingham West	111,200	458	476	485	548	584	1.14	0.90	1.46	7.3
	NHS Rushcliffe	112,800	328	372	390	443	417	0.82	0.61	1.08	6.9
	NHS Southern Derbyshire	518,200	355	390	413	442	463	0.95	0.83	1.07	11.0
East Anglia	NHS Cambridgeshire and Peterborough	855,000	371	396	408	433	457	0.95	0.86	1.04	9.5
	NHS Great Yarmouth & Waveney	213,800	299	313	337	430	477	0.93	0.77	1.13	2.7
	NHS Ipswich and East Suffolk	396,100	336	369	371	429	444	0.88	0.76	1.01	5.6
	NHS North Norfolk	168,500	368	404	374	499	481	0.88	0.71	1.09	1.5
	NHS Norwich	195,000	277	303	297	390	410	0.88	0.71	1.10	7.3
	NHS South Norfolk	237,400	383	362	383	476	489	0.95	0.79	1.14	2.6
	NHS West Norfolk	171,500	332	338	379	397	432	0.83	0.66	1.04	2.6
	NHS West Suffolk	223,800	362	371	407	411	416	0.84	0.68	1.02	4.6
Essex	NHS Basildon and Brentwood	252,800	364	384	388	475	475	0.98	0.82	1.17	7.1
	NHS Castle Point, Rayleigh and Rochford	172,500	359	359	371	417	493	0.94	0.76	1.16	3.0
	NHS Mid Essex	381,500	388	427	417	472	480	0.94	0.82	1.09	4.4
	NHS North East Essex	316,300	345	379	395	433	490	0.99	0.84	1.15	5.5
	NHS Southend	175,800	341	358	404	461	495	1.02	0.82	1.25	8.4
	NHS Thurrock	160,800	323	361	373	379	404	0.87	0.68	1.11	14.1
	NHS West Essex	293,200	361	368	406	419	454	0.92	0.77	1.09	8.2
Hertfordshire and the South Midlands	NHS Bedfordshire	425,900	404	413	470	488	528	1.07	0.94	1.21	11.2
	NHS Corby	64,200	327	358	327	327	343	0.72	0.48	1.10	4.5
	NHS East and North Hertfordshire	546,300	357	372	403	428	458	0.95	0.84	1.08	10.4
	NHS Herts Valleys	575,800	384	406	419	448	485	1.01	0.90	1.13	14.6
	NHS Luton	**208,000**	**380**	**433**	**471**	**524**	**596**	**1.40**	**1.17**	**1.67**	**45.3**
	NHS Milton Keynes	261,400	375	413	444	448	509	1.09	0.92	1.29	19.6
	NHS Nene	626,600	393	409	402	429	474	0.96	0.86	1.07	9.1
Leicestershire and Lincolnshire	NHS East Leicestershire and Rutland	321,900	373	391	410	432	481	0.94	0.80	1.10	9.8
	NHS Leicester City	**333,800**	**503**	**536**	**560**	**617**	**677**	**1.60**	**1.41**	**1.83**	**49.5**
	NHS Lincolnshire East	229,400	366	370	392	423	445	0.83	0.68	1.00	2.0
	NHS Lincolnshire West	229,600	327	344	357	396	422	0.85	0.70	1.04	3.0
	NHS South Lincolnshire	*142,600*	*281*	*281*	*309*	*309*	*365*	*0.70*	*0.53*	*0.92*	*2.3*
	NHS South West Lincolnshire	*122,800*	*252*	*309*	*334*	*358*	*374*	*0.72*	*0.54*	*0.96*	*2.3*
	NHS West Leicestershire	377,300	419	445	461	482	501	1.00	0.86	1.15	6.9
Shropshire and Staffordshire	*NHS Cannock Chase*	*133,600*	*337*	*329*	*329*	*359*	*367*	*0.72*	*0.54*	*0.95*	*2.4*
	NHS East Staffordshire	*124,600*	*233*	*257*	*249*	*329*	*329*	*0.66*	*0.48*	*0.89*	*9.0*
	NHS North Staffordshire	214,400	354	382	410	443	443	0.86	0.70	1.05	3.5
	NHS Shropshire	*308,600*	*347*	*360*	*344*	*356*	*369*	*0.70*	*0.59*	*0.84*	*2.0*
	NHS South East Staffs and Seisdon and Peninsular	224,500	401	392	379	423	450	0.86	0.71	1.05	3.6
	NHS Stafford and Surrounds	151,700	316	343	363	402	435	0.83	0.65	1.05	4.7
	NHS Stoke on Trent	258,400	410	406	433	433	460	0.96	0.81	1.15	11.0
	NHS Telford & Wrekin	*168,500*	*285*	*291*	*285*	*332*	*332*	*0.69*	*0.53*	*0.89*	*7.3*

Table 3.4 Continued

UK area	CCG/HB	Total population	Crude rate pmp					Age and gender standardised rate ratio 2014			% non-White
			2010	2011	2012	2013	2014	O/E	95% LCL	95% UCL	
London	NHS Barking & Dagenham	194,400	329	391	386	453	484	1.20	0.98	1.47	41.7
	NHS Barnet	**369,100**	**463**	**515**	**580**	**607**	**615**	**1.37**	**1.20**	**1.56**	**35.9**
	NHS Camden	229,700	392	440	466	470	474	1.07	0.89	1.30	33.7
	NHS City and Hackney	265,000	328	328	343	392	441	1.07	0.89	1.28	44.6
	NHS Enfield	**320,500**	**484**	**543**	**596**	**618**	**671**	**1.51**	**1.33**	**1.73**	**39.0**
	NHS Haringey	**263,400**	**421**	**459**	**501**	**528**	**581**	**1.32**	**1.13**	**1.55**	**39.5**
	NHS Havering	*242,100*	*310*	*326*	*339*	*392*	*384*	*0.80*	*0.65*	*0.98*	*12.3*
	NHS Islington	**215,700**	**459**	**496**	**538**	**566**	**603**	**1.39**	**1.17**	**1.65**	**31.8**
	NHS Newham	**318,200**	**305**	**317**	**368**	**431**	**497**	**1.26**	**1.08**	**1.47**	**71.0**
	NHS Redbridge	**288,300**	**413**	**437**	**496**	**524**	**590**	**1.35**	**1.16**	**1.57**	**57.5**
	NHS Tower Hamlets	272,900	264	268	304	326	381	1.00	0.82	1.21	54.8
	NHS Waltham Forest	**265,800**	**406**	**433**	**433**	**470**	**542**	**1.25**	**1.06**	**1.47**	**47.8**
	NHS Brent	**317,300**	**574**	**589**	**640**	**712**	**744**	**1.67**	**1.47**	**1.90**	**63.7**
	NHS Central London (Westminster)	162,700	449	455	473	498	559	1.17	0.95	1.43	36.2
	NHS Ealing	**342,500**	**569**	**593**	**625**	**642**	**707**	**1.57**	**1.39**	**1.78**	**51.0**
	NHS Hammersmith and Fulham	178,700	431	420	437	470	492	1.11	0.90	1.37	31.9
	NHS Harrow	**243,400**	**703**	**703**	**723**	**731**	**801**	**1.73**	**1.50**	**1.99**	**57.8**
	NHS Hillingdon	**286,800**	**502**	**554**	**586**	**593**	**655**	**1.47**	**1.27**	**1.69**	**39.4**
	NHS Hounslow	**262,400**	**492**	**507**	**522**	**591**	**644**	**1.44**	**1.24**	**1.67**	**48.6**
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	219,800	469	464	460	482	519	1.09	0.90	1.31	33.4
	NHS Bexley	**236,700**	**499**	**511**	**524**	**566**	**579**	**1.23**	**1.04**	**1.46**	**18.1**
	NHS Bromley	317,900	475	475	503	525	547	1.13	0.97	1.31	15.7
	NHS Croydon	372,800	338	365	378	416	443	0.97	0.83	1.13	44.9
	NHS Greenwich	**264,000**	**348**	**383**	**420**	**458**	**542**	**1.25**	**1.06**	**1.47**	**37.5**
	NHS Kingston	166,800	390	402	438	456	492	1.08	0.87	1.34	25.5
	NHS Lambeth	314,200	309	350	395	442	484	1.12	0.96	1.32	42.9
	NHS Lewisham	286,200	370	381	391	468	510	1.16	0.99	1.37	46.5
	NHS Merton	**203,200**	**403**	**433**	**472**	**536**	**566**	**1.24**	**1.03**	**1.49**	**35.1**
	NHS Richmond	191,400	308	334	361	392	418	0.86	0.69	1.07	14.0
	NHS Southwark	**298,500**	**469**	**499**	**546**	**593**	**637**	**1.47**	**1.28**	**1.70**	**45.8**
	NHS Sutton	195,900	434	449	485	495	500	1.05	0.86	1.28	21.4
	NHS Wandsworth	310,500	328	364	386	415	454	1.05	0.89	1.24	28.6
Bath, Gloucestershire, Swindon and Wiltshire	NHS Bath and North East Somerset	180,100	283	283	289	361	400	0.84	0.67	1.06	5.4
	NHS Gloucestershire	*605,700*	*352*	*383*	*378*	*421*	*424*	*0.83*	*0.74*	*0.94*	*4.6*
	NHS Swindon	219,300	410	438	447	483	520	1.07	0.89	1.29	10.0
	NHS Wiltshire	*479,600*	*352*	*379*	*398*	*402*	*434*	*0.86*	*0.75*	*0.98*	*3.4*
Bristol, North Somerset, Somerset and South Gloucestershire	**NHS Bristol**	**437,500**	**464**	**471**	**494**	**530**	**549**	**1.26**	**1.11**	**1.42**	**16.0**
	NHS North Somerset	206,100	461	471	505	534	534	1.04	0.86	1.25	2.7
	NHS Somerset	*538,100*	*379*	*411*	*414*	*435*	*452*	*0.87*	*0.77*	*0.99*	*2.0*
	NHS South Gloucestershire	269,100	453	468	476	502	502	1.01	0.86	1.20	5.0

