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Foreword

Welcome to the 2014 edition of the UK Renal Registry report. The UK kidney community is fortunate to have such a mature source of information, with statistics that demonstrate the clinical effectiveness of treatment regimes and real-world data for research. For years it has provided an invaluable repository of information which is extracted and used by healthcare professionals to improve patient care, and to show how well their hospital is managing kidney failure in clinical terms.

However, whilst the UK Renal Registry is a resource created to improve patient care it has traditionally done this ***for*** patients – now it plans to do it ***with*** patients. People and families affected by kidney disease want to know about how well their care is being delivered, whether it is better or worse (for outcomes and experience) in their hospital or the one up the road. The UK Renal Registry reports on areas that are essential to patients, but not many patients know about it. It is a resource for all and 2014 marks the year when its first Patient Council was formed to advise and guide on its work from the perspective of those who receive care. This year the first, more accessible report, aimed at a patient audience was published, with a selection of facts and figures for kidney patients, showing for example the proportion of patients on home dialysis therapies, numbers starting dialysis by age, gender and race, and numbers on the transplant waiting list. Perhaps in time it can bring out differences in outcomes for those on different dialysis therapies, or waiting times for transplant by different units.

The Kidney Health: Delivering Excellence report (2013) (www.britishrenal.org/getattachment/Kidney-Health/Kidney-Health-Delivering-Excellence.pdf.aspx) demonstrated the effectiveness of patients and professionals working together. This is espoused in in new UK Renal Registry projects such as that addressing the huge patient safety issue that is Acute Kidney Injury and another to test how activating and coaching people with Chronic Kidney Disease might lead to improved outcomes, including experience.

The core reporting data about access to, quality of and outcomes from dialysis will become even more important to monitor patient care in the face of significant economic challenges and commissioning changes. Publishing registry data to guide commissioners and to assure patients that they continue to receive the right care and choices is key for the future.

The word *data* is derived from the Latin word 'datum', meaning 'something given'. The UK Renal Registry can give something to all of us, so sharing it, making it accessible and keeping it timely can guide and protect us and help us work together to assure consistency of care and to answer our questions. Congratulations to registry staff for their hard work in producing the 2014 report in good time.

Fiona Loud
UK Renal Registry Patient Council
British Kidney Patient Association

Chapters and appendices

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UK Renal Registry 17th Annual Report: Introduction

Fergus Caskey, Ron Cullen

UK Renal Registry, Bristol

Activity since the last UK Renal Registry Annual Report

We remain indebted to the founders of the UK Renal Registry (UKRR), Professor Terry Feest and Dr David Ansell, whose foresight and innovative thinking led to the automatic capture of data from electronic health records in renal centres in the mid-1990s. With this model however, issues such as timeliness of reporting and data completeness have proven difficult and stubbornly resistant to improvement. Overlapping requests for extraction of the same or similar data have emerged from PatientView and NHS Blood and Transplant and are leading to several extraction routines in local renal IT systems all needing to be maintained. There is also a need to be able to evolve our dataset more quickly in response to improved understanding of diseases and treatments and in response to commissioners as they monitor the quality of the services they are funding. In short, the UKRR needs to innovate again if it is to survive and thrive in the new NHS.

The UK Renal Data Collaboration

The UK Renal Data Collaboration (UKRDC) is a collaboration between the UK Renal Registry and eight other major organisations with an interest in collecting routine renal health data (figure 1). It has been in development for several years now, but took a major step forward in December 2013 when it successfully completed a feasibility and pilot project with Intersystems®. Following this, and with approval from the Renal Information Governance Board of the Renal Association, the UKRR proceeded to purchase the necessary hardware to house an Intersystems® HealthShare® database and obtain the necessary information governance permissions. It is anticipated that data will start flowing into the new UKRDC data warehouse before the end of 2014.

For renal centres, commissioners and patients, this is likely to lead to a number of noticeable benefits:

- Data will be collected from renal centres daily (rather than at the end of a quarter) and so the UKRR will

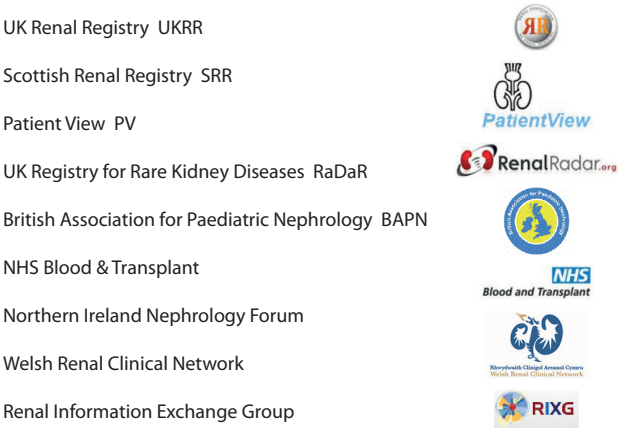

Fig. 1. UK Renal Data Collaboration member organisations

have a dataset that (1) contains all laboratory results from the quarter not just the latest one and (2) is a real-time copy of the local renal IT system
- It will be possible to improve and standardise data extractions and transfers with the ultimate aim of being able to transfer a patient's electronic health record between renal centres, with the patient's permission, as required for continuity of clinical care
- Only one data extraction routine will be required (rather than one for each of the partner organisations) making it easier to maintain mapping and therefore data completeness
- Two-way data communication will become possible between renal centres, the UKRR and patients.

For more information on the UKRDC and how it is going to affect you and your renal centre please see the UKRR website (www.renalreg.org).

An update of the UKRR's dataset

Recognising the changes that lie ahead with the implementation of the UKRDC, the UKRR released the latest version of its dataset in September 2014. The main purpose of this release was to update the list of data items for the core UKRR work and to enable the automation of dashboard, dialysis access audit and some CQUIN returns.

One of the main changes coming with this new dataset was the change in the extraction rules for reporting patients to the UKRR. In recognition of the currently uncaptured conservative kidney management work and the huge variation in adoption of the 2009 rule to record patients at the time of their first dialysis (and meaningless 0–90 day data as a result), the UKRR will move to extract data on:

- all patients with an eGFR of less than 30 on a renal centre IT system
- all patients receiving acute dialysis or plasma exchange in the renal centre.

We are working with suppliers to achieve this through a change in the logic that identifies patients for reporting to the UKRR.

The adoption of this new dataset will be mandated from the 1st January 2016, but renal centres may wish to work with us to adopt some features before then, such as:

- the fields to capture dashboard indicator data automatically
- the fields to capture the shared-care HD CQUIN automatically
- the fields to capture the dialysis access data automatically
- the first ever UKRR PD dataset – agreed through expert consensus

It is also worth pointing out that the Commissioning Reference Group sent out a letter on the 2nd September 2014 that mandates the reporting of dialysis-dependent AKI from 1st January 2015.

We are in discussion with national standards groups about the formats to be used to transmit the data in 2016. They will be very different to our traditional format and hence suppliers should not modify their extracts until further guidance has been issued. Some particular changes are likely to include:

- Moving away from a quarterly or monthly block towards a continuous feed of all activity including blood results and dialysis sessions
- Moving away from a modality timeline towards a series of episodes
- Moving away from multiple extracts (e.g. to PV, RADAR, the UKRR and NHS BT) to a single standardised extract serving all purposes.

To help explain this we have included a sheet in the dataset that begins to outline some of these formatting changes and will be of particular interest to the system suppliers. We recognise the varying states of renal IT systems around the UK and will continue to liaise with suppliers about these technicalities.

We appreciate that these modifications will require renal units to make some changes to their renal IT system and the way they record data, but hope the reasons behind them and the benefits they should be able to deliver are clear.

The Acute Kidney Injury Programme

With much kidney disease being managed in primary care, it is important that the UKRR develops an ability to look beyond the renal centre. The Acute Kidney Injury National Programme, which is being jointly run with NHS England and the National Clinical Director Dr Richard Fluck, has provided an opportunity to begin exploring ways in which we might do this.

Following a lot of consideration and discussion, a level 3 National Patient Safety Alert was issued by NHS England in June 2014 requiring laboratories in all Trusts in England to do two things essential for measuring AKI rates by 9th March 2015:

1. Incorporate a standard, nationally-agreed algorithm into local laboratory information management systems to identify patients with KDIGO stage 1, 2 or 3 acute kidney injury and create the appropriate AKI Warning Stage Test Result for secondary and later primary care.
2. Send a file of all cases of AKI, with identifiers and serum creatinine results from the preceding and following 15 months to the UKRR.

An AKI Measurement Work Stream Committee has been established with representation from adult and paediatric nephrology, primary care, public health, pharmacy and patients. The main purpose of that committee at the moment is to plan the work required to validate the data, once available, and begin to think about the best use for the data – from describing the epidemiology of AKI and differences between areas to using the data to study population level interventions. Health Research Authority temporary exemption from section 251 of the NHS Act 2006 has already been granted allowing the UKRR to hold identifiable data and link to other health datasets.

For further information including details of the other workstreams of the Acute Kidney Injury National Programme – Education, Detection, Intervention, Detection and Commissioning – or to get involved, please visit the AKI website (www.thinkkidneys.nhs.uk).

Patient participation

It is also great to be able to report progress towards piloting the routine collection of patient quality of life, experience and activation measures in range of renal patients. With funding from NHS England and in collaboration with their Patient Participation Team and the National Clinical Director, the UKRR has appointed a Board, co-chaired by a patient, to oversee the work and is planning a first full meeting for early 2015. Hopefully patient reported outcomes will then begin to be reported to the UKRR from the pilot sites over the following months.

More generally relating to patient participation is the news that the UKRR has established, in the last 12 months, a Patient Council to oversee its work. Chaired by a patient and with 10–12 appointed patient representatives this group will aim to advise and monitor present and future initiatives of the UKRR and increase the usefulness of the UKRR to patients.

Other changes

In addition to the establishment of the Patient Council, there have been a number of alterations to the organisation of study groups. In order to provide concentrated methodological expertise in one place, a Research Methods study group has been established with the aim of:

- advising on analytical issues that have arisen during core UKRR work or identified in clinical study groups
- evaluating and refining ideas for new high impact analyses involving UKRR data.

It has also been decided to incorporate the UKRR's Chronic Kidney Disease study group into the UK Kidney Research Consortium CKD study group. The Measurement Workstream of the AKI National Programme will act as the UKRR's AKI study group for the duration of that programme (figure 2).

Tony Wing fellowship

With funding from the British Kidney Patient Association, managed by Kidney Research UK, the UKRR in association with the University of Bristol has appointed Dr Alex Hamilton, an adult nephrology trainee, to the position of Tony Wing Fellow. This fellowship has two purposes: first to further strengthen the links between

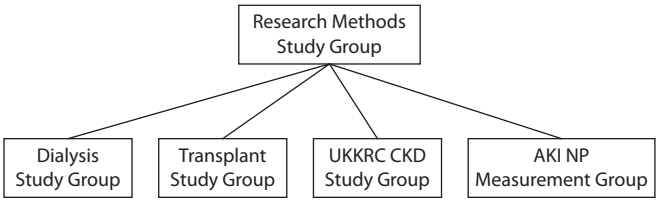

Fig. 2. Revised organisation of UKRR study groups
AKI – acute kidney injury; CKD – chronic kidney disease; NP – National Programme; UKKRC – UK Kidney Research Consortium

the adult and paediatric registries and second to use existing and new data to understand how lives are affected by developing end-stage renal disease in young adulthood.

Output during 2014

A major achievement for one of the UKRR's senior statisticians, was the successful defence of Dr Retha Steenkamp's PhD on 'Multiple Imputation of Missing Data and Prognostic Survival Modelling for Incident Patients Starting Dialysis in England, Wales and Northern Ireland'. This took a very systematic approach to handling missing data in the UKRR before using that new dataset to build a prognostic model that predicts survival on dialysis and then validating that model using ANZDATA data.

The UKRR's collaboration with researchers at SCHARR has also been very successful, linking UKRR data with Hospital Episode Statistics data at the RCP and leading to a number of useful publications and the award of Dr James Fotheringham's PhD.

The UKRR is keen to become formally included in research grant applications, with early involvement to ensure appropriate integration in the study design and consideration of its costs. In the last 12 months it has been a co-applicant on three grant applications:

- NIHR SBRI D4D: Medicines Reconciliation, led by Dr Keith Simpson exploring possibilities for medicines reconciliation using PatientView and linkage to GP medication data
- NIHR RfPB: UK PDOPPS-catheter, led by Dr Martin Wilkie (Sheffield) exploring the practice patterns associated with early PD catheter failure
- Health Foundation: ASSIST-CKD, led by Dr Hugh Gallagher (Epsom and St Heliers) evaluating a quality improvement intervention that involves generating eGFR graphs for GPs in CKD patients with deteriorating kidney function.

A number of requests for data sharing have been approved in the past 12 months and a number of projects previously approved remain open. For details see table 1. Data are shared for specific analyses only and securely destroyed at the end of the agreed period. For further details or to enquire about accessing UKRR data please see the UKRR's website (www.renalreg.org).