Table 3.4 Continued

UK area	CCG/HB	Total population	Crude rate pmp					Age and gender standardised rate ratio 2014			% non-White
			2010	2011	2012	2013	2014	O/E	95% LCL	95% UCL	
Devon, Cornwall and Isles of Scilly	NHS Kernow	543,600	456	482	521	548	570	1.09	0.97	1.22	1.8
	NHS North, East, West Devon	874,300	424	431	455	491	503	1.00	0.91	1.10	3.0
	NHS South Devon and Torbay	275,000	469	487	495	553	596	1.12	0.97	1.31	2.1
Kent and Medway	NHS Ashford	121,700	460	485	534	534	575	1.18	0.93	1.49	6.3
	NHS Canterbury and Coastal	202,400	400	425	494	504	553	1.16	0.97	1.40	5.9
	NHS Dartford, Gravesham and Swanley	251,900	476	465	484	512	548	1.14	0.96	1.34	13.0
	NHS Medway	271,100	406	409	432	468	480	1.01	0.85	1.20	10.4
	NHS South Kent Coast	203,600	344	368	388	417	467	0.91	0.74	1.11	4.5
	NHS Swale	109,600	420	520	547	611	620	1.26	1.00	1.60	3.8
	NHS Thanet	**136,800**	**409**	**461**	**541**	**592**	**629**	**1.27**	**1.03**	**1.57**	**4.5**
	NHS West Kent	*467,500*	*347*	*361*	*385*	*409*	*430*	*0.87*	*0.75*	*0.99*	*4.9*
Surrey and Sussex	NHS Brighton & Hove	278,100	349	356	363	370	388	0.84	0.70	1.02	10.9
	NHS Coastal West Sussex	480,200	394	423	421	456	479	0.93	0.82	1.06	3.8
	NHS Crawley	*109,000*	*257*	*284*	*294*	*294*	*321*	*0.70*	*0.50*	*0.98*	*20.1*
	NHS East Surrey	*177,900*	*326*	*337*	*343*	*377*	*365*	*0.74*	*0.58*	*0.94*	*8.3*
	NHS Eastbourne, Hailsham and Seaford	*183,500*	*316*	*327*	*338*	*360*	*371*	*0.73*	*0.58*	*0.93*	*4.4*
	NHS Guildford and Waverley	*207,800*	*284*	*270*	*308*	*322*	*337*	*0.70*	*0.55*	*0.88*	*7.2*
	NHS Hastings & Rother	*181,800*	*325*	*352*	*347*	*369*	*396*	*0.77*	*0.61*	*0.97*	*4.6*
	NHS High Weald Lewes Havens	169,100	331	337	396	402	426	0.81	0.64	1.02	3.1
	NHS Horsham and Mid Sussex	*225,300*	*324*	*324*	*328*	*355*	*408*	*0.81*	*0.66*	*0.99*	*4.9*
	NHS North West Surrey	340,200	420	429	453	476	494	1.00	0.86	1.17	12.5
	NHS Surrey Downs	284,700	393	397	400	432	453	0.90	0.75	1.07	9.1
	NHS Surrey Heath	94,400	477	508	540	508	466	0.92	0.68	1.24	9.3
Thames Valley	NHS Aylesbury Vale	199,500	491	521	541	562	577	1.15	0.96	1.38	9.7
	NHS Bracknell and Ascot	134,400	417	454	476	499	499	1.03	0.81	1.31	9.5
	NHS Chiltern	319,400	426	423	470	498	498	1.01	0.86	1.18	15.8
	NHS Newbury and District	105,700	501	568	568	577	568	1.13	0.88	1.46	4.4
	NHS North & West Reading	99,900	410	410	440	500	490	0.98	0.74	1.30	10.4
	NHS Oxfordshire	652,300	423	437	469	483	520	1.09	0.98	1.21	9.3
	NHS Slough	**143,000**	**601**	**608**	**636**	**762**	**811**	**1.91**	**1.60**	**2.30**	**54.3**
	NHS South Reading	**109,000**	**495**	**504**	**495**	**532**	**587**	**1.42**	**1.11**	**1.82**	**30.5**
	NHS Windsor, Ascot and Maidenhead	139,900	408	436	508	558	593	1.23	0.99	1.53	14.7
	NHS Wokingham	157,900	405	418	443	450	481	0.96	0.77	1.21	11.6
Wessex	*NHS Dorset*	*754,500*	*404*	*412*	*410*	*419*	*441*	*0.87*	*0.78*	*0.96*	*4.0*
	NHS Fareham and Gosport	197,100	396	411	406	467	487	0.96	0.79	1.17	3.4
	NHS Isle of Wight	*138,400*	*354*	*361*	*376*	*354*	*354*	*0.67*	*0.50*	*0.88*	*2.7*
	NHS North East Hampshire and Farnham	207,500	366	366	385	414	453	0.93	0.76	1.14	9.7
	NHS North Hampshire	*217,800*	*331*	*358*	*372*	*386*	*404*	*0.81*	*0.66*	*0.99*	*6.4*
	NHS Portsmouth	207,500	371	371	386	410	410	0.92	0.75	1.14	11.6
	NHS South Eastern Hampshire	209,900	414	405	434	448	510	1.00	0.82	1.20	3.1
	NHS Southampton	242,100	326	372	405	446	483	1.12	0.93	1.34	14.1
	NHS West Hampshire	*548,000*	*398*	*411*	*422*	*438*	*445*	*0.87*	*0.77*	*0.98*	*3.9*
Wales	*Betsi Cadwaladr University*	*692,000*	*361*	*361*	*355*	*341*	*358*	*0.70*	*0.62*	*0.80*	*2.5*
	Powys Teaching	*132,700*	*414*	*407*	*354*	*377*	*384*	*0.72*	*0.54*	*0.94*	*1.6*
	Hywel Dda	383,900	401	430	425	487	492	0.96	0.83	1.11	2.2
	Abertawe Bro Morgannwg University	**520,700**	**490**	**545**	**574**	**601**	**613**	**1.23**	**1.11**	**1.38**	**3.9**
	Cwm Taf	**295,100**	**630**	**664**	**688**	**742**	**732**	**1.49**	**1.30**	**1.70**	**2.6**
	Aneurin Bevan	**579,100**	**499**	**521**	**582**	**597**	**604**	**1.21**	**1.09**	**1.35**	**3.9**
	Cardiff and Vale University	478,900	441	466	497	510	505	1.11	0.98	1.26	12.2

Table 3.4 Continued

UK area	CCG/HB	Total population	Crude rate pmp 2010	2011	2012	2013	2014	Age and gender standardised rate ratio 2014 O/E	95% LCL	95% UCL	% non-White
Scotland	Ayrshire and Arran	372,200	395	387	414	435	465	0.89	0.76	1.03	1.2
	Borders	113,900	465	465	527	544	553	1.02	0.79	1.30	1.3
	Dumfries and Galloway	150,300	366	399	393	393	439	0.81	0.64	1.03	1.2
	Fife	*366,900*	*333*	*360*	*376*	*409*	*422*	*0.83*	*0.71*	*0.97*	*2.4*
	Forth Valley	299,700	317	344	370	397	444	0.87	0.73	1.03	2.2
	Grampian	579,200	373	387	406	439	447	0.89	0.79	1.01	4.0
	Greater Glasgow and Clyde	**1,137,900**	**424**	**439**	**485**	**522**	**549**	**1.12**	**1.04**	**1.21**	**7.3**
	Highland	321,000	483	480	483	505	530	0.99	0.85	1.15	1.3
	Lanarkshire	652,600	408	428	461	481	527	1.04	0.93	1.15	2.0
	Lothian	*849,700*	*347*	*364*	*374*	*385*	*410*	*0.84*	*0.76*	*0.94*	*5.6*
	Orkney	21,600	371	371	371	371	278	0.51	0.23	1.14	0.7
	Shetland	23,200	259	216	259	259	259	0.50	0.22	1.11	1.5
	Tayside	412,200	405	417	425	446	459	0.91	0.79	1.05	3.2
	Western Isles	27,400	255	292	292	292	292	0.54	0.27	1.07	0.9
Northern Ireland	Belfast	349,600	383	395	429	458	509	1.12	0.97	1.29	3.2
	Northern	466,700	358	373	384	414	456	0.95	0.83	1.09	1.2
	Southern	365,700	306	345	388	418	468	1.02	0.88	1.19	1.2
	South Eastern	350,800	359	388	393	419	465	0.95	0.82	1.11	1.3
	Western	296,900	347	354	360	438	522	1.12	0.95	1.31	1.0

Table 3.5. Distribution of prevalent patients on RRT by centre and modality on 31/12/2014

Centre	*N*	% HD	% PD	% transplant
Transplant centres				
B QEH	2,137	45	7	49
Belfast	750	27	2	71
Bristol	1,460	36	5	59
Camb	1,243	30	2	68
Cardff	1,593	31	5	64
Covnt	962	41	9	50
Edinb	758	37	3	60
Glasgw	1,641	36	3	61
L Barts	2,236	43	10	47
L Guys	1,924	34	2	64
L Rfree	2,010	35	7	57
L St.G	797	37	6	55
L West	3,244	44	2	54
Leeds	1,500	35	4	61
Leic	2,151	42	6	52
Liv Roy	1,312	28	5	67
M RI	1,815	29	4	67
Newc	983	29	5	66
Nottm	1,066	34	8	58
Oxford	1,658	28	5	67
Plymth	510	27	7	66
Ports	1,595	39	5	56
Sheff	1,360	43	5	53

Table 3.5. Continued

Centre	*N*	% HD	% PD	% transplant
Dialysis centres				
Abrdn	515	41	5	53
Airdrie	399	46	2	51
Antrim	229	54	6	41
B Heart	638	65	5	30
Bangor*	99	84	16	
Basldn	280	62	10	28
Bradfd	549	41	4	56
Brightn	916	47	7	46
Carlis	250	30	11	59
Carsh	1,565	51	9	41
Chelms	263	51	10	38
Clwyd	165	55	7	38
Colchr	119	100		
D & Gall	133	37	13	50
Derby	519	46	17	37
Donc	285	64	9	26
Dorset	665	42	8	51
Dudley	305	58	18	25
Dundee	414	43	6	51
Exeter	950	44	10	46
Glouc	429	49	10	41
Hull	804	41	10	49
Inverns	227	31	7	62
Ipswi	369	34	8	57
Kent	1,019	40	6	53
Klmarnk	306	46	12	42
Krkcldy	283	52	6	42
L Kings	1,025	53	9	38
Liv Ain	218	74	19	7
Middlbr	858	39	2	59
Newry	208	44	8	48
Norwch	691	47	5	48
Prestn	1,171	48	5	47
Redng	763	39	10	52
Salford	969	42	9	49
Shrew	349	55	9	36
Stevng	782	62	3	34
Sthend	238	49	8	43
Stoke	776	43	11	46
Sund	452	47	4	49
Swanse	704	47	8	45
Truro	380	39	6	55
Ulster	149	66	3	31
West NI	272	43	5	52
Wirral	246	83	9	7
Wolve	575	55	14	32
Wrexm	281	40	11	49
York	461	31	6	63
England	**49,842**	**41**	**6**	**52**
N Ireland	**1,608**	**39**	**4**	**57**
Scotland	**4,676**	**40**	**5**	**56**
Wales	**2,842**	**39**	**7**	**54**
UK	**58,968**	**41**	**6**	**53**

*Bangor was only able to report on a few transplant patients with the rest reported by Liverpool Royal. These have thus been reallocated to Liverpool Royal to maintain consistency with previous annual reports, for analyses shown in tables 3.3 and 3.5 only
Blank cells: no patients on that modality

Table 3.6. Median age and gender ratio of incident and prevalent transplant patients 2009–2014

	Incident transplants			Prevalent transplants*		
Year	*N*	Median age	M:F ratio	*N*	Median age	M:F ratio
2009	2,488	48.3	1.6	23,500	50.8	1.5
2010	2,584	49.6	1.7	24,889	51.2	1.6
2011	2,627	49.1	1.7	26,180	51.7	1.6
2012	2,781	50.4	1.6	27,541	52.3	1.6
2013	3,123	50.3	1.6	29,467	52.8	1.6
2014	3,020	50.6	1.5	31,164	53.3	1.5

*As on 31st December for given year

geographical differences in access to renal transplantation in the UK. This has previously been analysed in detail by the UKRR [2] and is currently the focus of a large national study (access to Transplant and Transplant Outcome Measures (ATTOM)).