Completeness of data returns from UK renal centres

Data completeness has improved over the last few years for returns on ethnic origin, primary renal diagnosis and date first seen by a nephrologist (table 2). Comorbidity at the start of RRT remains poorly returned, with almost half (27/62) of the adult renal centres in England Wales and Northern Ireland having less than 75% completeness for comorbidity data. For a number of centres this limits the UKRR's ability to adjust their survival for casemix, something that is particularly relevant to outlying centres [1]. The UKRR and the Health and Social Care Information Centre have agreed that routine linkage with Hospital Episode Statistics should become routine in the next two years [2], although as with everything linked to the HSCIC the delivery of this will depend on the outcome of the ongoing inquiry by the House of Commons Health Select Committee on Handling of NHS Patient Data [3] and the work programme arising from the Partridge Review [4].

Interpretation of centre-specific clinical measures and survival comparisons

The UKRR continues to advise caution in the interpretation of the comparisons of centre-specific attainment of clinical performance measures provided in this report. In general terms, the UKRR has not tested for a 'significant difference' between the highest achiever of a standard and the lowest achiever, as centres were not identified in advance of looking at the data and statistically this approach can be invalid. As in previous UKRR reports, the arbitrary 95% confidence interval is shown for compliance with a guideline. The calculation of this confidence interval (based on the binomial distribution) and the width of the confidence interval depends on the number of values falling within the standard and the number of patients with reported data. However for many of these analyses no adjustment can be made for the range of factors known to influence the measured variable as outlined above.

For a number of years de-anonymised centre specific reports on survival of RRT patients have been published. The Francis and Keogh Enquiries and the ongoing CQC inspections of patient care and outcomes at a number of hospital trusts highlight the ongoing need for such transparency. In 2011 (2010 data) the UKRR sent letters to six centres with lower than expected survival at one year after

Table 1. Data sharing projects open or commenced during 2014

Originator: name and organisation	Aims and objectives	Dates			
		Original application	Data shared	End	Funding?
Albert Power, North Bristol NHS Trust[a]	National Study of Acute Stroke in Patients on Renal Replacement Therapies	June 13	Results shared June 13	June 16	None
Catrin Treharne, City University, London[b]	The cost-effectiveness of alternative treatment pathways in patients with ESRD: modality changes and survival	July 13	Aug 13	July 16	For Masters research project, City University
Francis Keeley, Sarah Fowler, John Henderson, BAUS Nephrectomy[a]	Patient and disease factors predictive of adverse perioperative outcomes after nephrectomy	Sept 13	Mar 14	July 15	None
Borislava Mihaylova, University of Oxford[b]	Vascular, non-vascular and overall mortality in CKD patients on RRT in the UK	Sept 13	Results shared Oct 13	Oct 13	SHARP study
Shahid Muhammad, University of West of England[b]	University of West of England, paper on 15–25yrs old on RRT	April 14	April 14	April 17	None
Kate Birnie, University of Bristol[c]	Erythropoietin therapy for treating anaemia among haemodialysis patients: associations with survival and comparison of treatment strategies	April 14	July 14	May 19	MRC fellowship
Gill Coombes, University of Birmingham[b]	Assessing prevalence and outcomes of home haemodialysis	July 14	Oct 14	Oct 24	Devices4Dignity
Charlie Tomson[c]	Analysis of questionnaire on Treatment decision making in CKD patients	Mar 13	Results shared June 14	Nov 14	NHS Institute for Innovation and Improvement
Richard Phelps, University of Edinburgh[c]	Demographics of patients registering and using RPV	July 13	Ongoing	July 2015	None
Lyn Atlass, NHS England (London Region)[b]	RRT Incidence in London, by CCG and by London renal centres	Sept 13	Nov 13	Dec 14	None
Cath Byrne, East Midland Network[b]	Numbers of treatment swaps and death rates in last 3 years for Derby, Leicester and Nottingham	Jan 14	Jan 14	Jan 15	None
Michelle Timeoney, Cheshire and Merseyside Strategic Clinical Networks NHS England[c]	Prevalent numbers in Preston to assess future demand for HD in Lancashire	July 14	Results shared Aug 14	Feb 15	None

Table 1. Continued

Originator: name and organisation	Aims and objectives	Dates			
		Original application	Data shared	End	Funding?
Graham Brushett, Salford Royal Foundation Trust Bereavement and Donation committee	North West dialysis data for cost analysis	Sept 13	Oct 13	Oct 15	None
Kidney Research UK	Information on numbers of people on dialysis/transplant for various towns/counties for press releases etc	Ongoing	Ongoing	Ongoing	N/A
Andrew Hughes, Public Health England[b]	Prevalence by regions (GOR) over time for the Global Burden of Diseases project	Oct 13	Oct 13	Oct 16	None
Bromley CCG	Information on existing small satellite dialysis units so that feasibility of a potential new small satellite can be considered	Apr 14	Apr 14	Apr 2014	N/A
James Hollingshead, Public Health England	Incidence rates and standardised rate ratios, modality usage and other information for CCG profiles	Dec 13	Apr 14	Ongoing/ Annual	N/A
Neil Parkinson, NHS England	Renal indicators at CCG level for Commissioning for Value pathway	July 2014	Sept 14	Sept 14	N/A

[a]UKRR will perform most of the analysis and the write up
[b]no input from the UKRR after supplying the data
[c]some support with statistics and interpretation required from the UKRR

90 days for incident patients starting on RRT; in 2012 (2011 data) this was required for only three centres and in 2013 (2012 data) two centres. This year (2013 data) four centres were contacted because of lower than expected survival in patients starting dialysis.

For the present, centres are asked to report their outlying status internally at trust level and follow up with robust mortality and morbidity meetings. The UKRR has no statutory powers. However, the fact that the UKRR provides centre-specific de-anonymised analyses of important clinical outcomes, including survival, makes it important to define how the UKRR responds to apparent under-performance. The senior management team of the UKRR communicate survival outlier status with the renal centres in advance of publication of this finding. The centres are asked to provide evidence that the Clinical Governance department and Chief Executive of the Trust housing the service have been informed. In the event that no such evidence is provided, the Director or Medical Director of the UKRR would inform the President of the Renal Association, who would then take action to ensure that the findings were properly investigated.

Information governance

At present the UKRR operates within a comprehensive governance framework which concerns data handling, reporting and research, including data linkages and sharing agreements. The Chair of the Renal Association

Table 2. Percentage completeness of data returns for ethnicity, primary renal diagnosis, date first seen by a nephrologist, comorbidity at start of RRT (incident patients 2013) and cause of death (for deaths in 2013 amongst incident or prevalent patients)

Centre	Ethnicity	Primary diagnosis	Date first seen	Comorbidity	Cause of death	Average completeness	Country
Newry	100.0	100.0	100.0	100.0	100.0	100.0	N Ireland
Dorset	100.0	100.0	100.0	100.0	98.3	99.7	England
Leeds	100.0	100.0	98.3	99.5	100.0	99.6	England
L Kings	100.0	100.0	98.8	100.0	98.9	99.5	England
Truro	100.0	100.0	100.0	100.0	97.4	99.5	England
Ulster	100.0	100.0	100.0	96.6	100.0	99.3	N Ireland
Nottm	100.0	100.0	97.3	99.1	100.0	99.3	England
Bradfd	100.0	100.0	100.0	98.4	97.9	99.3	England
Wrexm	97.3	100.0	100.0	100.0	95.7	98.6	Wales
Oxford	98.8	98.8	96.4	98.8	98.2	98.2	England
Basldn	100.0	100.0	100.0	100.0	90.5	98.1	England
Antrim	100.0	100.0	96.6	93.1	100.0	97.9	N Ireland
Swanse	99.1	96.4	100.0	92.7	97.8	97.2	Wales
Exeter	99.0	98.0	97.1	89.2	100.0	96.7	England
Bangor	100.0	100.0	95.8	87.5	100.0	96.7	Wales
York	100.0	94.4	[b]	91.7	100.0	96.5	England
Middlbr	100.0	100.0	99.1	98.2	82.4	95.9	England
Kent	97.9	99.3	100.0	100.0	82.3	95.9	England
Donc	100.0	100.0	91.7	85.0	100.0	95.3	England
West NI	100.0	100.0	100.0	80.0	95.8	95.2	N Ireland
B Heart	100.0	88.9	93.9	93.9	98.7	95.1	England
Hull	96.7	100.0	96.6	93.5	85.3	94.4	England
Sund	100.0	98.0	93.9	91.8	82.6	93.3	England
Derby	91.9	100.0	97.3	82.4	93.1	92.9	England
Stevng	95.6	98.1	98.7	100.0	71.3	92.7	England
Redng	85.5	97.4	99.2	86.3	93.4	92.4	England
Sthend	83.3	97.6	97.6	81.0	100.0	91.9	England
B QEH	100.0	98.4	99.5	94.8	63.6	91.3	England
Wolve	98.9	95.5	98.9	71.6	89.1	90.8	England
Cardff	100.0	100.0	97.6	81.1	74.0	90.5	Wales
Dudley	95.7	100.0	100.0	59.6	95.8	90.2	England
Glouc	100.0	100.0	96.2	51.9	100.0	89.6	England
Clwyd	92.9	85.7	[b]	92.9	83.3	88.7	Wales
Chelms	81.0	100.0	100.0	61.9	92.3	87.0	England
Carlis	97.6	95.1	100.0	36.6	92.3	84.3	England
Belfast	98.6	95.7	95.7	81.2	46.3	83.5	N Ireland
Shrew	100.0	98.4	100.0	100.0	17.7	83.2	England
Bristol	97.7	91.9	49.7	93.6	82.5	83.1	England
Newc	100.0	100.0	94.7	93.7	23.9	82.5	England
Covnt	100.0	100.0	97.7	40.2	71.4	81.9	England
Plymth	100.0	82.5	68.3	54.0	100.0	81.0	England
Leic	92.4	77.7	96.6	56.4	80.4	80.7	England
Prestn	98.7	98.0	99.3	9.3	98.0	80.7	England
L West	100.0	100.0	99.0	0.3	97.1	79.3	England
Sheff	95.6	100.0	99.2	89.8	2.0	77.3	England
Norwch	98.7	98.7	[b]	17.1	92.2	76.7	England
Ports	93.4	86.9	86.2	62.1	41.4	74.0	England
L Barts	99.0	90.0	1.7	65.3	82.8	67.8	England
Liv Roy	98.9	100.0	98.9	1.1	34.8	66.7	England
L St.G	85.5	81.6	52.6	42.1	64.8	65.3	England
Colchr	96.7	33.3[a]	100.0	0.0	91.7	64.3	England
Ipswi	84.6	51.3[a]	94.9	5.1	83.9	64.0	England
Camb	93.5	49.6[a]	88.5	4.3	81.0	63.4	England
Brightn	98.6	97.1	98.5	14.4	0.0	61.7	England

Table 2. Continued

Centre	Ethnicity	Primary diagnosis	Date first seen	Comorbidity	Cause of death	Average completeness	Country
M RI	93.0	88.5	99.0	26.5	0.8	61.6	England
L Rfree	86.4	95.6	98.7	19.3	6.0	61.2	England
Stoke	92.0	65.0	78.0	0.0	56.7	58.3	England
Liv Ain	95.5	98.5	97.0	0.0	0.0	58.2	England
Wirral	97.1	67.7	98.5	0.0	26.7	58.0	England
Carsh	54.1	42.0	68.7	20.8	17.4	40.6	England
L Guys	96.2	13.9	54.3	1.5	1.1	33.4	England
Salford	99.1	14.4	0.9	0.0	0.0	22.9	England
Abrdn		100.0			100.0		Scotland
Airdrie		100.0			100.0		Scotland
D & Gall		100.0			100.0		Scotland
Dundee		100.0			100.0		Scotland
Edinb		100.0			100.0		Scotland
Glasgw		100.0			100.0		Scotland
Inverns		100.0			100.0		Scotland
Klmarnk		97.4			100.0		Scotland
Krkcldy		100.0			100.0		Scotland

[a]Data from these centres included a high proportion of patients whose primary renal diagnosis was 'uncertain'. This appears to have been largely because software in these centres was defaulting missing values to 'uncertain'. For these centres the value given is the percentage with a specific diagnosis

[b]As in previous UKRR reports, all 'first seen' dates have been set to 'missing' because at least 10% of the dates returned were identical to the date of start of RRT. Whilst it is possible to start RRT on the day of presentation, comparison with the data returned from other centres raises the possibility, requiring further investigation, of incorrect data entry or extraction from these centres

Renal Information Governance Board is appointed as the Lead for Governance, with the UKRR Director responsible for day to day management of governance compliance and the Head of Operations is the operational information governance lead. The Framework is based on good practice, as described in the Information Governance Framework [5] and the Research Governance Framework for Health and Social Care (2005). The UKRR has temporary exemption, granted by the Secretary of State under section 251 of The National Health Service Act (2006), to hold patient identifiable data. This exemption is reviewed annually. The UKRR has successfully completed the Connecting for Health information governance toolkit to a satisfactory standard.