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

Age and gender

The gender ratio amongst incident and prevalent transplant patients has remained stable for at least the last ten years (table 3.6, figure 3.1). Note, absolute patient numbers differ from those published in previous reports as a result of additional data validation and reallocation of patients. The average age of incident transplant patients has steadily increased during the same time period. There has also been a gradual increase in the average age of prevalent transplant patients, which could reflect the increasing age at which patients are transplanted and/or improved survival after renal transplantation over the last few years. The prevalent transplant patient workload across the UK increased to 31,164 patients at the end of 2014. The continued expansion of this patient group means there is a need for careful planning by renal centres for future service provision and resource allocation.

Primary renal diagnosis

The primary renal diagnosis of patients receiving kidney transplants in the UK has remained relatively stable over the last five years (table 3.7).

Ethnicity

It was difficult to compare the proportion of patients within each ethnic group receiving a transplant to those commencing dialysis from the same group because data on ethnicity were missing in a considerable number of patients who were classified as ethnicity 'unknown' (table 3.8). The percentages of patients with unknown ethnicity between 2009 and 2013 provided in this year's chapter are different from those in last year's chapter [3]; this reflects retrospective input of ethnicity data, improving data completeness.

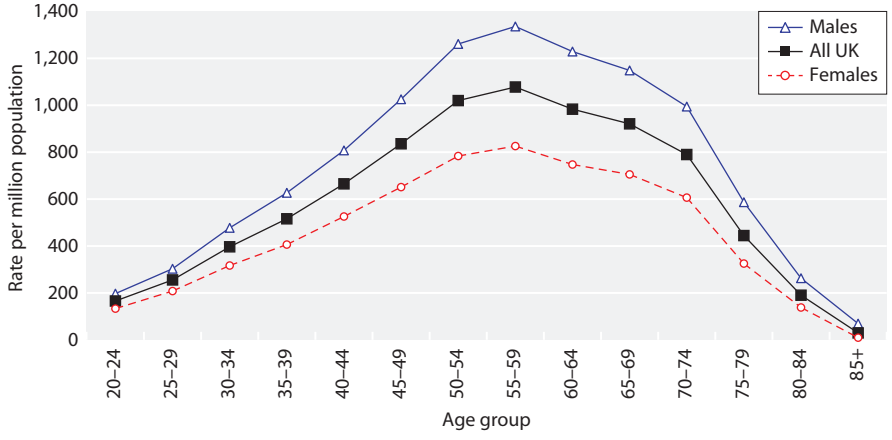

Fig. 3.1. Transplant prevalence rate per million population by age and gender on 31/12/2014

Table 3.7. Primary renal diagnosis in renal transplant recipients 2009–2014

	New transplants by year							Established transplants on 01/01/2014	
Primary renal diagnosis	2009 %	2010 %	2011 %	2012 %	2013 %	2014 %	2014 *N*	%	*N*
Aetiology uncertain	14.0	14.1	14.6	12.2	13.0	11.8	347	14.9	4,396
Diabetes	13.1	11.3	13.0	15.2	13.8	15.0	439	10.0	2,943
Glomerulonephritis	23.3	19.8	22.9	23.1	22.8	21.4	628	23.1	6,817
Polycystic kidney disease	13.2	13.5	12.3	13.5	13.8	13.7	402	13.1	3,860
Pyelonephritis	11.2	9.5	10.0	10.4	10.1	8.5	248	13.3	3,906
Reno-vascular disease	6.2	7.0	7.0	7.0	8.3	7.5	219	5.9	1,752
Other	15.9	16.0	17.0	17.0	15.1	17.1	502	17.5	5,145
Not available	3.1	8.8	3.2	1.7	3.2	4.9	145	2.2	648

Clinical and laboratory outcomes

Introduction

There continued to be marked variation in the completeness of data (tables 3.9a, 3.9b) reported by each renal centre, particularly for blood pressure. Better data records (or possibly better extraction of data held within renal IT systems) would facilitate more meaningful comparisons between centres and help to determine the causes of inter-centre differences in outcomes. For this reason, along with differences in repatriation policies of prevalent transplant patients between centres as highlighted previously, caution needs to be exercised when comparing centre performance.

The 71 renal centres in the UK comprise 52 centres in England, five in Wales, five in Northern Ireland and nine in Scotland. Colchester was reported as having no transplanted patients and was therefore excluded. After exclusion of this centre, prevalent patient data from 70 renal centres across the UK were analysed.

For the one year post-transplant analyses, in which patients were assigned to the centre that performed their transplant, all 23 transplant centres across the UK were included in the analysis.

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 2007–2013, with patients attributed to the transplant centre that performed the procedure.

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

Centres with <20 patients or <50% data completeness have been excluded from the figures. Scottish centres were also excluded from blood pressure analyses as data were not provided.

Prevalent patient data

Biochemical and clinical data for patients with a functioning transplant followed in either a transplanting or non-transplanting

Table 3.8. Ethnicity of patients who received a transplant in the years 2009–2014

Year	% White	% S Asian	% Black	% Other	% Unknown
2009	76.2	10.5	6.9	2.1	4.3
2010	76.8	10.6	6.0	2.1	4.4
2011	76.1	9.9	6.5	2.4	5.1
2012	73.3	9.9	7.4	2.9	6.5
2013	71.5	12.0	7.4	2.2	6.9
2014	68.6	12.7	7.3	2.9	8.4

Table 3.9a. Percentage completeness of ethnicity, eGFR and blood pressure by centre for prevalent transplant patients on 31/12/2014

Centre	*N*	Ethnicity[a]	eGFR	Blood pressure[b]
England				
B Heart	189	100	93	1
B QEH	1,008	100	94	93
Basldn	78	100	99	82
Bradfd	295	100	94	67
Brightn	407	99	96	0
Bristol	835	100	100	71
Camb	819	98	90	80
Carlis	144	100	95	0
Carsh	627	100	89	0
Chelms	98	99	96	92
Covnt	487	100	96	82
Derby	184	100	96	90
Donc	67	100	97	97
Dorset	320	100	88	74
Dudley	73	100	99	47
Exeter	430	100	98	92
Glouc	173	100	98	92
Hull	389	99	95	1
Ipswi	211	100	97	0
Kent	528	100	98	91
L Barts	995	100	98	0
L Guys	1,200	99	97	0
L Kings	385	100	98	99
L RFree	1,109	99	97	78
L St.G	417	95	97	91
L West	1,699	100	95	0
Leeds	884	100	98	97
Leic	1,077	98	97	39
Liv Ain	12	92	100	0
Liv Roy	861	99	89	1
M RI	1,163	99	96	0
Middlbr	492	100	92	40
Newc	627	100	99	0
Norwch	328	100	98	4
Nottm	598	100	98	84
Oxford	1,057	95	99	17
Plymth	317	100	96	89
Ports	876	99	95	11
Prestn	522	100	99	0
Redng	361	99	99	0
Salford	436	100	96	0
Sheff	695	100	99	97
Shrew	123	100	89	0
Stevng	263	100	98	25
Sthend	101	100	98	49
Stoke	349	100	99	1
Sund	217	100	98	1
Truro	207	100	100	1
Wirral	14	100	86	0
Wolve	182	100	96	73
York	278	99	95	37
N Ireland				
Antrim	93	100	99	97
Belfast	511	100	99	51
Newry	97	100	100	87
Ulster	44	100	100	95
West NI	123	100	100	95
Scotland				
Abrdn	268	59	96	n/a
Airdrie	200	62	73	n/a
D & Gall	66	29	94	n/a
Dundee	210	65	99	n/a
Edinb	445	26	97	n/a
Glasgw	989	24	71	n/a
Inverns	139	86	87	n/a
Klmarnk	125	73	61	n/a
Krkcldy	118	38	94	n/a
Wales				
Bangor	3	100	100	0
Cardff	995	100	99	98
Clwyd	60	100	88	62
Swanse	308	100	98	98
Wrexm	135	100	99	16
England	**25,228**	**99**	**96**	**38**
N Ireland	**868**	**100**	**99**	**68**
Scotland	**2,560**	**41**	**83**	**n/a**
Wales	**1,501**	**100**	**99**	**89**
UK	**30,157**	**94**	**95**	**42[c]**

[a]Patients with missing ethnicity were classed as White for eGFR calculation
[b]Scottish centres excluded from blood pressure analysis as data not provided by the Scottish Renal Registry
[c]Excluding Scotland

centre were included in the analyses. The cohort consisted of prevalent patients as on 31st December 2014. Patients were considered as having a functioning transplant if 'transplant' was listed as the last mode of RRT in the last quarter of 2014. 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 usually allocated to the non-transplant centre (see appendix B2). Patients with a functioning transplant of less than three months duration were excluded from analyses. For haemoglobin, estimated glomerular filtration rate (eGFR), corrected calcium, phosphate and blood pressure (BP), the latest value in quarter 3 or quarter 4 of 2014 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

Table 3.9b. Percentage completeness of haemoglobin, serum cholesterol, serum calcium, serum phosphate and serum PTH by centre for prevalent transplant patients on 31/12/2014

Centre	*N*	Haemoglobin	Total serum cholesterol	Adjusted serum calcium[b]	Serum phosphate	Serum PTH
England						
B Heart	189	92	67	91	90	22
B QEH	1,008	94	92	94	93	77
Basldn	78	99	46	97	87	38
Bradfd	295	93	71	82	57	28
Brightn	407	96	68	93	93	44
Bristol	835	100	95	99	99	99
Camb	819	89	85	90	89	84
Carlis	144	95	63	92	88	14
Carsh	627	89	58	89	89	41
Chelms	98	95	85	96	78	12
Covnt	487	95	1	94	71	46
Derby	184	95	93	95	94	89
Donc	67	97	54	97	97	52
Dorset	320	86	73	86	68	40
Dudley	73	99	92	99	99	75
Exeter	430	98	86	97	97	33
Glouc	173	98	58	97	97	26
Hull	389	95	26	92	92	25
Ipswi	211	95	49	97	97	48
Kent	528	97	80	96	96	19
L Barts	995	98	98	98	98	97
L Guys	1,200	0	61	95	95	43
L Kings	385	98	79	98	98	65
L RFree	1,109	96	76	96	96	83
L St.G	417	97	90	97	97	80
L West	1,699	95	39	95	95	35
Leeds	884	98	98	97	97	36
Leic	1,077	97	95	96	96	48
Liv Ain	12	100	83	100	100	67
Liv Roy	861	89	71	86	86	62
M RI	1,163	96	72	96	96	52
Middlbr	492	91	39	90	90	10
Newc	627	99	92	99	99	65
Norwch	328	97	98	95	95	21
Nottm	598	98	82	96	93	92
Oxford	1,057	98	71	98	98	39
Plymth	317	96	62	93	93	38
Ports	876	95	59	92	90	22
Prestn	522	99	66	98	97	62
Redng	382	99	81	99	87	51
Salford	436	96	89	96	95	56
Sheff	695	99	63	99	99	26
Shrew	123	89	75	82	82	2
Stevng	263	98	60	94	83	47
Sthend	101	98	54	97	94	16
Stoke	349	99	99	99	98	59
Sund	217	97	95	97	97	92
Truro	207	100	99	99	99	92
Wirral	14	86	93	86	86	71
Wolve	182	96	82	95	85	66
York	278	94	59	93	90	13

Table 3.9b. Continued

Centre	*N*	Haemoglobin	Total serum cholesterol	Adjusted serum calcium[b]	Serum phosphate	Serum PTH
N Ireland						
Antrim	93	99	99	94	98	98
Belfast	511	98	99	98	98	29
Newry	97	100	100	99	100	98
Ulster	44	100	100	93	100	48
West NI	123	94	99	96	98	97
Scotland						
Abrdn	268	96	n/a	95	94	n/a
Airdrie	200	99	n/a	99	96	n/a
D & Gall	66	98	n/a	95	91	n/a
Dundee	210	99	n/a	98	96	n/a
Edinb	445	97	n/a	95	91	n/a
Glasgw	989	98	n/a	98	97	n/a
Inverns	139	82	n/a	74	68	n/a
Klmarnk	125	98	n/a	99	98	n/a
Krkcldy	118	92	n/a	94	94	n/a
Wales						
Bangor	3	100	100	100	100	67
Cardff	995	99	96	99	99	20
Clwyd	60	98	100	95	95	87
Swanse	308	99	90	97	97	70
Wrexm	135	99	99	99	99	98
England	**25,228**	**91**	**73**	**95**	**93**	**52**
N Ireland	**868**	**98**	**99**	**97**	**98**	**55**
Scotland[a]	**2,560**	**97**	**n/a**	**95**	**94**	**n/a**
Wales	**1,501**	**99**	**95**	**98**	**98**	**40**
UK	**30,157**	**92**	**75[c]**	**95**	**94**	**52[c]**

[a]Dataset provided by the Scottish Renal Registry for Scottish centres shown did not include data on serum cholesterol or serum PTH
[b]Serum calcium corrected for serum albumin
[c]Excluding Scotland

eGFR from the serum creatinine concentration as reported by the centre (unless otherwise stated). A wide variety of creatinine assays are in use in clinical biochemistry laboratories in the UK, and it is not possible to ensure that all measurements of creatinine concentration collected by the UKRR are harmonised. Although many laboratories are now reporting assay results that have been aligned to the isotope dilution-mass spectrometry standard (which would necessitate use of the modified MDRD formula), this was not the case at the end of 2014. 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 2007 and 31st December 2013 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.

Patients who had died or experienced graft failure within 12 months of transplantation were excluded from the analyses. Patients with more than one transplant during 2007–2013 were included as separate episodes provided each of the transplants functioned for a year.

For each patient, the most recent laboratory or blood pressure result for the relevant 4th/5th quarter 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 conclusions

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 [4]. 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 52.5 ml/min/1.73 m^2, with 13% of prevalent transplant recipients having an eGFR <30 ml/min/1.73 m^2.

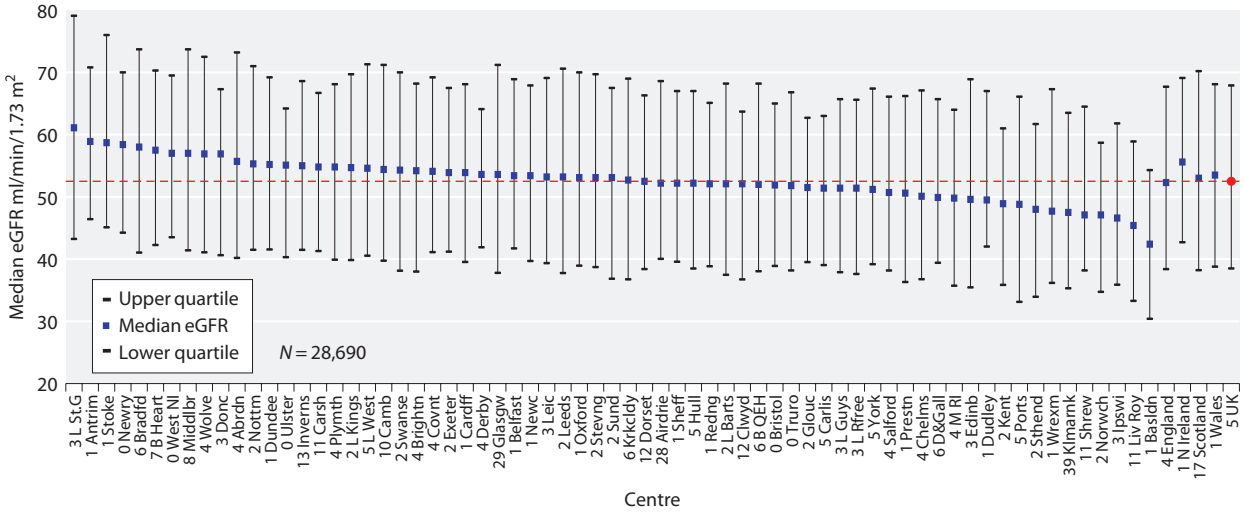

Fig. 3.2. Median eGFR in prevalent transplant patients by centre on 31/12/2014

Table 3.10 summarises the proportion of transplant patients with an eGFR <30 ml/min/1.73 m^2 by centre. Whilst local repatriation policies on timing of transfer of care for patients with failing transplants from transplant centres to referring centres might explain some of the differences, it is notable that both transplanting and non-transplanting centres feature at both ends of the scale. The accuracy of the 4–variable MDRD equation in estimating GFR $\geqslant$ 60 ml/min/1.73 m^2 is questionable [5], therefore a figure describing this is not included in this chapter.

Figure 3.4 shows the percentage of prevalent patients by centre with eGFR <30 ml/min/1.73 m^2 as a funnel plot, enabling a more reliable comparison of outcomes between centres across the UK. The solid lines show the 2 standard deviation limits (95%) and the dotted lines the limits for 3 standard deviations (99.9%). With 67 centres included and a normal distribution, 3–4 centres would be expected to fall between the 95–99.9% CI (1 in 20) and no centres should fall outside the 99.9% limits.

There continued to be variation between centres; these data show over-dispersion with 14 centres falling outside the 95% CI of which five centres were outside the 99.9% CI. Three centres (Nottingham, London St Georges, London West) fell outside the lower 99.9% CI suggesting a lower than expected proportion of patients with eGFR <30 ml/min/1.73 m^2. Liverpool Royal and Portsmouth both fell outside the upper 99.9% CI suggesting a higher

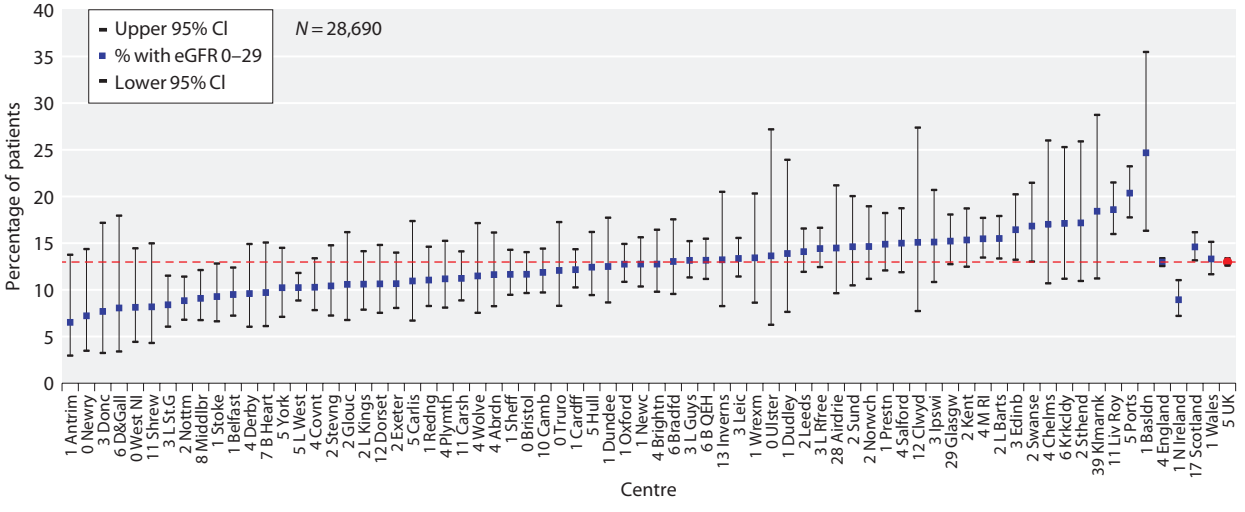

Fig. 3.3. Percentage of prevalent transplant patients by centre on 31/12/2014 with eGFR <30 ml/min/1.73 m^2

Table 3.10. Percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 on 31/12/2014

Centre	Patients with eGFR data (*N*)	Percentage with eGFR <30
Ulster	44	13.6
Clwyd	53	15.1
D & Gall	62	8.1
Donc	65	7.7
Dudley	72	13.9
Klmarnk	76	18.4
Basldn	77	24.7
Antrim	92	6.5
Chelms	94	17.0
Newry	97	7.2
Sthend	99	17.2
Shrew	110	8.2
Krkcldy	111	17.1
Inverns	121	13.2
West NI	123	8.1
Wrexm	134	13.4
Carlis	137	10.9
Airdrie	145	14.5
Glouc	170	10.6
Wolve	174	11.5
B Heart	175	9.7
Derby	177	9.6
Ipswi	205	15.1
Truro	207	12.1
Dundee	208	12.5
Sund	212	14.6
Abrdn	258	11.6
Stevng	259	10.4
York	264	10.2
Bradfd	276	13.0
Dorset	282	10.6
Swanse	303	16.8
Plymth	304	11.2
Norwch	321	14.6
Stoke	345	9.3
Hull	370	12.4
L Kings	377	10.6
Redng	380	11.1
Brightn	392	12.8
L St.G	405	8.4
Salford	420	15.0
Exeter	422	10.7
Edinb	432	16.4
Middlbr	451	9.1
Covnt	467	10.3
Belfast	505	9.5
Kent	515	15.3
Prestn	517	14.9
Carsh	561	11.2
Nottm	588	8.8
Newc	619	12.8
Sheff	686	11.7
Glasgw	703	15.2
Camb	733	11.9
Liv Roy	764	18.6
Bristol	831	11.7
Ports	835	20.4
Leeds	866	14.1
B QEH	949	13.2
L Barts	974	15.5
Cardff	987	12.2
Oxford	1,043	12.8
Leic	1,048	13.4
L Rfree	1,075	14.4
M RI	1,112	15.5
L Guys	1,163	13.2
L West	1,621	10.2

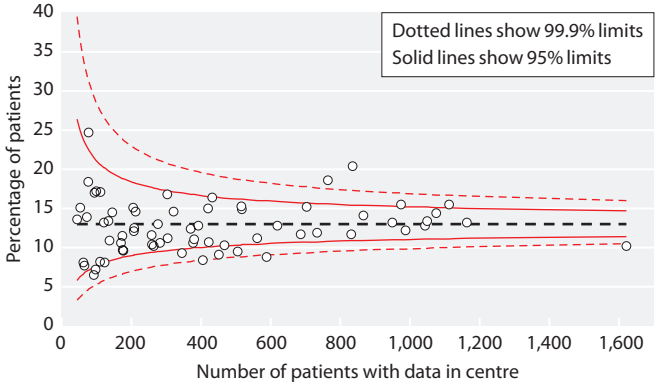

Fig. 3.4. Funnel plot of percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 by centre size on 31/12/2014

than expected proportion of patients with eGFR <30 ml/min/1.73 m^2.

eGFR in patients one year after transplantation

Graft function at one year post-transplantation may predict subsequent long term graft outcome [6]. Figures 3.5a, 3.5b, and 3.5c show the median one year post-transplant eGFR for patients transplanted between 2007–2013, by transplant type. Living kidney donation had the highest median eGFR at one year (57.4 ml/min/1.73 m^2), followed by donation after brainstem death (53.6 ml/min/1.73 m^2) and donation after circulatory death (50.1 ml/min/1.73 m^2).