As the UKRR's work expands, the importance of Information Governance only increases. These policies and procedures provide the solid reassurance to renal centres, auditors, patients and the public so that they can have faith in the system. As more and more pressure is exerted on health care spending, the role of the UKRR in monitoring equity of access to renal services and the quality of those services has never been greater.

Conflicts of interest: None

References

1 Fotheringham J, Jacques RM, Fogarty D, Tomson CR, El Nahas M, Campbell MJ: Variation in centre-specific survival in patients starting renal replacement therapy in England is explained by enhanced comorbidity information from hospitalization data. Nephrol Dial Transplant 2014;29(2): 422–30

2 Health and Social Care Information Centre: Release of health data to the UK Renal Registry (UKRR) Improvements in the analysis of renal care services for patients undergoing renal replacement therapy (RRT). 2014. http://www.hscic.gov.uk/casestudy/renalcareanalysis

3 House of Commons Health Select Committee: Handling of NHS patient data. 2014. http://www.parliament.uk/business/committees/committees-a-z/commons-select/health-committee/inquiries/parliament-2010/cdd-2014/

4 Partridge N. Data Release Review: 2014. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/367791/HSCIC_Data_Release_Review_PwC_Final_Report.pdf

5 Health and Social Care Information Centre. 2014

UK Renal Registry 17th Annual Report: Chapter 1 UK Renal Replacement Therapy Incidence in 2013: National and Centre-specific Analyses

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[a]UK Renal Registry, Bristol, UK; [b] Belfast Health and Social Care Trust

Key Words

Acceptance rates · Clinical Commissioning Group · Comorbidity · Diabetes · Dialysis · End stage renal disease · End stage renal failure · Established renal failure · Glomerulonephritis · Haemodialysis · Incidence · Peritoneal dialysis · Registries · Renal replacement therapy · Transplantation · Treatment modality

Summary

- In 2013 the incidence rate in the UK was stable at 109 per million population (pmp) reflecting renal replacement therapy (RRT) initiation for 7,006 new patients.
- From 2006 to 2013 the incidence rate pmp has remained stable for England.
- The median age of all incident patients was 64.5 years but this was highly dependant on ethnicity (66.0 for White incident patients; 57.0 for non-White patients).
- Diabetic renal disease remained the single most common cause of renal failure (25%).
- By 90 days, 66.1% of patients were on haemodialysis, 19.0% on peritoneal dialysis, 9.5% had a functioning transplant and 5.3% had died or stopped treatment.
- The mean eGFR at the start of RRT was 8.5 ml/min/1.73 m^2 similar to the previous four years.
- Late presentation (<90 days) fell from 23.9% in 2006 to 18.4% in 2013.

Introduction

This chapter contains analyses of adult patients starting renal replacement therapy (RRT) in the UK in 2013. The methodology and results for these analyses are in three separate sections: geographical variations in incidence rates, the demographic and clinical characteristics of patients starting RRT and analyses of late presentation and delayed referral.

Definitions

The definition of incident patients is given in detail in appendix B: Definitions and Analysis Criteria (www.renalreg.org). In brief, it is all patients over 18 who commenced RRT in the UK in 2013 and who did not recover renal function within 90 days. Note that this does not include those with a failed renal transplant who returned to dialysis.

Differences may be seen in the 2008 to 2012 numbers now quoted when compared with previous publications because of retrospective updating of data in collaboration with renal centres, in particular for patients who were initially thought to have acute renal failure. Where applicable and possible, pre-emptive transplant patients were allocated to their work up centre rather than their transplant centre. However, this was not possible for all such patients and consequently some patients probably remain incorrectly allocated to the transplanting centre. The term established renal failure (ERF) as used within this chapter is synonymous with the terms end stage renal failure/disease (ESRF or ESRD).

UK Renal Registry coverage

The UK Renal Registry (UKRR) received individual patient level data from all 71 adult renal centres in the UK (five renal centres in Wales, five in Northern Ireland, nine in Scotland, 52 in England). Data from centres in Scotland were obtained from the Scottish Renal Registry. Data on children and young adults can be found in chapter 4: Demography of the UK Paediatric Renal Replacement Therapy population in 2013.

Renal Association Guidelines

Table 1.1 lists the relevant items from the Renal Association Guidelines on the Planning, Initiating and

Table 1.1. Summary of Renal Association audit measures relevant to RRT incidence

RA audit measure	Reported	Reason for non-inclusion/comment
Percentage of patients commencing RRT referred <3 months and <12 months before date of starting RRT	Yes	Registry dataset allows reporting on time elapsed between date first seen and start of RRT
Percentage of incident RRT patients followed up for >3 months in dedicated pre-dialysis or low clearance clinic	No	Not in UKRR dataset
Proportion of incident patients on UK transplant waiting list at RRT initiation	No	Not in UKRR dataset
Proportion of incident RRT patients transplanted pre-emptively from living donors and cadaveric donors	Yes	
Mean eGFR at time of pre-emptive transplantation	No	Numbers with data will be small, the UKRR will consider doing a combined years analysis in future reports
Proportion of incident patients commencing peritoneal or home haemodialysis	Part	Proportion starting on PD is reported
Proportion of patients who have undergone a formal education programme prior to initiation of RRT	No	Not in UKRR dataset
Proportion of haemodialysis patients who report that they have been offered a choice of RRT modality	No	Not in UKRR dataset
Proportion of patients who have initiated dialysis in an unplanned fashion who have undergone formal education by 3 months.	No	Not in UKRR dataset
Evidence of formal continuing education programme for patients on dialysis	No	Not in UKRR dataset
Proportion of incident patients known to nephrology services for 3 months or more prior to initiation (planned initiation)	No	Not in UKRR dataset
Proportion of planned initiations with established access or pre-emptive transplantation	Yes	See appendix F for pre-emptive transplantation, and see chapter 10 for dialysis access
Inpatient/outpatient status of planned initiations	No	Not in UKRR dataset
Mean eGFR at start of renal replacement therapy	Part	Reported but not at centre level due to poor data completness

Table 1.2. Number of new adult patients starting RRT in the UK in 2013

	England	N Ireland	Scotland	Wales	**UK**
Number starting RRT	5,964	180	502	360	**7,006**
Total estimated population mid-2013 (millions)*	53.9	1.8	5.3	3.1	**64.1**
Incidence rate (pmp)	111	98	94	117	**109**
(95% CI)	(108–114)	(84–113)	(86–102)	(105–129)	**(107–112)**

*Data from the Office for National Statistics, National Records of Scotland and the Northern Ireland Statistics and Research Agency – based on the 2011 census

Withdrawal of Renal Replacement Therapy [1]. Many of the audit measures are not currently reported by the UKRR; mainly due to a high proportion of incomplete data or because the relevant data item(s) is not currently within the specified UKRR dataset. Over time we hope to work with the renal community to improve reporting across the range of these measures.

1. Geographical variation in incidence rates

Introduction

Over the years, there have been wide variations in incidence rates between renal centres. Equity of access to RRT is an important aim but hard to assess as the need for RRT depends on many variables including medical, social and demographic factors such as underlying conditions, age, gender, social deprivation and ethnicity. Thus, comparison of crude incidence rates by geographical area can be misleading. This year's report again uses age and gender standardisation of Clinical Commissioning Group/Health Board (CCG/HB) rates as well as showing crude rates. It also gives the ethnic minority percentage of each area as this influences incidence rates.

Methods

CCG/HB level

Crude incidence rates per million population (pmp) and age/gender standardised incidence ratios were calculated as detailed in appendix D: Methodology used for Analyses (www.renalreg.org).

Centre level

For the methodology used to estimate catchment populations see appendix E: Methodology for Estimating Catchment Populations (www.renalreg.org).

Results

Overall

In 2013, the number of adult patients starting RRT in the UK was 7,006 equating to an incidence rate of 109 pmp (table 1.2), compared with 108 pmp in 2012. Wales remained the country with the highest incidence rate (figure 1.1). For England, incidence rates have been stable for the last eight years. There continued to be very marked gender differences in incidence rates which were 141 pmp (95% CI 137–145) in males and 79 pmp (95% CI 76–82) in females.

The denominators used for these rates were the entire population i.e. they include under 18 year olds. When incident patients aged under 18 were included in the numerator the UK rate was 111 pmp.

CCG/HB level

Table 1.3 shows incidence rates and standardised incidence ratios for CCG/HBs. There were wide variations

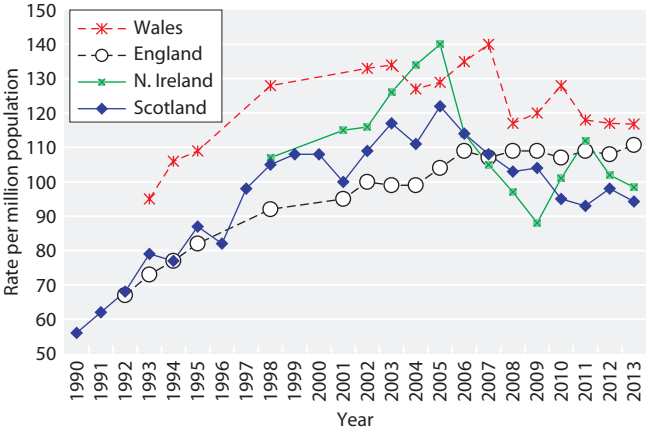

Fig. 1.1. RRT incidence rates in the countries of the UK 1990–2013

Table 1.3. Crude adult incidence rates (pmp) and age/gender standardised incidence ratios 2008–2013
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 – standardised incidence ratio
LCL – lower 95% confidence limit
UCL – upper 95% confidence limit
pmp – per million population
* – per year
Areas with significantly low incidence ratios over six years are italicised in greyed areas, those with significantly high incidence ratios over six years are bold in greyed areas. For the full methodology see appendix D
Confidence intervals are not given for the crude rates per million population but figures D1 and D2 in appendix D can be used to determine if a CCG/HB falls within the 95% confidence interval around the national average rate
Mid-2012 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