Figures 3.6a, 3.6b and 3.6c show one year post-transplant eGFR by donor type and year of transplantation. An upward trend in eGFR ($p = 0.0007$) over the time

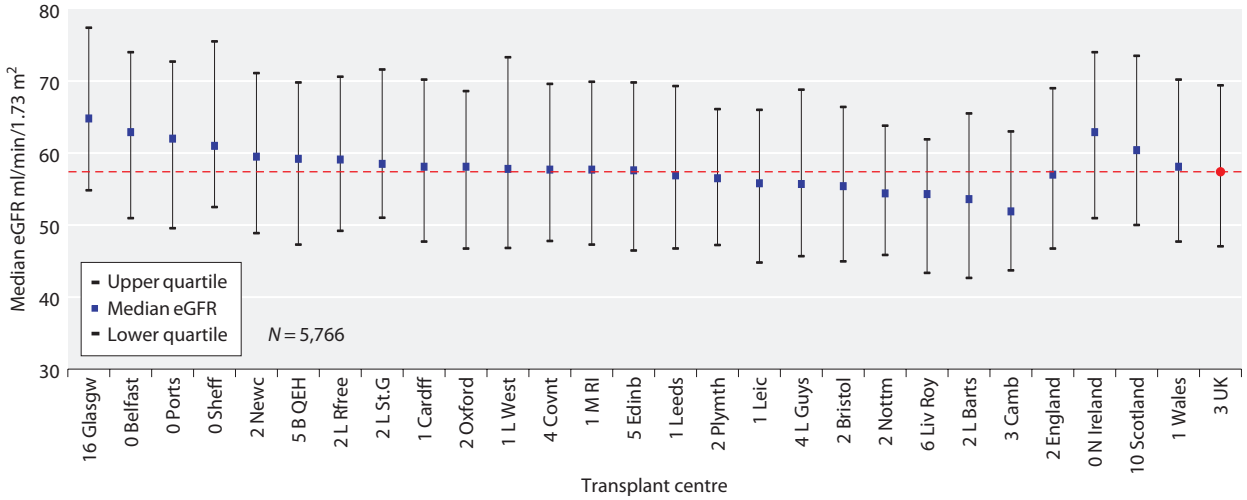

Fig. 3.5a. Median eGFR one year post-live donor transplant by transplant centre 2007–2013

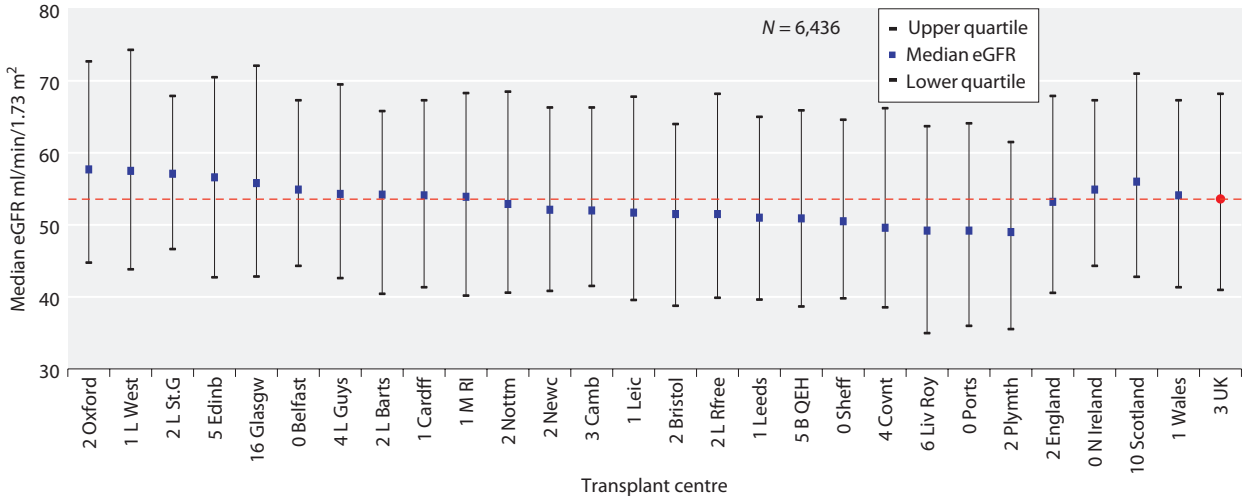

Fig. 3.5b. Median eGFR one year post-brainstem death donor transplant by transplant centre 2007–2013

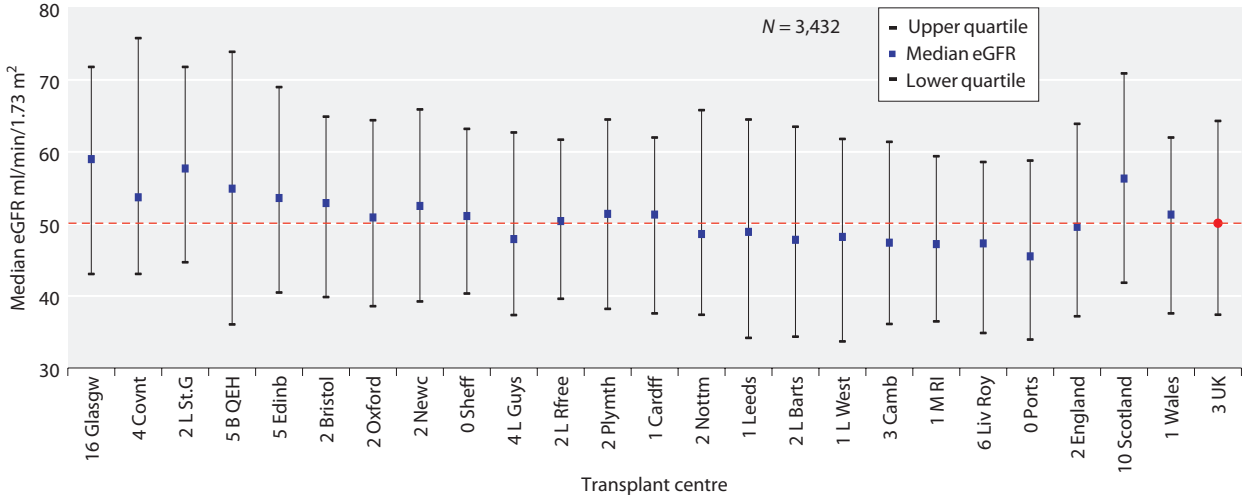

Fig. 3.5c. Median eGFR one year post-circulatory death donor transplant by transplant centre 2007–2013

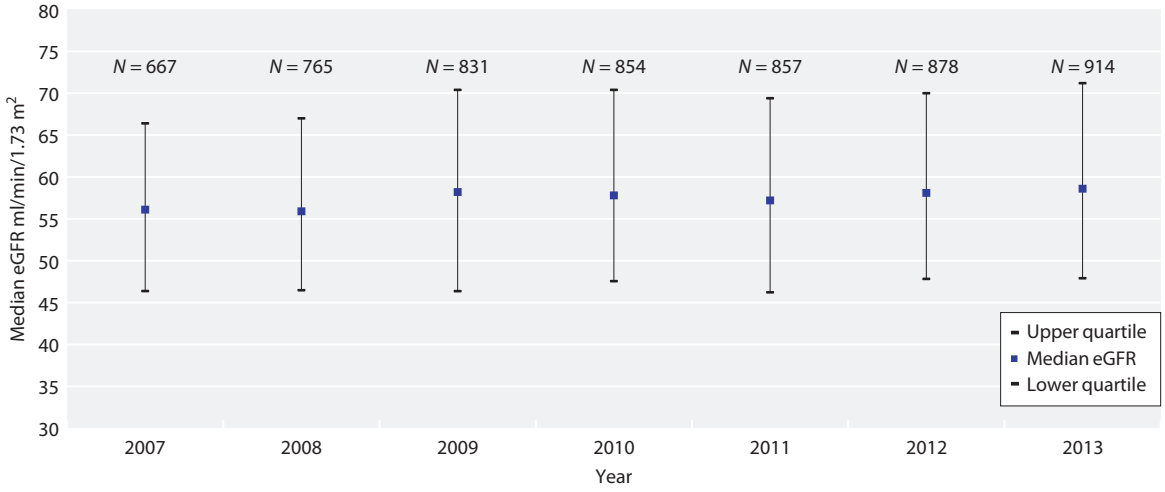

Fig. 3.6a. Median eGFR one year post-live donor transplant by year of transplantation 2007–2013

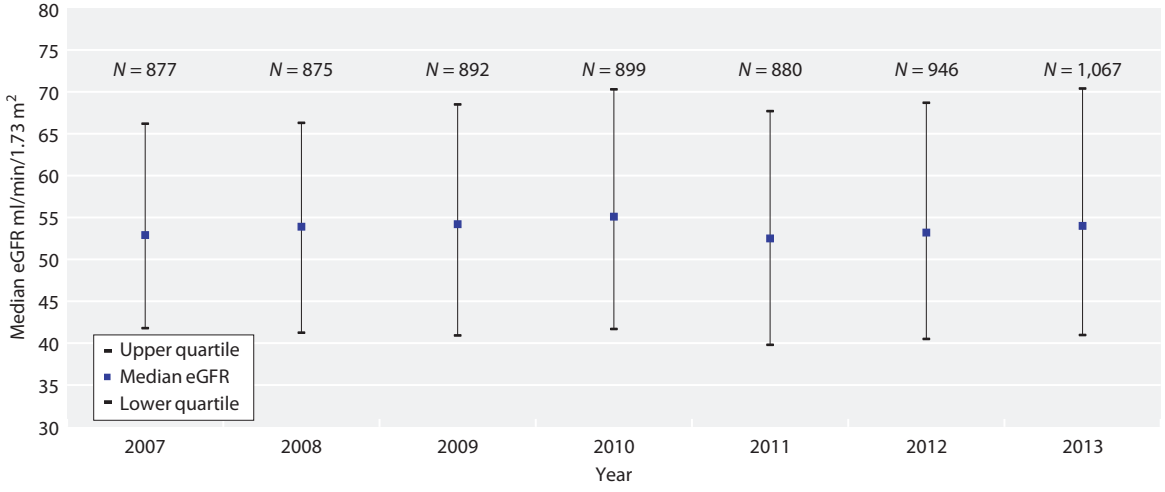

Fig. 3.6b. Median eGFR one year post-brainstem death donor transplant by year of transplantation 2007–2013