								2013		2008–2013				
UK Area	CCG/HB	Tot pop (2012)	2008 O/E	2009 O/E	2010 O/E	2011 O/E	2012 O/E	O/E	Crude rate pmp	O/E	LCL	UCL	Crude rate pmp*	% non-White
Cheshire, Warrington and Wirral	*NHS Eastern Cheshire*	*195,300*	*0.51*	*0.75*	*0.85*	*0.74*	*0.74*	*0.68*	*87*	*0.71*	*0.59*	*0.86*	*88*	*3.7*
	NHS South Cheshire	*176,800*	*0.61*	*0.70*	*0.71*	*0.74*	*0.59*	*1.15*	*136*	*0.75*	*0.61*	*0.92*	*86*	*2.9*
	NHS Vale Royal	102,100	0.54	0.88	0.81	0.87	0.78	1.27	147	0.86	0.67	1.11	96	2.1
	NHS Warrington	*203,700*	*0.61*	*1.01*	*0.61*	*0.46*	*0.86*	*0.67*	*74*	*0.70*	*0.57*	*0.86*	*75*	*4.1*
	NHS West Cheshire	228,100	0.61	0.90	1.18	1.04	0.81	1.01	123	0.92	0.79	1.08	109	2.8
	NHS Wirral	*320,200*	*0.72*	*0.81*	*0.88*	*0.94*	*0.59*	*0.99*	*119*	*0.82*	*0.71*	*0.95*	*95*	*3.0*
Durham, Darlington	NHS Darlington	105,200	1.05	0.95	0.97	0.94	1.27	0.83	95	1.00	0.79	1.26	111	3.8
	NHS Durham Dales, Easington and Sedgefield	273,000	0.71	0.98	1.03	1.09	0.84	1.00	121	0.94	0.81	1.09	110	1.2
	NHS Hartlepool and Stockton-on-Tees	284,600	1.01	0.69	0.81	0.91	1.04	0.86	95	0.89	0.76	1.03	95	4.4
	NHS North Durham	*241,300*	*0.68*	*0.52*	*0.49*	*0.55*	*1.28*	*0.64*	*75*	*0.69*	*0.58*	*0.84*	*78*	*2.5*
	NHS South Tees	273,700	1.03	0.77	1.06	0.93	0.96	1.20	135	0.99	0.86	1.15	108	6.7
Greater Manchester	NHS Bolton	279,000	0.89	0.84	1.40	0.94	0.90	0.82	86	0.96	0.83	1.12	99	18.1
	NHS Bury	186,200	0.78	0.82	0.73	0.71	1.35	0.79	86	0.86	0.71	1.05	91	10.8
	NHS Central Manchester	**182,400**	**2.20**	**1.79**	**2.08**	**1.11**	**1.70**	**2.22**	**154**	**1.85**	**1.56**	**2.18**	**125**	**48.0**
	NHS Heywood, Middleton & Rochdale	212,000	1.01	1.14	0.82	1.22	1.26	1.10	113	1.09	0.92	1.29	109	18.3
	NHS North Manchester	**167,100**	**0.99**	**1.68**	**0.93**	**1.50**	**1.43**	**1.48**	**120**	**1.34**	**1.11**	**1.62**	**106**	**30.8**
	NHS Oldham	225,900	1.15	0.86	0.88	1.03	0.71	0.96	97	0.93	0.78	1.11	91	22.5
	NHS Salford	237,100	1.07	0.97	1.39	0.74	0.87	1.11	110	1.02	0.87	1.21	98	9.9
	NHS South Manchester	161,300	0.90	0.89	0.99	1.17	1.18	1.23	105	1.06	0.86	1.31	89	19.6
	NHS Stockport	*283,900*	*0.80*	*0.53*	*0.92*	*0.87*	*0.64*	*0.51*	*60*	*0.71*	*0.60*	*0.84*	*80*	*7.9*
	NHS Tameside and Glossop	253,400	0.69	0.86	0.96	0.97	0.59	1.12	122	0.87	0.73	1.02	91	8.2
	NHS Trafford	228,500	0.55	1.08	1.28	0.54	1.15	1.13	123	0.96	0.81	1.13	101	14.5
	NHS Wigan Borough	*318,700*	*0.79*	*0.58*	*0.77*	*1.04*	*0.77*	*0.73*	*82*	*0.78*	*0.67*	*0.91*	*85*	*2.7*
Lancashire	NHS Blackburn with Darwen	147,700	0.52	0.88	1.04	1.44	1.22	0.91	88	1.00	0.81	1.24	94	30.8
	NHS Blackpool	142,000	1.00	0.98	0.62	0.85	1.45	1.12	134	1.01	0.83	1.22	116	3.3
	NHS Chorley and South Ribble	167,900	0.83	1.30	0.55	1.02	0.75	1.31	149	0.96	0.80	1.16	106	2.9
	NHS East Lancashire	*371,600*	*0.71*	*0.85*	*0.74*	*0.92*	*0.54*	*0.89*	*100*	*0.78*	*0.67*	*0.90*	*84*	*11.9*
	NHS Fylde & Wyre	*165,000*	*0.70*	*0.86*	*0.69*	*0.54*	*0.76*	*0.79*	*109*	*0.73*	*0.59*	*0.89*	*97*	*2.1*
	NHS Greater Preston	*202,000*	*0.88*	*0.67*	*0.54*	*0.52*	*1.00*	*0.84*	*89*	*0.74*	*0.61*	*0.91*	*77*	*14.7*
	NHS Lancashire North	*158,500*	*0.34*	*0.62*	*0.57*	*1.00*	*0.66*	*0.60*	*69*	*0.63*	*0.50*	*0.80*	*71*	*4.0*
	NHS West Lancashire	*110,900*	*1.03*	*0.62*	*0.63*	*0.84*	*0.76*	*0.67*	*81*	*0.76*	*0.59*	*0.98*	*89*	*1.9*
Merseyside	NHS Halton	125,700	0.31	1.07	0.86	1.59	0.97	0.95	103	0.96	0.77	1.20	101	2.2
	NHS Knowsley	145,900	0.46	0.78	0.93	1.16	1.28	0.69	75	0.89	0.71	1.10	94	2.8
	NHS Liverpool	469,700	1.16	1.19	0.87	1.08	1.19	0.98	98	1.08	0.96	1.21	105	11.1
	NHS South Sefton	159,400	1.12	0.77	1.28	1.36	1.02	1.27	151	1.14	0.95	1.35	131	2.2
	NHS Southport and Formby	114,300	0.55	0.80	0.61	0.93	0.73	1.36	184	0.84	0.67	1.05	109	3.1
	NHS St Helens	*176,100*	*0.76*	*0.70*	*0.92*	*0.74*	*0.88*	*0.63*	*74*	*0.77*	*0.63*	*0.94*	*88*	*2.0*

Table 1.3. Continued

UK Area	CCG/HB	Tot pop (2012)	2008 O/E	2009 O/E	2010 O/E	2011 O/E	2012 O/E	2013		2008–2013				% non-White
								O/E	Crude rate pmp	O/E	LCL	UCL	Crude rate pmp*	
Cumbria, Northumberland, Tyne and Wear	*NHS Cumbria*	*505,200*	*0.70*	*0.61*	*0.73*	*0.59*	*0.61*	*0.89*	*115*	*0.69*	*0.61*	*0.78*	*86*	*1.5*
	NHS Gateshead	*200,200*	*0.55*	*0.89*	*0.78*	*0.75*	*0.88*	*0.48*	*55*	*0.72*	*0.59*	*0.88*	*81*	*3.7*
	NHS Newcastle North and East	141,600	0.96	1.03	0.88	0.85	0.70	0.46	42	0.81	0.63	1.04	73	10.7
	NHS Newcastle West	140,900	1.25	0.87	0.67	0.86	0.86	0.91	92	0.90	0.72	1.13	89	18.3
	NHS North Tyneside	*201,400*	*0.50*	*0.89*	*0.90*	*0.62*	*0.87*	*0.94*	*109*	*0.79*	*0.65*	*0.95*	*89*	*3.4*
	NHS Northumberland	*316,100*	*0.68*	*0.62*	*0.60*	*0.82*	*0.78*	*0.62*	*79*	*0.69*	*0.59*	*0.80*	*85*	*1.6*
	NHS South Tyneside	148,400	0.55	1.31	0.73	1.06	0.59	0.75	88	0.83	0.67	1.03	94	4.1
	NHS Sunderland	*275,700*	*0.87*	*0.95*	*1.04*	*0.75*	*0.87*	*0.57*	*65*	*0.84*	*0.72*	*0.98*	*93*	*4.1*
North Yorkshire and Humber	*NHS East Riding of Yorkshire*	*314,500*	*1.00*	*0.93*	*0.69*	*0.72*	*0.74*	*0.48*	*64*	*0.76*	*0.65*	*0.88*	*96*	*1.9*
	NHS Hambleton, Richmondshire and Whitby	153,400	0.60	0.90	0.76	0.68	1.25	0.92	117	0.85	0.70	1.04	105	2.7
	NHS Harrogate and Rural District	*158,600*	*0.65*	*1.01*	*0.65*	*0.95*	*0.89*	*0.52*	*63*	*0.78*	*0.63*	*0.96*	*92*	*3.7*
	NHS Hull	257,200	1.06	1.00	0.94	0.75	0.79	0.93	93	0.91	0.77	1.08	89	5.9
	NHS North East Lincolnshire	159,700	1.09	0.85	0.69	1.34	0.67	0.82	94	0.91	0.74	1.11	101	2.6
	NHS North Lincolnshire	168,400	0.90	0.73	0.69	1.50	1.13	1.06	125	1.00	0.84	1.20	115	4.0
	NHS Scarborough and Ryedale	*110,500*	*0.80*	*0.92*	*0.58*	*0.56*	*0.91*	*0.69*	*91*	*0.74*	*0.58*	*0.95*	*95*	*2.5*
	NHS Vale of York	*346,100*	*0.74*	*0.65*	*0.69*	*1.08*	*0.92*	*0.78*	*90*	*0.81*	*0.70*	*0.93*	*91*	*4.0*
South Yorkshire and Bassetlaw	NHS Barnsley	233,700	1.10	0.93	1.18	0.80	1.03	1.01	116	1.01	0.86	1.18	112	2.1
	NHS Bassetlaw	113,200	0.61	0.68	0.92	0.82	1.04	1.23	150	0.89	0.70	1.12	105	2.6
	NHS Doncaster	302,700	0.80	1.03	0.93	1.05	0.81	1.14	129	0.96	0.83	1.11	105	4.7
	NHS Rotherham	258,400	1.39	0.95	1.11	0.69	0.83	0.78	89	0.95	0.82	1.11	106	6.4
	NHS Sheffield	**557,400**	**1.14**	**1.29**	**1.05**	**1.00**	**1.23**	**0.97**	**99**	**1.11**	**1.00**	**1.23**	**111**	**16.3**
West Yorkshire	*NHS Airedale, Wharfedale and Craven*	*158,200*	*0.56*	*1.03*	*0.56*	*0.49*	*0.64*	*0.84*	*101*	*0.69*	*0.55*	*0.86*	*80*	*11.1*
	NHS Bradford City	**82,300**	**2.10**	**0.38**	**3.32**	**1.87**	**2.66**	**2.60**	**170**	**2.15**	**1.70**	**2.73**	**138**	**72.2**
	NHS Bradford Districts	**333,500**	**1.26**	**0.96**	**1.21**	**1.08**	**1.35**	**1.05**	**102**	**1.15**	**1.01**	**1.31**	**108**	**28.7**
	NHS Calderdale	*205,300*	*0.89*	*0.97*	*0.52*	*0.59*	*0.77*	*1.06*	*117*	*0.80*	*0.66*	*0.97*	*85*	*10.3*
	NHS Greater Huddersfield	238,800	0.61	0.76	0.82	0.91	1.10	0.89	96	0.85	0.71	1.01	89	17.4
	NHS Leeds North	199,600	1.40	0.73	0.65	0.81	0.77	0.84	95	0.86	0.72	1.04	95	17.4
	NHS Leeds South and East	238,300	1.13	0.67	0.73	0.97	0.75	0.95	92	0.86	0.72	1.03	82	18.3
	NHS Leeds West	*319,800*	*0.69*	*0.96*	*0.59*	*0.64*	*0.71*	*1.13*	*106*	*0.79*	*0.67*	*0.93*	*72*	*10.8*
	NHS North Kirklees	186,700	0.94	1.47	1.06	1.24	0.54	1.48	150	1.12	0.94	1.34	111	25.3
	NHS Wakefield	*327,600*	*0.76*	*0.58*	*0.88*	*0.91*	*1.07*	*0.86*	*98*	*0.84*	*0.73*	*0.98*	*93*	*4.6*
Arden, Herefordshire and Worcestershire	**NHS Coventry and Rugby**	**423,900**	**1.32**	**1.62**	**1.33**	**1.43**	**1.74**	**1.26**	**127**	**1.45**	**1.31**	**1.61**	**142**	**22.2**
	NHS Herefordshire	184,900	0.93	1.13	0.71	0.82	0.90	0.76	97	0.87	0.73	1.04	109	1.8
	NHS Redditch and Bromsgrove	178,700	1.17	1.30	0.97	0.79	1.23	0.67	78	1.02	0.85	1.22	115	6.0
	NHS South Warwickshire	*259,200*	*0.88*	*0.79*	*0.74*	*1.01*	*0.65*	*0.57*	*69*	*0.77*	*0.66*	*0.91*	*91*	*7.0*
	NHS South Worcestershire	*292,300*	*0.82*	*0.86*	*0.70*	*0.71*	*0.84*	*0.75*	*92*	*0.78*	*0.67*	*0.91*	*94*	*3.7*
	NHS Warwickshire North	188,000	1.31	0.96	1.61	1.09	0.80	0.69	80	1.07	0.90	1.27	120	6.5
	NHS Wyre Forest	98,100	1.01	1.24	0.93	1.06	0.89	0.64	82	0.96	0.76	1.21	119	2.8
Birmingham and the Black Country	**NHS Birmingham CrossCity**	**721,400**	**1.84**	**1.52**	**1.38**	**1.62**	**1.48**	**1.41**	**133**	**1.54**	**1.42**	**1.67**	**141**	**35.2**
	NHS Birmingham South and Central	**199,600**	**1.47**	**1.85**	**1.47**	**1.82**	**1.55**	**1.68**	**150**	**1.64**	**1.41**	**1.91**	**143**	**40.4**
	NHS Dudley	313,600	0.89	1.38	0.80	0.84	1.19	1.09	128	1.03	0.90	1.18	117	10.0
	NHS Sandwell and West Birmingham	**475,700**	**2.45**	**2.04**	**1.82**	**1.69**	**1.46**	**1.45**	**135**	**1.81**	**1.66**	**1.99**	**163**	**45.3**
	NHS Solihull	207,400	1.03	1.35	0.99	0.67	0.99	0.89	106	0.98	0.84	1.16	113	10.9
	NHS Walsall	**270,900**	**1.35**	**1.08**	**1.93**	**1.21**	**1.34**	**1.56**	**170**	**1.41**	**1.24**	**1.60**	**149**	**21.1**
	NHS Wolverhampton	**251,000**	**1.42**	**1.12**	**1.46**	**1.15**	**1.49**	**1.05**	**112**	**1.28**	**1.12**	**1.47**	**132**	**32.0**

Table 1.3. Continued

UK Area	CCG/HB	Tot pop (2012)	2008 O/E	2009 O/E	2010 O/E	2011 O/E	2012 O/E	2013		2008–2013				% non-White
								O/E	Crude rate pmp	O/E	LCL	UCL	Crude rate pmp*	
Derbyshire and Notting-hamshire	NHS Erewash	94,600	1.28	1.35	0.89	1.15	1.33	1.30	148	1.22	0.97	1.52	134	3.2
	NHS Hardwick	108,900	1.04	1.02	0.40	0.70	0.85	0.76	92	0.80	0.62	1.02	93	1.8
	NHS Mansfield & Ashfield	192,500	0.91	1.09	0.92	0.75	0.83	0.82	93	0.88	0.74	1.06	98	2.5
	NHS Newark & Sherwood	115,900	0.97	0.95	0.97	1.30	0.93	0.49	60	0.93	0.75	1.17	111	2.4
	NHS North Derbyshire	*272,100*	*0.87*	*0.49*	*0.68*	*0.93*	*0.77*	*0.73*	*92*	*0.75*	*0.63*	*0.88*	*91*	*2.5*
	NHS Nottingham City	**308,700**	**1.33**	**1.28**	**1.58**	**1.10**	**1.23**	**1.28**	**110**	**1.30**	**1.13**	**1.49**	**109**	**28.5**
	NHS Nottingham North & East	146,200	0.80	1.21	0.87	0.78	0.72	0.70	82	0.85	0.68	1.05	96	6.2
	NHS Nottingham West	110,700	1.04	1.10	0.97	0.55	1.08	1.22	145	0.99	0.79	1.24	114	7.3
	NHS Rushcliffe	111,600	0.95	0.78	0.95	1.15	0.38	1.05	125	0.88	0.69	1.11	102	6.9
	NHS Southern Derbyshire	515,300	1.44	1.07	0.96	1.04	1.13	0.88	97	1.09	0.98	1.20	116	11.0
East Anglia	*NHS Cambridgeshire and Peterborough*	*849,000*	*0.78*	*1.06*	*0.77*	*0.91*	*0.67*	*1.09*	*118*	*0.88*	*0.81*	*0.97*	*92*	*9.5*
	NHS Great Yarmouth & Waveney	213,200	1.11	0.86	1.06	1.14	0.95	0.87	113	1.00	0.85	1.16	126	2.7
	NHS Ipswich and East Suffolk	*395,700*	*0.83*	*0.84*	*0.68*	*0.62*	*0.89*	*0.89*	*109*	*0.79*	*0.69*	*0.90*	*94*	*5.6*
	NHS North Norfolk	*167,900*	*1.00*	*0.47*	*0.78*	*0.51*	*0.71*	*0.86*	*125*	*0.72*	*0.59*	*0.87*	*101*	*1.5*
	NHS Norwich	193,400	1.00	1.18	1.15	1.07	0.87	0.71	78	0.99	0.83	1.19	105	7.3
	NHS South Norfolk	*235,200*	*0.49*	*0.59*	*0.67*	*0.96*	*0.82*	*0.97*	*123*	*0.75*	*0.63*	*0.89*	*93*	*2.6*
	NHS West Norfolk	*171,300*	*1.20*	*0.67*	*0.82*	*0.62*	*0.66*	*0.61*	*82*	*0.76*	*0.63*	*0.92*	*99*	*2.6*
	NHS West Suffolk	*221,000*	*0.52*	*0.87*	*0.84*	*0.70*	*0.89*	*0.84*	*100*	*0.78*	*0.65*	*0.93*	*90*	*4.6*
Essex	NHS Basildon and Brentwood	250,500	0.95	0.89	0.83	1.03	1.24	0.86	96	0.97	0.83	1.13	104	7.1
	NHS Castle Point, Rayleigh and Rochford	*172,100*	*0.62*	*0.56*	*0.86*	*0.74*	*0.69*	*1.18*	*151*	*0.78*	*0.64*	*0.95*	*97*	*3.0*
	NHS Mid Essex	*379,600*	*0.84*	*0.85*	*0.84*	*0.98*	*0.81*	*0.71*	*82*	*0.84*	*0.73*	*0.96*	*94*	*4.4*
	NHS North East Essex	314,300	1.64	0.86	0.98	1.25	0.95	0.86	105	1.09	0.96	1.23	129	5.5
	NHS Southend	174,800	1.24	0.63	0.65	0.84	0.94	1.17	132	0.91	0.75	1.10	99	8.4
	NHS Thurrock	159,500	1.50	0.47	1.17	1.20	0.79	0.91	88	1.00	0.82	1.23	94	14.1
	NHS West Essex	*290,000*	*0.42*	*0.83*	*0.65*	*0.72*	*1.19*	*0.98*	*110*	*0.80*	*0.68*	*0.94*	*87*	*8.2*
Hertford-shire and the South Midlands	*NHS Bedfordshire*	*419,200*	*0.71*	*0.86*	*0.90*	*0.74*	*1.00*	*1.06*	*117*	*0.88*	*0.77*	*1.00*	*93*	*11.2*
	NHS Corby	63,100	1.67	1.31	1.34	1.14	0.81	0.63	63	1.14	0.85	1.55	111	4.5
	NHS East and North Hertfordshire	*540,700*	*0.74*	*0.70*	*0.89*	*1.06*	*0.70*	*1.10*	*118*	*0.87*	*0.77*	*0.97*	*90*	*10.4*
	NHS Herts Valleys	569,900	1.06	0.92	0.86	0.78	0.89	0.93	98	0.91	0.81	1.01	93	14.6
	NHS Luton	**205,800**	**1.08**	**1.07**	**1.09**	**1.39**	**1.22**	**2.12**	**189**	**1.33**	**1.13**	**1.57**	**116**	**45.3**
	NHS Milton Keynes	257,900	0.91	0.90	1.05	0.98	1.14	0.91	85	0.98	0.83	1.16	89	19.6
	NHS Nene	621,800	1.17	0.81	0.75	0.90	1.07	0.98	106	0.95	0.86	1.05	100	9.1
Leicester-shire and Lincolnshire	*NHS East Leicestershire and Rutland*	*319,500*	*0.60*	*0.54*	*0.71*	*0.69*	*0.98*	*0.93*	*113*	*0.75*	*0.64*	*0.87*	*87*	*9.8*
	NHS Leicester City	**331,600**	**1.48**	**1.50**	**1.71**	**1.79**	**1.62**	**1.73**	**151**	**1.64**	**1.46**	**1.84**	**139**	**49.5**
	NHS Lincolnshire East	*228,100*	*0.70*	*0.69*	*0.77*	*0.88*	*0.74*	*1.11*	*153*	*0.82*	*0.70*	*0.96*	*110*	*2.0*
	NHS Lincolnshire West	*227,700*	*0.64*	*0.63*	*0.64*	*0.74*	*0.42*	*0.80*	*92*	*0.64*	*0.53*	*0.79*	*72*	*3.0*
	NHS South Lincolnshire	141,000	0.59	0.81	1.24	0.97	0.96	0.67	85	0.87	0.71	1.07	108	2.3
	NHS South West Lincolnshire	122,000	0.70	0.96	0.91	0.95	0.68	0.86	107	0.85	0.67	1.06	101	2.3
	NHS West Leicestershire	*374,200*	*0.79*	*0.97*	*1.11*	*0.91*	*0.52*	*0.82*	*94*	*0.85*	*0.74*	*0.97*	*94*	*6.9*
Shropshire and Staffordshire	NHS Cannock Chase	132,800	1.04	0.48	1.12	1.15	0.81	0.99	113	0.93	0.75	1.16	103	2.4
	NHS East Staffordshire	123,900	0.60	0.66	1.42	0.95	0.72	1.13	129	0.91	0.73	1.15	101	9.0
	NHS North Staffordshire	213,200	0.89	1.11	0.69	1.10	0.58	0.84	103	0.87	0.73	1.03	103	3.5
	NHS Shropshire	308,200	1.05	0.69	0.92	0.94	0.75	1.02	130	0.90	0.78	1.03	110	2.0
	NHS South East Staffs and Seisdon and Peninsular	222,800	1.22	0.81	0.71	0.99	0.72	0.63	76	0.84	0.71	1.00	99	3.6
	NHS Stafford and Surrounds	151,100	0.56	1.10	1.12	0.82	0.92	0.85	106	0.89	0.73	1.09	108	4.7
	NHS Stoke on Trent	258,100	0.99	1.38	1.37	1.03	0.85	1.05	112	1.11	0.96	1.28	116	11.0
	NHS Telford & Wrekin	**167,700**	**1.02**	**1.24**	**1.45**	**1.11**	**1.22**	**1.37**	**143**	**1.24**	**1.04**	**1.47**	**125**	**7.3**

Table 1.3. Continued

UK Area	CCG/HB	Tot pop (2012)	2008 O/E	2009 O/E	2010 O/E	2011 O/E	2012 O/E	2013		2008–2013				% non-White
								O/E	Crude rate pmp	O/E	LCL	UCL	Crude rate pmp*	
London	**NHS Barking & Dagenham**	**190,600**	**1.78**	**1.42**	**1.38**	**1.67**	**2.07**	**1.71**	**136**	**1.67**	**1.42**	**1.96**	**130**	**41.7**
	NHS Barnet	**364,000**	**1.43**	**1.25**	**1.78**	**1.45**	**1.53**	**1.30**	**124**	**1.46**	**1.30**	**1.63**	**134**	**35.9**
	NHS Camden	**225,000**	**1.05**	**1.46**	**1.71**	**1.18**	**1.24**	**1.42**	**124**	**1.34**	**1.15**	**1.57**	**115**	**33.7**
	NHS City and Hackney	**259,700**	**1.34**	**1.92**	**1.65**	**1.79**	**2.17**	**2.02**	**150**	**1.82**	**1.59**	**2.09**	**132**	**44.6**
	NHS Enfield	**317,300**	**1.37**	**1.35**	**1.38**	**2.00**	**1.64**	**1.68**	**154**	**1.57**	**1.39**	**1.77**	**140**	**39.0**
	NHS Haringey	**258,900**	**1.62**	**1.02**	**1.50**	**1.78**	**2.41**	**2.36**	**193**	**1.79**	**1.57**	**2.04**	**142**	**39.5**
	NHS Havering	*239,700*	*0.78*	*0.69*	*0.35*	*1.18*	*1.06*	*0.81*	*92*	*0.81*	*0.68*	*0.97*	*89*	*12.3*
	NHS Islington	**211,000**	**1.03**	**1.51**	**1.55**	**1.61**	**2.15**	**1.52**	**123**	**1.56**	**1.34**	**1.83**	**123**	**31.8**
	NHS Newham	**314,100**	**1.68**	**2.15**	**2.40**	**2.30**	**2.08**	**2.40**	**169**	**2.17**	**1.93**	**2.44**	**149**	**71.0**
	NHS Redbridge	**284,600**	**1.63**	**1.77**	**1.57**	**1.40**	**2.19**	**2.07**	**186**	**1.77**	**1.57**	**2.00**	**155**	**57.5**
	NHS Tower Hamlets	**263,000**	**1.91**	**1.80**	**1.55**	**1.83**	**2.15**	**2.44**	**163**	**1.95**	**1.70**	**2.24**	**128**	**54.8**
	NHS Waltham Forest	**262,600**	**1.32**	**1.40**	**1.25**	**1.85**	**1.30**	**1.72**	**145**	**1.48**	**1.28**	**1.70**	**121**	**47.8**
	NHS Brent	**314,700**	**1.92**	**2.24**	**2.71**	**2.14**	**2.50**	**2.02**	**178**	**2.25**	**2.03**	**2.50**	**193**	**63.7**
	NHS Central London (Westminster)	**161,000**	**1.22**	**1.40**	**1.37**	**1.39**	**1.32**	**1.49**	**143**	**1.37**	**1.14**	**1.63**	**127**	**36.2**
	NHS Ealing	**340,700**	**1.44**	**2.34**	**2.02**	**1.92**	**2.28**	**1.68**	**150**	**1.95**	**1.75**	**2.16**	**169**	**51.0**
	NHS Hammersmith and Fulham	**179,900**	**0.56**	**1.31**	**1.56**	**1.50**	**1.51**	**1.01**	**83**	**1.24**	**1.03**	**1.50**	**100**	**31.9**
	NHS Harrow	**242,400**	**1.51**	**2.08**	**2.13**	**2.23**	**1.59**	**1.11**	**111**	**1.77**	**1.57**	**2.01**	**173**	**57.8**
	NHS Hillingdon	**281,800**	**1.26**	**1.24**	**1.51**	**1.50**	**1.53**	**1.47**	**138**	**1.42**	**1.24**	**1.62**	**130**	**39.4**
	NHS Hounslow	**259,100**	**1.10**	**1.63**	**1.86**	**1.88**	**1.79**	**2.10**	**185**	**1.73**	**1.52**	**1.97**	**148**	**48.6**
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	**218,800**	**1.62**	**1.20**	**1.28**	**1.24**	**0.94**	**1.02**	**96**	**1.21**	**1.03**	**1.43**	**111**	**33.4**
	NHS Bexley	234,300	1.19	1.29	1.36	1.20	0.86	1.05	111	1.16	0.99	1.34	119	18.1
	NHS Bromley	314,000	1.26	0.99	1.13	0.71	0.71	0.81	89	0.93	0.81	1.08	99	15.7
	NHS Croydon	**368,900**	**1.52**	**1.64**	**1.44**	**1.27**	**2.03**	**1.93**	**182**	**1.64**	**1.47**	**1.83**	**150**	**44.9**
	NHS Greenwich	**260,100**	**1.61**	**1.36**	**2.12**	**1.07**	**1.25**	**2.37**	**200**	**1.63**	**1.43**	**1.87**	**134**	**37.5**
	NHS Kingston	163,900	1.35	0.93	0.89	0.99	1.12	1.10	104	1.06	0.87	1.30	98	25.5
	NHS Lambeth	**310,200**	**1.64**	**1.89**	**1.42**	**1.83**	**1.71**	**1.34**	**103**	**1.64**	**1.44**	**1.86**	**123**	**42.9**
	NHS Lewisham	**281,600**	**1.56**	**2.29**	**1.54**	**1.84**	**1.92**	**1.54**	**128**	**1.78**	**1.57**	**2.02**	**144**	**46.5**
	NHS Merton	**202,200**	**1.75**	**1.39**	**1.20**	**1.55**	**1.71**	**1.08**	**99**	**1.45**	**1.24**	**1.69**	**129**	**35.1**
	NHS Richmond	*189,100*	*0.66*	*0.81*	*0.89*	*0.70*	*0.80*	*0.95*	*95*	*0.80*	*0.65*	*0.99*	*78*	*14.0*
	NHS Southwark	**293,500**	**2.14**	**1.54**	**1.95**	**2.06**	**1.84**	**2.28**	**177**	**1.97**	**1.74**	**2.22**	**149**	**45.8**
	NHS Sutton	**193,600**	**1.44**	**0.99**	**1.44**	**1.30**	**1.55**	**0.86**	**88**	**1.26**	**1.07**	**1.48**	**125**	**21.4**
	NHS Wandsworth	**308,300**	**1.42**	**1.99**	**1.50**	**1.23**	**1.27**	**0.93**	**75**	**1.39**	**1.21**	**1.59**	**109**	**28.6**
Bath, Gloucestershire, and Wiltshire	NHS Bath and North East Somerset	177,600	0.74	1.24	0.63	0.56	0.91	0.95	107	0.84	0.69	1.02	92	5.4
	NHS Gloucestershire	602,200	0.63	1.14	0.90	0.89	1.18	0.73	86	0.91	0.82	1.01	105	4.6
	NHS Swindon	217,200	1.08	1.07	1.04	1.15	1.23	0.94	97	1.09	0.92	1.28	108	10.0
	NHS Wiltshire	*476,800*	*0.83*	*0.78*	*0.81*	*0.64*	*0.49*	*0.79*	*92*	*0.72*	*0.64*	*0.82*	*82*	*3.4*
Bristol, North Somerset, Somerset and South Gloucestershire	**NHS Bristol**	**432,500**	**1.53**	**1.28**	**1.49**	**1.41**	**1.24**	**1.36**	**127**	**1.38**	**1.24**	**1.54**	**126**	**16.0**
	NHS North Somerset	204,400	1.28	0.96	0.99	0.88	0.99	1.05	132	1.02	0.87	1.20	125	2.7
	NHS Somerset	*535,000*	*0.79*	*1.08*	*1.09*	*0.83*	*0.67*	*0.56*	*71*	*0.84*	*0.75*	*0.93*	*103*	*2.0*
	NHS South Gloucestershire	266,100	0.92	0.66	1.09	0.62	0.82	1.17	132	0.88	0.75	1.03	96	5.0
Devon, Cornwall and Isles of Scilly	NHS Kernow	540,200	0.91	1.07	0.89	0.81	0.96	0.87	113	0.92	0.83	1.02	115	1.8
	NHS North, East, West Devon	869,400	1.10	1.06	1.00	0.92	1.00	0.84	104	0.98	0.91	1.07	117	3.0
	NHS South Devon and Torbay	273,300	1.43	0.87	1.26	0.89	1.07	1.00	135	1.08	0.95	1.23	142	2.1