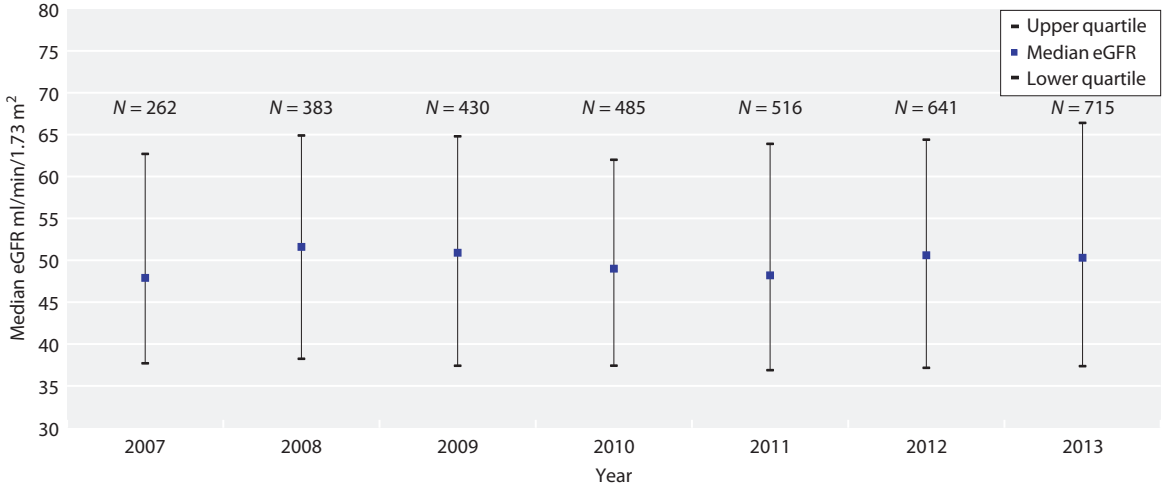

Fig. 3.6c. Median eGFR one year post-circulatory death donor transplant by year of transplantation 2007–2013

period was noticed with live kidney donation transplantation, but not with donation after brainstem death ($p = 0.14$) or donation after circulatory death ($p = 0.4$).

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 November 2010 [7] which have now been adopted for this report. These guidelines recommend '***achieving a population distribution centred on a mean of 11 g/dl with a range of 10–12 g/dl***' *[8]* (equivalent to 110 g/L, range 100–120 g/L). However, many transplant patients with good transplant function will have haemoglobin concentrations >120 g/L without the use of erythopoiesis stimulating agents, and so it is inappropriate to audit performance using the higher limit.

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

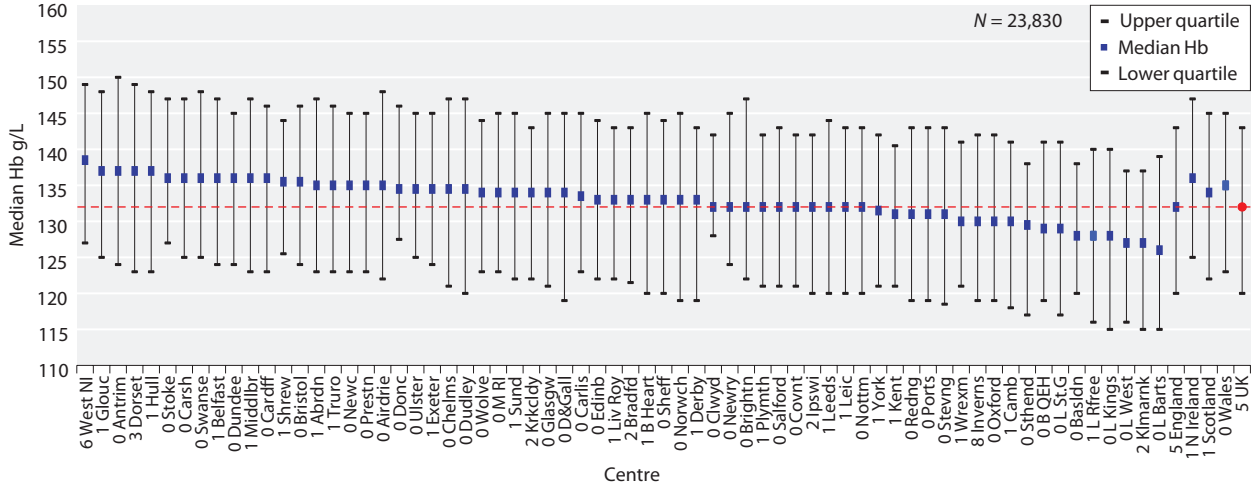

Fig. 3.7a. Median haemoglobin for prevalent transplant patients with eGFR ⩾30 ml/min/1.73 m^2 by centre on 31/12/2014

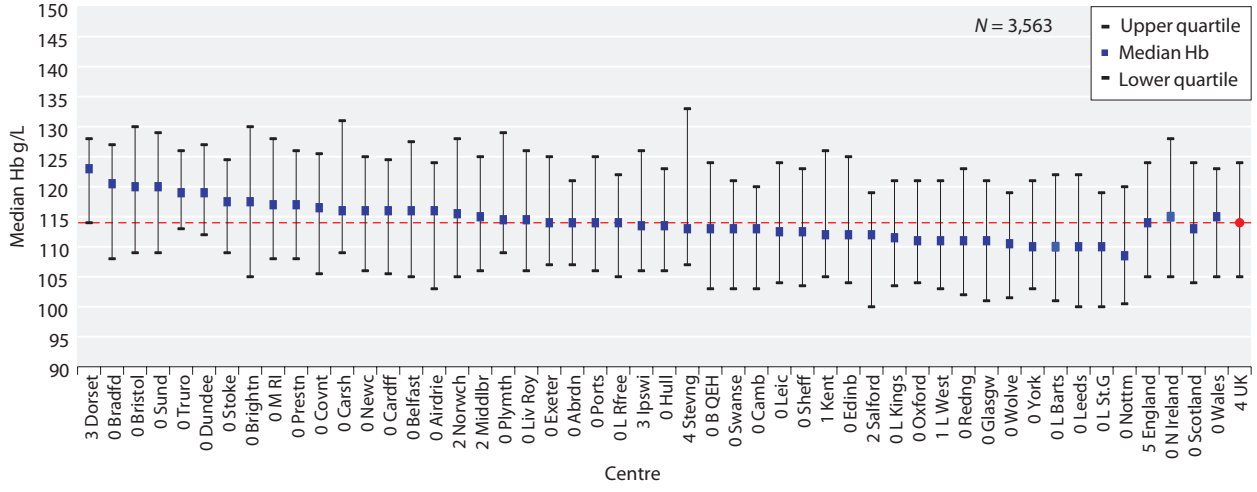

Fig. 3.7b. Median haemoglobin for prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 by centre on 31/12/2014

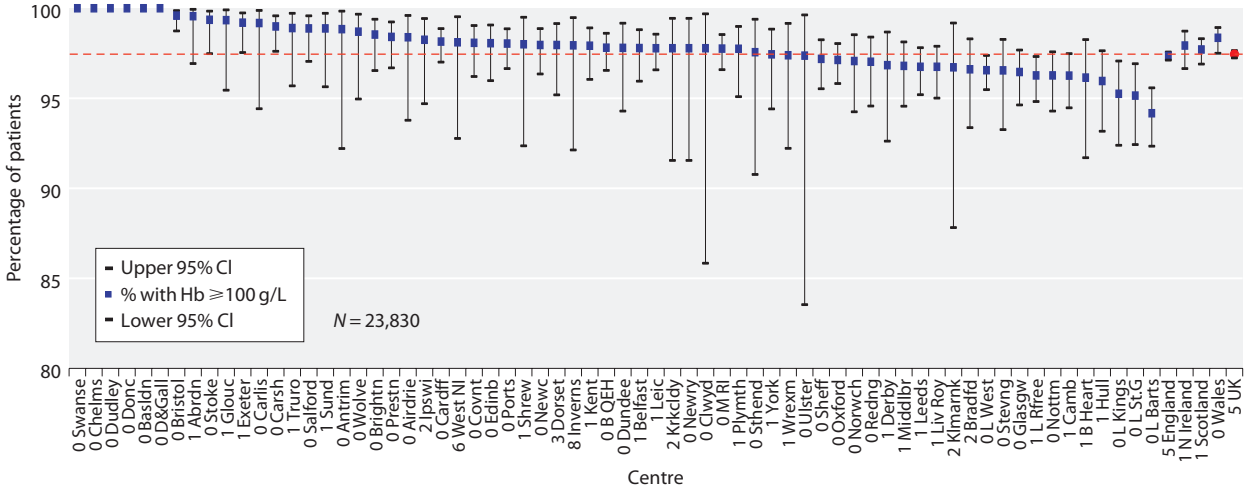

Fig. 3.8a. Percentage of prevalent transplant patients with eGFR ⩾30 ml/min/1.73 m^2 achieving haemoglobin ⩾100 g/L by centre on 31/12/2014

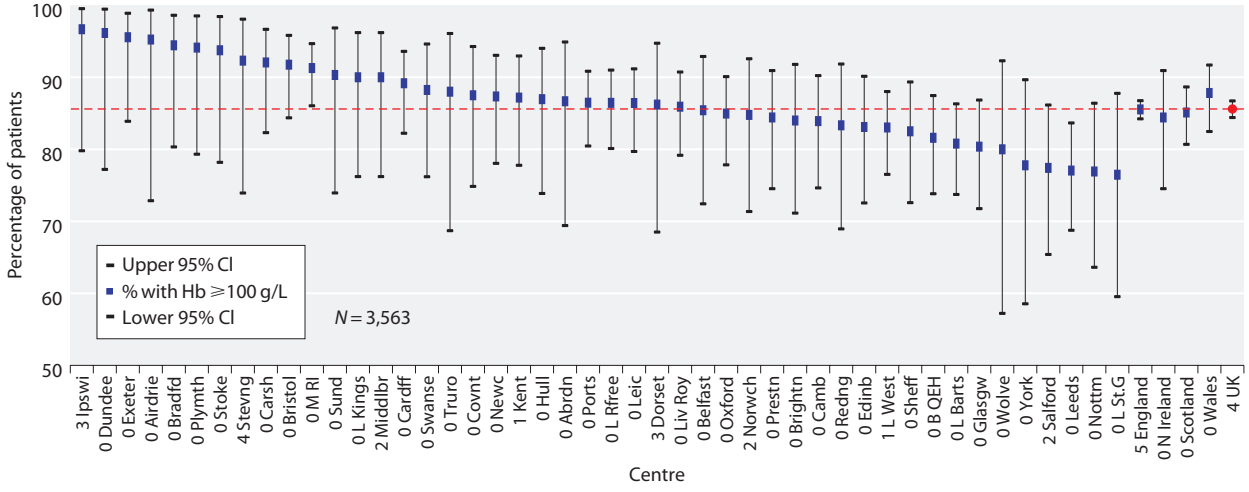

Fig. 3.8b. Percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 achieving haemoglobin ⩾100 g/L by centre on 31/12/2014

percentage of prevalent transplant patients achieving Hb ⩾100 g/L in each centre, stratified by eGFR, is displayed in figures 3.8a and 3.8b.