Table 1.3. Continued

UK Area	CCG/HB	Tot pop (2012)	2008 O/E	2009 O/E	2010 O/E	2011 O/E	2012 O/E	2013		2008–2013				% non-White
								O/E	Crude rate pmp	O/E	LCL	UCL	Crude rate pmp*	
Kent and Medway	NHS Ashford	120,100	1.50	1.01	0.95	0.85	1.29	1.12	125	1.12	0.91	1.38	121	6.3
	NHS Canterbury and Coastal	200,300	0.91	1.07	0.96	0.84	0.57	0.95	110	0.88	0.74	1.06	99	5.9
	NHS Dartford, Gravesham and Swanley	249,200	1.09	1.18	0.98	0.91	0.98	1.44	156	1.10	0.95	1.27	116	13.0
	NHS Medway	268,200	0.69	0.91	0.74	0.94	0.78	1.10	112	0.86	0.73	1.02	85	10.4
	NHS South Kent Coast	203,000	1.09	0.70	0.92	1.02	0.61	0.79	99	0.85	0.72	1.02	103	4.5
	NHS Swale	108,200	1.41	1.31	1.07	0.60	1.37	0.84	92	1.10	0.88	1.37	117	3.8
	NHS Thanet	**135,700**	**1.21**	**1.18**	**1.46**	**0.86**	**1.04**	**1.69**	**206**	**1.24**	**1.04**	**1.48**	**147**	**4.5**
	NHS West Kent	*463,700*	*0.97*	*0.81*	*0.75*	*0.86*	*0.60*	*0.70*	*80*	*0.78*	*0.69*	*0.89*	*86*	*4.9*
Surrey and Sussex	NHS Brighton & Hove	275,800	1.07	1.13	0.84	0.92	1.16	0.79	76	0.98	0.84	1.15	92	10.9
	NHS Coastal West Sussex	*476,700*	*0.87*	*0.68*	*0.51*	*0.65*	*0.79*	*0.79*	*105*	*0.72*	*0.63*	*0.81*	*92*	*3.8*
	NHS Crawley	108,300	1.22	1.51	1.95	0.50	0.79	1.07	102	1.17	0.92	1.48	108	20.1
	NHS East Surrey	175,900	0.65	0.69	1.31	0.74	1.26	0.98	108	0.94	0.78	1.14	100	8.3
	NHS Eastbourne, Hailsham and Seaford	182,000	0.74	0.51	0.60	0.84	1.13	1.19	159	0.84	0.70	1.00	109	4.4
	NHS Guildford and Waverley	205,900	1.06	0.99	0.69	0.71	1.15	0.52	58	0.85	0.71	1.03	92	7.2
	NHS Hastings & Rother	181,400	0.85	0.61	0.80	0.95	0.78	1.18	154	0.87	0.72	1.04	109	4.6
	NHS High Weald Lewes Havens	*167,800*	*0.55*	*0.74*	*0.65*	*0.68*	*0.92*	*0.62*	*77*	*0.69*	*0.56*	*0.86*	*84*	*3.1*
	NHS Horsham and Mid Sussex	*223,300*	*0.74*	*0.76*	*0.74*	*0.80*	*0.51*	*0.77*	*90*	*0.72*	*0.60*	*0.87*	*81*	*4.9*
	NHS North West Surrey	338,200	0.96	0.83	1.13	1.29	0.90	0.94	103	1.01	0.88	1.15	108	12.5
	NHS Surrey Downs	282,700	0.83	1.09	0.95	0.95	0.89	1.05	124	0.96	0.83	1.11	110	9.1
	NHS Surrey Heath	94,100	1.08	1.16	0.79	0.77	0.67	0.47	53	0.82	0.62	1.08	90	9.3
Thames Valley	*NHS Aylesbury Vale*	*196,400*	*0.83*	*0.58*	*0.98*	*1.05*	*0.76*	*0.70*	*76*	*0.82*	*0.67*	*0.99*	*87*	*9.7*
	NHS Bracknell and Ascot	132,900	1.02	0.77	1.03	0.77	0.38	1.19	120	0.86	0.68	1.09	84	9.5
	NHS Chiltern	*317,900*	*0.79*	*1.14*	*0.67*	*0.68*	*0.73*	*0.97*	*110*	*0.83*	*0.72*	*0.97*	*92*	*15.8*
	NHS Newbury and District	105,100	0.74	1.09	0.65	0.63	0.71	1.14	124	0.83	0.64	1.08	87	4.4
	NHS North & West Reading	*99,300*	*1.15*	*0.28*	*0.29*	*0.93*	*0.93*	*0.64*	*70*	*0.70*	*0.53*	*0.94*	*76*	*10.4*
	NHS Oxfordshire	647,100	0.67	1.01	0.91	1.01	0.98	0.89	96	0.91	0.83	1.01	95	9.3
	NHS Slough	**141,800**	**2.36**	**1.88**	**2.12**	**2.22**	**1.77**	**1.74**	**141**	**2.01**	**1.70**	**2.38**	**159**	**54.3**
	NHS South Reading	**107,200**	**2.28**	**1.31**	**1.34**	**1.17**	**1.18**	**2.43**	**196**	**1.62**	**1.31**	**2.01**	**128**	**30.5**
	NHS Windsor, Ascot and Maidenhead	139,000	0.63	1.17	0.91	1.23	0.61	1.33	144	0.98	0.80	1.21	103	14.7
	NHS Wokingham	156,700	0.86	0.78	0.80	1.32	0.47	0.87	96	0.85	0.69	1.05	90	11.6
Wessex	*NHS Dorset*	*750,300*	*0.83*	*0.63*	*0.61*	*0.72*	*0.71*	*0.72*	*93*	*0.70*	*0.64*	*0.78*	*88*	*4.0*
	NHS Fareham and Gosport	196,100	0.63	1.10	1.12	0.78	0.78	1.10	133	0.92	0.77	1.10	107	3.4
	NHS Isle of Wight	*138,700*	*0.28*	*0.17*	*0.62*	*0.76*	*0.87*	*1.28*	*173*	*0.67*	*0.53*	*0.84*	*88*	*2.7*
	NHS North East Hampshire and Farnham	206,800	1.54	0.90	0.87	0.84	1.16	1.19	126	1.08	0.91	1.28	111	9.7
	NHS North Hampshire	*216,200*	*0.45*	*0.53*	*0.77*	*0.70*	*0.48*	*0.72*	*79*	*0.61*	*0.49*	*0.75*	*64*	*6.4*
	NHS Portsmouth	206,800	0.91	0.69	0.54	1.30	1.10	1.12	106	0.95	0.78	1.14	87	11.6
	NHS South Eastern Hampshire	209,100	0.94	1.03	1.06	0.75	0.63	1.00	124	0.90	0.76	1.06	108	3.1
	NHS Southampton	239,400	1.23	0.79	1.24	1.15	0.88	0.63	58	0.98	0.83	1.17	88	14.1
	NHS West Hampshire	*544,400*	*0.72*	*0.66*	*0.47*	*0.67*	*0.62*	*0.67*	*83*	*0.63*	*0.56*	*0.72*	*76*	*3.9*
Wales	Betsi Cadwaladr University	690,400	0.98	0.95	0.97	0.82	0.99	0.86	106	0.93	0.85	1.02	111	2.5
	Powys Teaching	133,000	0.94	1.04	0.70	1.25	1.30	0.72	98	0.99	0.82	1.20	130	1.6
	Hywel Dda	383,400	1.20	0.77	1.11	1.18	0.90	1.07	136	1.04	0.93	1.16	127	2.2
	Abertawe Bro Morgannwg University	**519,500**	**1.24**	**1.51**	**1.51**	**1.16**	**1.42**	**1.05**	**121**	**1.31**	**1.20**	**1.44**	**148**	**3.9**
	Cwm Taf	**294,500**	**1.11**	**1.29**	**0.99**	**1.46**	**0.92**	**1.09**	**122**	**1.14**	**1.00**	**1.31**	**125**	**2.6**
	Aneurin Bevan	578,000	0.95	0.95	1.31	1.19	1.17	1.03	118	1.10	1.00	1.21	122	3.9
	Cardiff and Vale University	475,300	1.03	1.17	1.33	1.01	1.00	1.11	112	1.11	0.99	1.24	108	12.2