Figure 3.9 describes the percentage of prevalent patients by centre with haemoglobin <100 g/L as a funnel plot enabling more reliable comparison of outcomes between centres across the UK. With 66 centres included and a normal distribution, 3–4 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.

One centre (London St Bartholomew's) fell outside the upper 99.9% CI and two further centres (Leeds, Glasgow) fell outside the upper 95% CI indicating a higher than

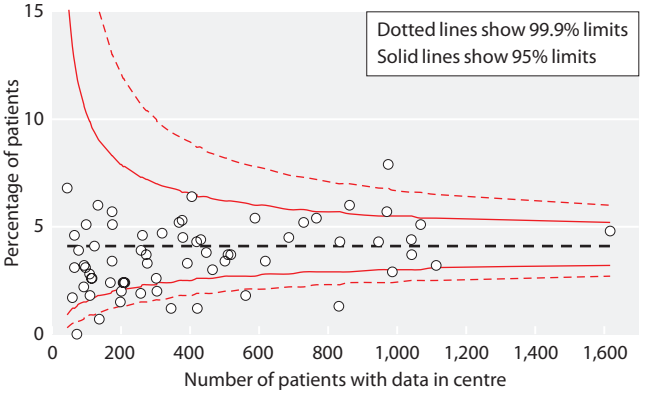

Fig. 3.9. Funnel plot of percentage of prevalent transplant patients with haemoglobin <100 g/L by centre size on 31/12/2014

predicted proportion of transplant patients not achieving the haemoglobin target. Six centres fell outside the lower 99.9% CI, indicating they performed better than expected with fewer than predicted patients having a haemoglobin <100 g/L.

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 kidney transplant recipients 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). Figures 3.10a and 3.10b show the percentage of patients with a blood pressure of <130/80 mmHg, by eGFR. The percentage of patients with BP <130/80 (systolic BP <130 **and** diastolic BP <80 mmHg) was higher (26.5% vs. 20.3%) in those with better renal function (eGFR ⩾30 ml/min/1.73 m^2).

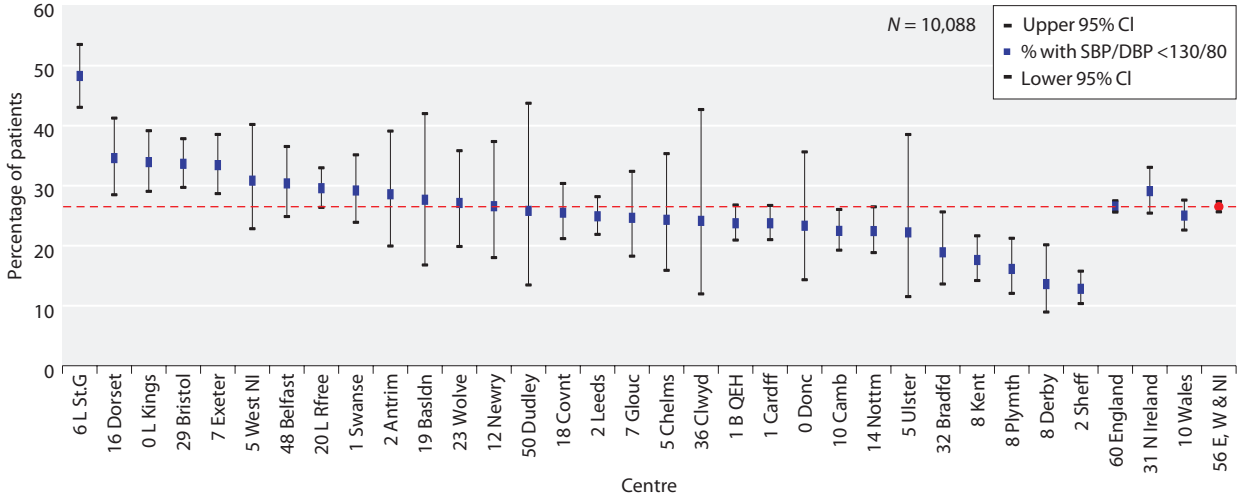

Fig. 3.10a. Percentage of prevalent transplant patients with eGFR ⩾30 ml/min/1.73 m^2 achieving blood pressure of <130/80 mmHg by centre on 31/12/2014

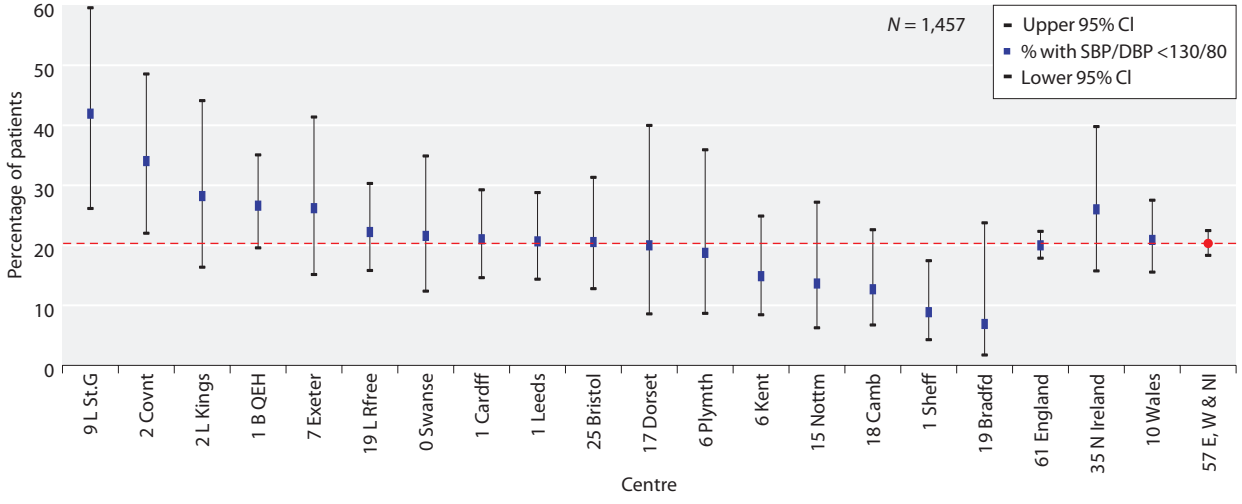

Fig. 3.10b. Percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 achieving blood pressure of <130/80 mmHg by centre on 31/12/2014

Analysis of prevalent patients by CKD stage

Introduction

Approximately 2.4% of prevalent transplant patients returned to dialysis in 2014, a similar percentage to that seen over the last few years. Amongst patients with native chronic kidney disease, late presentation is associated with poor outcomes, largely attributable to lack of specialist management of anaemia, acidosis, hyperphosphataemia and to inadequate advance preparation for dialysis. Transplant recipients on the other hand, are almost always followed up regularly in specialist transplant or renal clinics and it would be reasonable to expect patients with failing grafts to receive appropriate care and therefore have many of their modifiable risk factors addressed before complete graft failure and return to dialysis.

Methods

The transplant cohort consisted of prevalent transplant recipients as on 31st December 2014 ($N = 28,707$) 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 2014, comprised the comparison dialysis cohort ($N = 21,408$) including 2,222 peritoneal dialysis patients. Only patients on peritoneal dialysis were considered when examining differences in serum phosphate between transplant recipients and dialysis patients. For both the transplant and dialysis cohorts, the analysis used the most recent available value from the last two quarters of the 2014 laboratory data. Scottish centres were excluded from blood pressure, cholesterol and PTH analyses as corresponding data were not provided.

Results and conclusions

Table 3.11 shows that 13% of the prevalent transplant population (3,732 patients), had moderate to advanced

Table 3.11. Analysis by CKD stage for prevalent transplant patients compared with prevalent dialysis patients on 31/12/2014

	Stage 1–2T (⩾60)	Stage 3T (30–59)	Stage 4T (15–29)	Stage 5T (<15)	Stage 5D
Number of patients	10,548	14,427	3,293	439	21,408
% of patients	36.7	50.3	11.5	1.5	
eGFR ml/min/1.73 m^2 [a]					
mean ± SD	77.6 ± 15.6	45.8 ± 8.4	23.8 ± 4.1	11.9 ± 2.4	
median	73.5	46.1	24.4	12.3	
Systolic BP mmHg					
mean ± SD	133.7 ± 16.6	136.3 ± 17.6	140.2 ± 19.4	144.1 ± 23.0	133.1 ± 25.4
% ⩾130	58.9	64.1	71.9	76.0	53.1
Diastolic BP mmHg					
mean ± SD	78.7 ± 9.9	78.8 ± 10.2	78.7 ± 11.4	79.7 ± 12.8	68.7 ± 14.9
% ⩾80	49.4	48.6	49.2	49.2	22.0
Cholesterol mmol/L					
mean ± SD	4.4 ± 1.0	4.6 ± 1.1	4.6 ± 1.2	4.6 ± 1.3	3.9 ± 1.1
% ⩾4	66.8	70.6	71.9	65.6	43.4
Haemoglobin g/L					
mean ± SD	137.0 ± 16.1	128.3 ± 16.6	115.7 ± 15.3	106.2 ± 15.5	111.4 ± 13.8
% <100.0	1.5	3.3	12.1	32.6	17.5
Phosphate mmol/L [b]					
mean ± SD	0.9 ± 0.2	1.0 ± 0.2	1.1 ± 0.3	1.5 ± 0.4	1.6 ± 0.4
% >1.7	0.1	0.3	2.6	29.2	35.3
Corrected calcium mmol/L					
mean ± SD	2.4 ± 0.1	2.4 ± 0.1	2.4 ± 0.2	2.3 ± 0.2	2.4 ± 0.2
% >2.5	24.7	24.3	19.6	15.0	16.2
% <2.2	3.7	4.7	9.3	18.3	16.4
PTH pmol/L					
median	8.2	9.5	15.7	31.4	31.5
% >72	0.5	0.6	3.2	15.4	17.2

[a]Prevalent transplant patients with no ethnicity data were classed as White
[b]Only PD patients included in stage 5D, $N = 2,222$

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

eGFR slope analysis

Introduction

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

Methods

All UK patients aged ⩾ 18 years receiving their first renal transplant between 1st January 2003 and 31st December 2012, were considered for inclusion. A minimum duration of 18 months graft function was required and three or more creatinine measurements from the second year of graft function onwards were used to plot eGFR slope. If a transplant failed but there were at least three creatinine measurements between one year post-transplant and graft failure, the patient was included but no creatinine measurements after the quarter preceding the recorded date of transplant failure were analysed.