Table 1.3. Continued

UK Area	CCG/HB	Tot pop (2012)	2008 O/E	2009 O/E	2010 O/E	2011 O/E	2012 O/E	2013 O/E	2013 Crude rate pmp	2008–2013 O/E	2008–2013 LCL	2008–2013 UCL	2008–2013 Crude rate pmp*	% non-White
Scotland	Ayrshire and Arran	373,200	0.88	0.88	1.11	0.81	0.94	0.99	121	0.93	0.82	1.06	111	1.2
	Borders	*113,700*	*1.07*	*0.97*	*1.06*	*0.55*	*0.48*	*0.47*	*62*	*0.76*	*0.60*	*0.97*	*97*	*1.3*
	Dumfries and Galloway	*150,800*	*1.11*	*1.08*	*0.58*	*0.56*	*1.01*	*0.45*	*60*	*0.80*	*0.65*	*0.98*	*103*	*1.2*
	Fife	366,200	0.99	1.19	1.24	1.16	0.88	1.01	117	1.08	0.95	1.21	122	2.4
	Forth Valley	299,100	0.78	1.01	1.03	0.82	0.84	1.00	114	0.91	0.79	1.06	100	2.2
	Grampian	*573,400*	*0.91*	*0.85*	*0.85*	*0.82*	*0.82*	*0.91*	*101*	*0.86*	*0.77*	*0.96*	*92*	*4.0*
	Greater Glasgow and Clyde	1,217,000	0.95	0.99	0.87	1.07	1.09	0.95	102	0.99	0.92	1.06	103	7.3
	Highland	*319,800*	*0.76*	*0.75*	*0.63*	*0.51*	*0.63*	*0.62*	*78*	*0.65*	*0.56*	*0.76*	*79*	*1.3*
	Lanarkshire	572,500	0.74	0.86	1.01	0.82	1.12	0.85	94	0.90	0.81	1.00	97	2.0
	Lothian	*843,700*	*0.97*	*0.85*	*0.62*	*0.73*	*0.74*	*0.60*	*63*	*0.75*	*0.68*	*0.83*	*76*	*5.6*
	Orkney	21,500	1.16	1.13	0.39	0.00	1.85	0.73	93	0.88	0.52	1.48	108	0.7
	Shetland	*23,200*	*0.00*	*0.78*	*0.40*	*0.77*	*0.00*	*0.75*	*86*	*0.45*	*0.21*	*0.95*	*50*	*1.5*
	Tayside	411,700	1.16	1.27	1.01	1.15	0.69	0.86	102	1.02	0.91	1.14	118	3.2
	Western Isles	27,600	0.29	0.85	1.45	0.00	0.00	1.10	145	0.62	0.36	1.06	79	0.9
Northern Ireland	**Belfast**	**348,300**	**1.02**	**0.77**	**1.30**	**1.05**	**1.67**	**1.15**	**115**	**1.16**	**1.02**	**1.32**	**113**	**3.2**
	Northern	465,500	1.16	0.81	1.15	1.26	1.15	1.00	105	1.09	0.97	1.22	111	1.2
	Southern	363,100	0.99	0.77	1.03	1.29	0.82	0.83	80	0.96	0.83	1.10	89	1.2
	South Eastern	*350,100*	*0.87*	*0.66*	*0.70*	*0.93*	*0.79*	*0.90*	*97*	*0.81*	*0.70*	*0.94*	*84*	*1.3*
	Western	296,600	0.83	1.21	0.84	1.09	0.56	0.99	98	0.92	0.79	1.08	88	1.0

between areas. From the analysis using all six years combined, 49 areas were significantly high and 66 were significantly low out of a total of 237 areas. The standardised incidence ratios ranged from 0.45 to 2.25 (IQR 0.82, 1.10). As previously reported, urban areas with high percentages of non-White residents tended to have high incidence rates. Figure 1.2 shows the strong positive correlation between the standardised incidence ratio and the percentage of the CCG/HB population that was non-White.

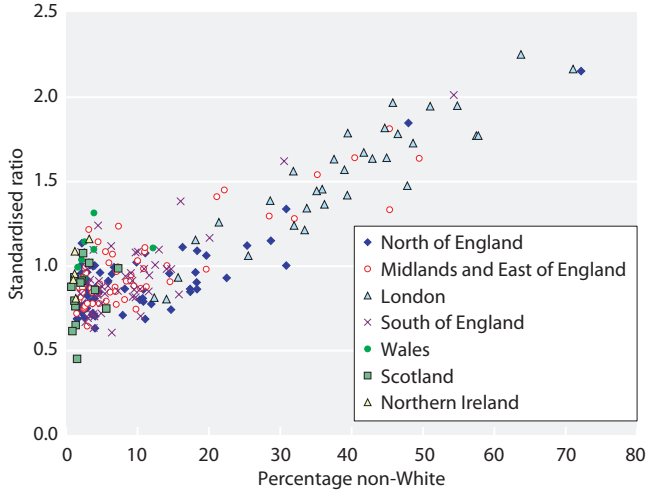

Fig. 1.2. Age/gender standardised incidence ratio (2008–2013) by percentage non-White

Centre level

The number of new patients starting RRT at each renal centre from 2008 to 2013 is shown in table 1.4. The table also shows centre level incidence rates (per million population) for 2013. For most centres there was a lot of variability in the numbers of incident patients from one year to the next making it hard to see any underlying trend. Some centres have had an increase in new patients over time and others have fallen. The variation may reflect chance fluctuation, the introduction of new centres, changes in catchment populations or in completeness of reporting. Variation over time may also be due to changing incidence of established renal failure (increases in underlying disease prevalence, survival from comorbid conditions and recognition of ERF), changes to treatment thresholds such as a greater emphasis on pre-emptive transplantation or the introduction of conservative care programmes. Analysis of CKD stage 5 patients not yet on RRT is required to explore some of these underlying mechanisms for centre level incidence rate changes.

There was a fall of approximately 5% in the number of new patients for Scotland between 2008 and 2013. There was an increase of 6% in new patients for England

Table 1.4. Number of patients starting RRT by renal centre 2008–2013

Centre	Year						Catchment population (millions)	2013 crude rate pmp[a]	(95% CI)
	2008	2009	2010	2011	2012	2013			
England									
B Heart	105	99	94	113	102	99	0.74	134	(108–161)
B QEH	267	256	198	216	213	191	1.70	112	(96–128)
Basldn	41	28	34	44	53	32	0.42	77	(50–104)
Bradfd	62	57	67	60	69	62	0.65	95	(71–119)
Brightn	118	117	106	119	135	139	1.30	107	(89–125)
Bristol	175	157	169	140	148	173	1.44	120	(102–138)
Camb	94	134	106	122	125	139	1.16	120	(100–140)
Carlis	30	28	22	28	19	41	0.32	128	(89–167)
Carsh	210	202	216	207	243	231	1.91	121	(105–136)
Chelms	36	51	45	47	46	42	0.51	82	(57–107)
Colchr	58	21	32	44	29	30	0.30	100	(64–136)
Covnt[b]	113	115	114	110	113	96	0.89	108	(86–129)
Derby	96	77	78	76	79	74	0.70	105	(81–129)
Donc	26	40	45	43	40	60	0.41	146	(109–183)
Dorset	82	73	72	79	73	74	0.86	86	(66–105)
Dudley	47	67	43	43	56	47	0.44	106	(76–137)
Exeter[b]	135	145	139	112	135	108	1.09	99	(80–118)
Glouc	46	79	61	58	76	54	0.59	92	(67–116)
Hull	110	99	86	109	97	92	1.02	90	(72–109)
Ipswi	38	38	33	29	43	39	0.40	98	(67–128)
Kent	138	126	132	121	115	145	1.22	118	(99–138)
L Barts	206	236	201	251	268	291	1.83	159	(141–177)
L Guys	161	172	144	123	129	130	1.08	120	(99–141)
L Kings	151	127	144	139	124	162	1.17	138	(117–160)
L Rfree	172	170	203	220	237	228	1.52	150	(131–170)
L St.G[b]	99	110	85	72	90	81	0.80	102	(79–124)
L West	294	357	365	365	355	303	2.40	126	(112–141)
Leeds	160	149	125	158	154	184	1.67	110	(94–126)
Leic	242	227	244	266	236	291	2.44	119	(106–133)
Liv Ain	42	38	50	58	63	66	0.48	136	(103–169)
Liv Roy	102	110	99	112	104	94	1.00	94	(75–113)
M RI	130	146	161	155	161	200	1.53	131	(113–149)
Middlbr	95	96	100	101	120	108	1.00	108	(87–128)
Newc	99	97	91	97	104	95	1.12	85	(68–102)
Norwch	84	71	85	85	74	76	0.79	97	(75–118)
Nottm	115	133	116	114	101	113	1.09	104	(85–123)
Oxford	147	174	165	177	170	166	1.69	98	(83–113)
Plymth[c]	69	57	56	60	55	63	0.47	134	(101–167)
Ports	170	149	149	187	160	198	2.02	98	(84–111)
Prestn	113	146	123	140	146	151	1.49	101	(85–117)
Redng	103	94	89	103	73	117	0.91	129	(105–152)
Salford[b]	138	125	149	132	134	122	1.49	82	(67–96)
Sheff	179	149	142	135	157	137	1.37	100	(83–117)
Shrew	59	48	58	61	58	61	0.50	122	(91–152)
Stevng[b]	103	98	107	110	109	130	1.20	108	(89–127)
Sthend	36	23	27	29	26	42	0.32	133	(92–173)
Stoke	79	108	95	91	74	100	0.89	112	(90–134)
Sund	45	64	54	57	71	49	0.62	79	(57–101)
Truro	41	58	46	38	49	46	0.41	111	(79–144)
Wirral	39	63	60	60	44	68	0.57	119	(91–147)
Wolve	89	65	106	77	87	88	0.67	132	(104–159)
York	37	43	38	51	53	36	0.49	73	(49–97)

Table 1.4. Continued

Centre	Year						Catchment population (millions)	2013 crude rate pmp[a]	(95% CI)
	2008	2009	2010	2011	2012	2013			
N Ireland									
Antrim	41	22	41	30	26	29	0.29	98	(63–134)
Belfast	70	57	70	68	93	69	0.64	108	(83–134)
Newry	21	19	21	36	17	23	0.26	88	(52–124)
Ulster	14	13	20	36	29	29	0.27	109	(69–149)
West NI	31	37	26	38	21	30	0.35	85	(55–116)
Scotland									
Abrdn	56	55	51	50	53	58	0.60	97	(72–122)
Airdrie	39	48	57	48	60	51	0.55	92	(67–118)
D & Gall	19	17	10	10	18	9	0.15	61	(21–100)
Dundee	64	69	50	58	39	42	0.46	91	(63–118)
Edinb	103	98	70	77	78	71	0.96	74	(57–91)
Glasgw	159	174	154	177	185	173	1.62	107	(91–122)
Inverns	25	21	27	13	17	19	0.27	70	(39–102)
Klmarnk	33	39	43	33	40	41	0.36	113	(79–148)
Krkcldy	30	33	45	43	30	38	0.32	120	(82–158)
Wales									
Bangor	40	30	26	20	21	24	0.22	110	(66–154)
Cardff	148	177	184	186	171	169	1.42	119	(101–137)
Clwyd[b]	15	25	21	17	22	20	0.19	105	(59–152)
Swanse	125	113	135	117	119	110	0.89	124	(101–147)
Wrexm	21	19	25	26	34	37	0.24	154	(104–204)
							% change since 2008		
England	**5,626**	**5,712**	**5,569**	**5,744**	**5,795**	**5,964**	**6.0**		
N Ireland	**177**	**148**	**178**	**208**	**186**	**180**	**1.7**		
Scotland	**528**	**554**	**507**	**509**	**520**	**502**	**−4.9**		
Wales	**349**	**364**	**391**	**366**	**367**	**360**	**3.2**		
UK	**6,680**	**6,778**	**6,645**	**6,827**	**6,868**	**7,006**	**4.9**		

[a]pmp – per million population
[b]Subsequent to closing the 2013 database several centres reported a variation to the numbers returned for 2013. Tables 1.2 and 1.4 (but not the remainder of this chapter) reflect these revisions (Covnt (+9), Exeter (+6), L St.G (+5), Salford (+11), Stevng (−29), Clwyd (+6))
[c]In last year's report the data included 47 incident patients for Plymouth for 2012 but the centre advised the UKRR that the number was 75 and an adjustment was made to the summary tables. After extensive data validation work the data now shows that there were 55 incident patients for 2012

between 2008 and 2013. Across all four countries the change between 2008 and 2013 was an increase of 4.9%.

2. Demographics and clinical characteristics of patients starting RRT

Methods

Age, gender, primary renal disease, ethnic origin and treatment modality were examined for patients starting RRT. Individual EDTA codes for primary diagnoses were grouped into eight categories, the details are given in appendix H: Ethnicity and ERA-EDTA Coding (www.renalreg.org).

Most centres electronically upload ethnicity coding to their renal information technology (IT) system from the hospital Patient Administration System (PAS). Ethnicity coding in these PAS systems is based on self-reported ethnicity. For the remaining centres, ethnicity coding is performed by clinical staff and recorded directly into the renal IT system (using a variety of coding systems). For all these analyses, data on ethnic origin were grouped into White, South Asian, Black, Chinese or Other. The details of regrouping of the PAS codes into the above ethnic categories are provided in appendix H: Ethnicity and ERA-EDTA Coding (www.renalreg.org). Chi-squared, Fisher's exact, ANOVA and Kruskal Wallis tests were used as appropriate to test for significant differences.

Estimated glomerular filtration rate (eGFR) at the start of RRT was studied amongst patients with eGFR data within 14 days before the start of RRT. The eGFR was calculated using the abbreviated 4 variable MDRD study equation [2]. For the purpose of the eGFR calculation, patients who had missing ethnicity but a valid serum creatinine measurement were classed as White. The eGFR values were log transformed in order to normalise the data.

Results

Age

Overall, incidence rates have plateaued in the last eight years (figure 1.3). Figure 1.4 shows RRT incidence rates for 2013 by age group and gender. For women, the peak rate was in the 75–79 age group and in men in the 80–84 age group. Showing numbers starting RRT (rather than rates), figure 1.5 shows that the 65–74 age group contained the most incident patients for both HD and PD.

In 2013, the median age of patients starting renal replacement therapy was 64.5 years (table 1.5) and this has changed little over the last six years (data not shown). The median age at start was 67.1 years for patients starting on HD, 59.7 for patients starting on PD and 49.7 for those having a pre-emptive transplant (table 1.6). The median age of non-White patients (57.0 years) was considerably lower than for White patients (66.0 years) reflecting CKD differences and the younger age distribution of ethnic minority populations in general compared with the White population (in the 2011 census data for England and Wales 5.3% of ethnic minorities were over 65 years old compared to 18.3% of Whites) [3]. The median age of new patients with diabetes was similar to the overall median and has not varied greatly over the last five years.