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

Results and conclusions

The study cohort consisted of 15,970 patients. The median GFR slope was −0.48 ml/min/1.73 m^2/year (table 3.12). The gradient was steeper for Black recipients (−0.94 ml/min/1.73 m^2/year), in keeping with previously published data suggesting poorer outcomes for this group [12, 13]. There was no statistically significant difference in eGFR slope in recipients of deceased donor kidneys (−0.51 ml/min/1.73 m^2/year) compared to patients who received organs from live donors (−0.44 ml/min/1.73 m^2/year). Female patients had a steeper slope (−0.8 ml/min/1.73 m^2/year) than males (−0.27 ml/min/1.73 m^2/year), as did diabetic patients (−1.12 ml/min/1.73 m^2/year) compared to non-diabetic patients (−0.38 ml/min/1.73 m^2/year). The slope was steeper in younger recipients, possibly reflecting increased risk of immunological damage. As might be expected, the steepest slope was in patients where the transplant subsequently failed. This analysis has assumed linearity of progression of fall in GFR and further work is ongoing to characterise the patterns of progression more precisely.

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

Cause of death in transplant recipients

Introduction

Differences in causes of death between dialysis and transplant patients may be expected due to selection for transplantation and use of immunosuppression. Chapter 5 includes a more detailed discussion on cause 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. Analysis of prevalent patients included all those aged over 18 years and receiving RRT on 1st January 2014.

Results and conclusions

Table 3.13 and figure 3.11 show the differences in the cause of death between prevalent dialysis and transplant patients. Table 3.14 shows the cause of death for prevalent transplant patients by age. Death due to cardiovascular disease was less common in transplanted patients than in dialysis patients, perhaps reflecting the

Table 3.12. Differences in median eGFR slope between subgroups of prevalent transplant patients

Patients characteristics		*N*	Median Slope	Lower Quartile	Upper Quartile	p-value
Age at transplant	<40	4,718	−0.95	−3.90	1.09	<0.0001
	40–55	6,117	−0.28	−2.54	1.60	
	>55	5,135	−0.32	−2.61	1.70	
Ethnicity	Asian	1,484	−0.82	−3.81	1.57	<0.0001
	Black	1,000	−0.94	−4.06	1.35	
	Other	347	−0.64	−3.86	1.80	
	White	12,385	−0.41	−2.76	1.47	
Gender	Male	9,776	−0.27	−2.59	1.62	<0.0001
	Female	6,194	−0.80	−3.59	1.21	
Diabetes	Non-diabetic	13,315	−0.38	−2.74	1.54	<0.0001
	Diabetic	2,225	−1.12	−3.96	1.09	
Donor	Cadaveric	10,340	−0.51	−3.00	1.47	0.2
	Live	5,630	−0.44	−2.90	1.51	
Year of transplant	2003	973	−0.63	−2.26	0.72	<0.0001
	2004	1,141	−0.37	−2.03	0.85	
	2005	1,134	−0.31	−2.01	1.06	
	2006	1,442	−0.61	−2.57	0.95	
	2007	1,579	−0.64	−2.51	1.00	
	2008	1,810	−0.50	−2.61	1.14	
	2009	1,891	−0.72	−3.18	1.13	
	2010	1,978	−0.44	−3.25	1.83	
	2011	1,926	−0.08	−3.82	2.86	
	2012	2,096	−0.04	−5.29	5.05	
Status of transplant at end of follow-up	Died	1,115	−0.69	−3.90	1.93	<0.0001
	Failed	1,164	−6.24	−12.02	−2.95	
	Re-transplanted	56	−4.31	−7.47	−1.94	
	Functioning	13,635	−0.22	−2.28	1.64	
All		**15,970**	**−0.48**	**−2.97**	**1.49**	

cardiovascular screening undertaken during transplant work-up; transplant recipients are a pre-selected lower risk group of patients. The leading causes of death amongst transplant patients were malignancy (26%) and infection (24%). There has been a reduction over time in the proportion of deaths in transplant patients attributed to cardiovascular or stroke disease (43% in 2003 compared to 23% in 2014) with an increase in the

Table 3.13. Cause of death by modality in prevalent RRT patients on 1/1/2014, who died in 2014

	All modalities		Dialysis		Transplant	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	722	23	628	24	94	18
Cerebrovascular disease	136	4	112	4	24	5
Infection	622	20	498	19	124	24
Malignancy	350	11	214	8	136	26
Treatment withdrawal	504	16	490	19	14	3
Other	607	19	517	20	90	17
Uncertain	189	6	154	6	35	7
Total	**3,130**		**2,613**		**517**	
No cause of death data	1,564	33	1,313	33	251	33

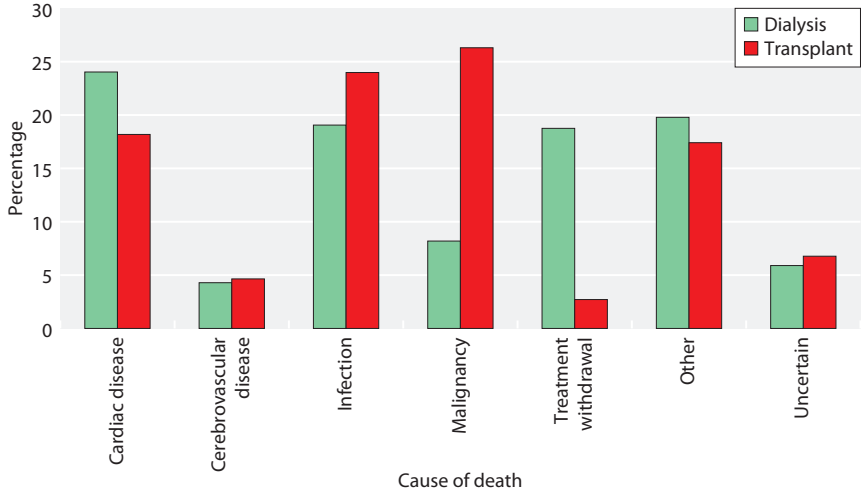

Fig. 3.11. Cause of death by modality for prevalent patients on 1/1/2014, who died in 2014

Table 3.14. Cause of death in prevalent transplant patients on 1/1/2014 by age, who died in 2014

	All age groups		<65 years		⩾65 years	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	94	18	42	18	52	19
Cerebrovascular disease	24	5	12	5	12	4
Infection	124	24	48	20	76	27
Malignancy	136	26	65	27	71	25
Treatment withdrawal	14	3	7	3	7	3
Other	90	17	47	20	43	15
Uncertain	35	7	17	7	18	6
Total	**517**		**238**		**279**	
No cause of death data	251	33	107	31	144	34

proportion ascribed to infection or malignancy (30% in 2003 compared to 50% in 2014). This change has also been reported in other registries, e.g. ANZDATA (http://www.anzdata.org.au) and may reflect better management of cardiovascular risk (although table 3.11 shows blood pressure management remained sub-optimal). Explanations for the rising death rate secondary to malignancy may include the increasing age of transplant recipients and the increased intensity of immunosuppressive regimens leading to complications of over-immunosuppression.

Conflicts of interest: Dr I MacPhee has received research funding and speaker honoraria from Astellas and speaker honoraria from Chiesi.

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Appendix 1: Reporting status of audit measures

Table 3.15. The reporting status of the recommended Renal Association Audit Measures for the Post-operative Care of Kidney Transplant Recipients in the 18th Annual Report

RA audit measure	Included in UKRR annual report?	Reason for non-inclusion
1. Proportion of blood results available for review, and reviewed, within 24 hours	No	UKRR does not currently collect these data
2. Proportion of units with a written follow-up schedule available to all staff and patients	No	UKRR does not currently collect these data
3. Percentage of patients accessing their results through Renal Patient View	No	Requires linkage with RPV
4. Percentage of total patients assessed in an annual review clinic.	No	UKRR does not currently collect these data
5. Percentage of total patients receiving induction with ILRAs and TDAs	No	Poor data completeness
6. Percentage of de novo KTRs receiving tacrolimus	No	Poor data completeness
7. Percentage of de novo KTRs receiving MPA based immunosuppression	No	Poor data completeness
8. Percentage of de novo KTRs receiving corticosteroid maintenance therapy	No	Poor data completeness
9. Use of generic agents	No	UKRR does not currently collect these data
10 Severity of biopsy proven acute rejection (BPAR) recorded by BANFF criteria.	No	UKRR does not currently collect these data
11. Percentage of KTRs with BPAR in first 3 months and first 12 months.	No	UKRR does not currently collect these data
12. Percentage of KTRs requiring TDAs to treat rejection in first year	No	UKRR does not currently collect these data
13. Complication rates after renal transplant biopsy	No	UKRR does not currently collect these data
14. Proportion of patients receiving a target blood pressure of 130/80 mmHg or 125/75 mmHg in the presence of proteinuria (PCR>100 or ACR<70)	No	Poor data completeness
15. Proportion of patients receiving an ACE inhibitor or angiotensin receptor blocker	No	Poor data completeness
16. Proportion of patients with proteinuria assessed by dipstick and, if present, quantified at each clinic visit.	No	UKRR does not currently collect these data
17. Proportion of renal transplant recipients with an annual fasting lipid profile	No	UKRR does not currently collect these data
18. Proportion of KTR taking statins (including the type of statin) for primary and secondary prevention of premature cardiovascular disease	No	UKRR does not currently collect these data
19. Proportion of patients on other lipid lowering agents	No	Poor data completeness
20. Proportion of patients achieving dyslipidaemia targets	Yes	
21. Incidence of new onset diabetes after transplantation (NODAT) at three months and at annual intervals thereafter	No	UKRR does not currently collect these data
22. Proportion of patients who require insulin, and in whom remedial action is undertaken – minimisation of steroids and switching of CNIs	No	UKRR does not currently collect these data
23. Proportion of patients with ischaemic heart disease	No	Poor data completeness
24. Proportion of patients suffering myocardial infarction	No	Poor data completeness
25. Proportion of patients undergoing primary revascularisation	No	Poor data completeness
26. Proportion of patients receiving secondary prevention with a statin, anti-platelet agents and RAS blockers	No	UKRR does not currently collect these data

Table 3.15. Continued

RA audit measure	Included in UKRR annual report?	Reason for non-inclusion
27. Proportion of patients who are obese	No	Poor data completeness
28. Proportion of patients having screening procedures for neoplasia at the annual review clinic	No	UKRR does not currently collect these data
29. Incidence of CMV disease	No	Poor data completeness
30. Rate of EBV infection and PTLD	No	UKRR does not currently collect these data
31. Completeness of records for EBV donor and recipient serology	No	UKRR does not currently collect these data
32. Rates of primary VZV and shingles infection	No	UKRR does not currently collect these data
33. Completeness of records for VZV recipient serology	No	UKRR does not currently collect these data
34. Rates and outcomes of HSV infection.	No	UKRR does not currently collect these data
35. Rates of BK viral infection in screening tests.	No	UKRR does not currently collect these data
36. Rates and outcomes of BK nephropathy	No	UKRR does not currently collect these data
37. Frequency of bisphosponate use	No	UKRR does not currently collect these data
38. Incidence of fractures	No	UKRR does not currently collect these data
39. Incidence of hyperparathyroidism	No	Poor data completeness
40. Incidence of parathyroidectomy	No	UKRR does not currently collect these data
41. Use of cinacalcet	No	Poor data completeness
42. Frequency of hyperuricaemia and gout	No	UKRR does not currently collect these data
43. Prevalence of anaemia	Yes	
44. Prevalence of polycythaemia	No	Poor data completeness
45. Pregnancy rates and outcomes	No	UKRR does not currently collect these data
46. Prevalence of sexual dysfunction	No	UKRR does not currently collect these data