There were large differences between centres in the median age of incident patients (figure 1.6) reflecting differences in the age and ethnic structure of the catchment populations and also, particularly in smaller

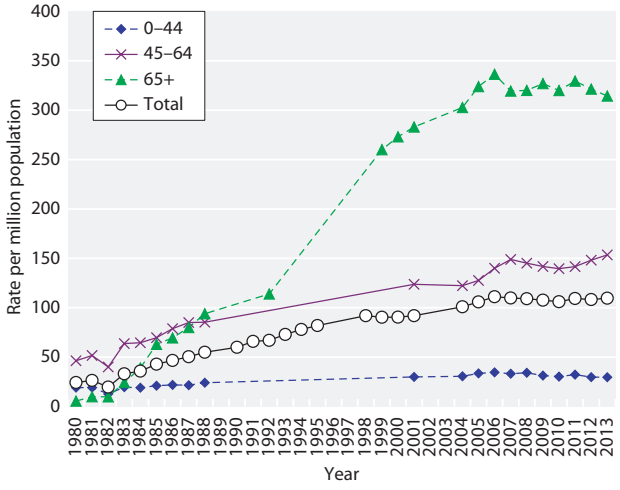

Fig. 1.3. RRT incidence rates between 1980 and 2013

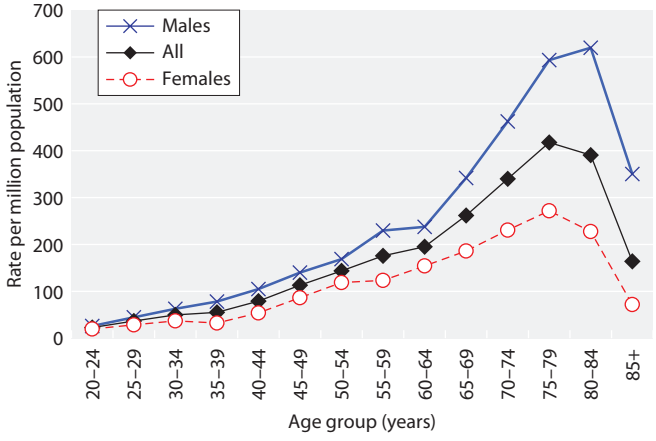

Fig. 1.4. RRT incidence rates in 2013 by age and gender

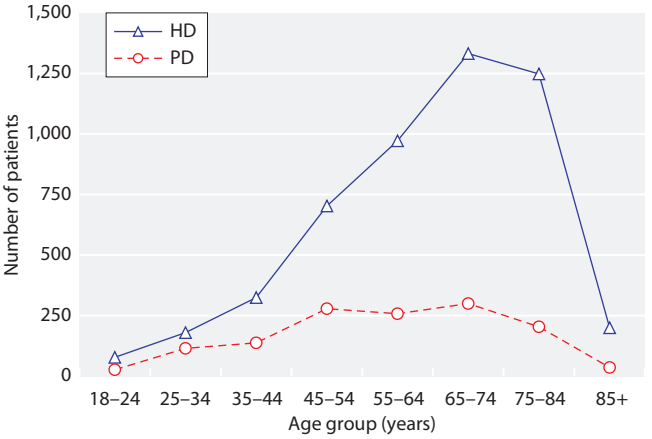

Fig. 1.5. Number of incident dialysis patients in 2013, by age group and initial dialysis modality

Table 1.5. Median, inter-quartile range and 90% range of the age of patients starting renal replacement therapy in 2013 by country

Country	Median	IQR	90% range
England	64.2	(51.0–74.6)	(31.3–83.9)
N Ireland	66.7	(50.9–75.0)	(32.0–82.8)
Scotland	64.1	(51.1–74.1)	(31.7–82.8)
Wales	68.9	(57.2–75.9)	(34.4–84.6)
UK	**64.5**	**(51.2–74.7)**	**(31.6–83.9)**

Table 1.6. Median, inter-quartile range and 90% range of the age of patients starting renal replacement therapy in 2013 by initial treatment modality

Treatment	Median	IQR	90% range
HD	67.1	(54.6–76.2)	(34.7–84.5)
PD	59.7	(47.2–71.5)	(29.3–82.5)
Transplant	49.7	(40.6–59.3)	(25.1–69.2)

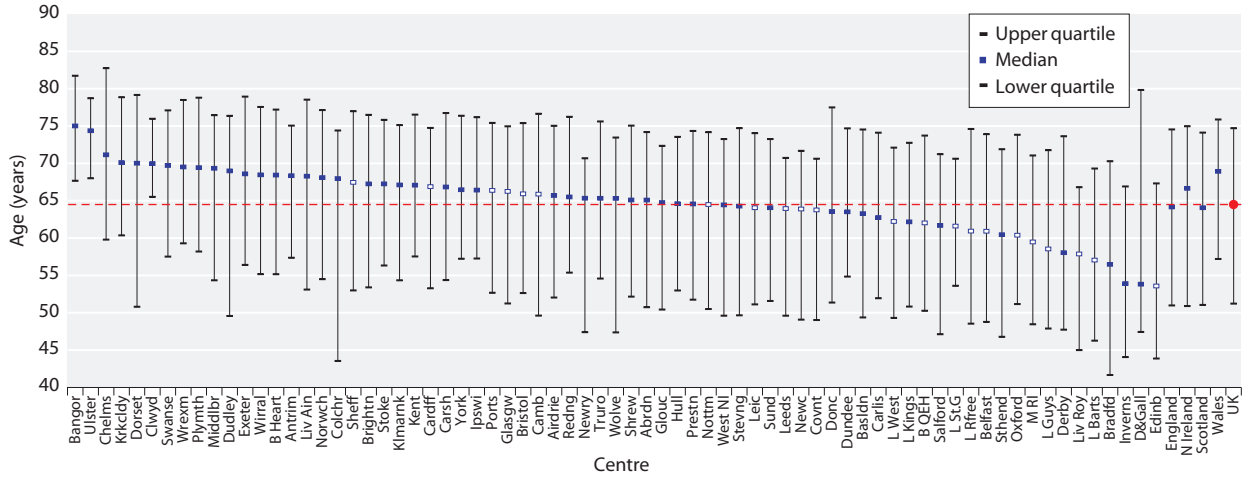

Fig. 1.6. Median age of incident RRT patients by centre in 2013
White points indicate transplant centres

centres, chance fluctuations. The median age of patients starting treatment at transplant centres was 62.8 years (IQR 49.8, 73.8) and at non-transplanting centres 65.7 years (IQR 52.4, 75.4) ($p < 0.0001$).

Averaged over 2008–2013, crude CCG/HB incidence rates in the over 75 years age group varied from 99 per million age related population (pmarp) in Shetland to 947 pmarp in NHS Brent (data not shown). Excluding two areas which had much higher rates than the rest, there was 7.3-fold variation (99 pmarp to 722 pmarp). The wide range of treatment rates suggests that there was geographical variation in the prevalence of comorbid and predisposing renal conditions as well as uncertainty within the renal community about the suitability of older patients for dialysis. The 7.3-fold variation between CCG/HBs seen in the over 75s was much greater than the 2.7-fold variation (64 pmp to 173 pmp) after excluding two outliers seen in the overall analysis although some of this difference is likely to be due to the smaller numbers included in the over 75 analysis.

Gender

There continued to be more men than women starting RRT in every age group (figure 1.7). The overall breakdown was 63.4% male, 36.6% female equating to a M : F ratio of 1.73.

Ethnicity

As in previous reports, Scotland is not included in this section as ethnicity completeness was low. Across centres in England, Wales and Northern Ireland the average completeness fell slightly in 2013 to 95.2% (vs. 98.1% for 2012). This was in large part due to one centre (Carshalton) which fell from a completeness of 85.9 to 54.1%. Completeness was 80% or more for all the other centres for 2013 (table 1.7) and was over 90% for all but seven centres. Ten centres reported no non-White patients starting in 2013 whilst some London centres reported over 50%.

Primary renal diagnosis

The breakdown of primary renal diagnosis (PRD) by centre is shown in table 1.8. The information was missing for 9.5% of patients. Fifty-eight centres provided data on over 90% of incident patients and 36 of these centres had 100% completeness. There was only a small amount of missing data for Wales, Northern Ireland and Scotland, whilst England had 11.0% missing (up from 7.4% for 2012). The overall percentage missing was up on 2012

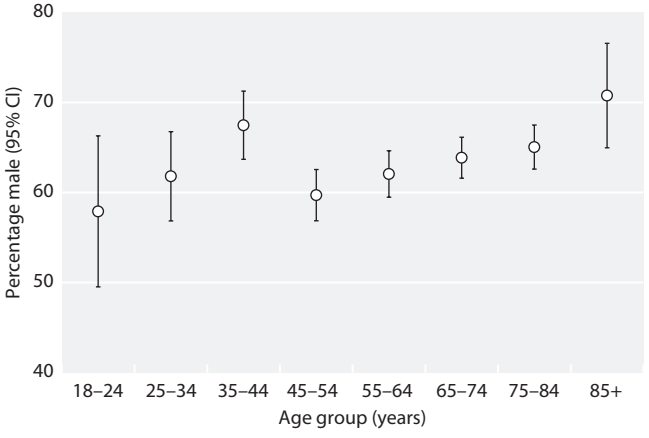

Fig. 1.7. Percentage of patients starting RRT in 2013 who were male, by age group

Table 1.7. Percentage of incident RRT patients (2013) in different ethnic groups by centre

Centre	% data not available	*N* with data	Percentage in each ethnic group				
			White	South Asian	Black	Chinese	Other
England							
B Heart	0.0	99	55.6	34.3	7.1	2.0	1.0
B QEH	0.0	191	64.9	22.0	10.5		2.6
Basldn	0.0	32	90.6	6.3		3.1	
Bradfd	0.0	62	53.2	43.5	1.6		1.6
Brightn	1.4	137	90.5	2.9	1.5		5.1
Bristol	2.3	169	88.8	4.1	2.4	0.6	4.1
Camb	6.5	130	96.2	1.5	1.5		0.8
Carlis	2.4	40	95.0		2.5		2.5
Carsh	45.9	125	72.0	17.6	4.8	0.8	4.8
Chelms	19.0	34	88.2	5.9		5.9	
Colchr	3.3	29	100.0				
Covnt	0.0	87	83.9	12.6	3.4		
Derby	8.1	68	89.7	5.9	2.9		1.5
Donc	0.0	60	91.7	3.3	1.7		3.3
Dorset	0.0	74	95.9	1.4	1.4		1.4
Dudley	4.3	45	88.9	8.9	2.2		
Exeter	1.0	101	100.0				
Glouc	0.0	54	92.6	3.7	1.9		1.9
Hull	3.3	89	97.8	2.2			
Ipswi	15.4	33	100.0				
Kent	2.1	142	96.5	0.7	1.4	0.7	0.7
L Barts	1.0	288	33.3	25.7	39.2	1.4	0.3
L Guys	3.8	125	50.4	11.2	30.4	1.6	6.4
L Kings	0.0	162	54.3	8.0	30.2	2.5	4.9
L Rfree	13.6	197	39.6	21.3	26.4	1.0	11.7
L St.G	14.5	65	46.2	23.1	23.1		7.7
L West	0.0	303	39.3	40.6	18.5	1.7	
Leeds	0.0	184	79.9	13.0	4.9	1.1	1.1
Leic	7.6	269	75.8	19.0	3.0	1.1	1.1
Liv Ain	4.5	63	92.1	1.6	1.6	1.6	3.2
Liv Roy	1.1	93	90.3	4.3	2.2		3.2
M RI	7.0	186	75.8	10.2	10.8		3.2
Middlbr	0.0	108	96.3	2.8		0.9	
Newc	0.0	95	95.8	3.2	1.1		
Norwch	1.3	75	100.0				
Nottm	0.0	113	89.4	6.2	2.7		1.8
Oxford	1.2	164	82.9	9.1	5.5	1.2	1.2
Plymth	0.0	63	98.4	1.6			
Ports	6.6	185	96.8	2.2	0.5		0.5
Prestn	1.3	149	86.6	12.8	0.7		
Redng	14.5	100	80.0	12.0	6.0	1.0	1.0
Salford	0.9	110	76.4	20.9	1.8		0.9
Sheff	4.4	131	88.6	6.9	2.3		2.3
Shrew	0.0	61	91.8	6.6	1.6		
Stevng	4.4	152	72.4	16.4	7.9	0.7	2.6
Sthend	16.7	35	97.1				2.9
Stoke	8.0	92	93.5	3.3	2.2		1.1
Sund	0.0	49	98.0	2.0			
Truro	0.0	46	100.0				
Wirral	2.9	66	98.5			1.5	
Wolve	1.1	87	69.0	21.8	5.7	2.3	1.1
York	0.0	36	94.4		2.8		2.8

Table 1.7. Continued

Centre	% data not available	*N* with data	Percentage in each ethnic group				
			White	South Asian	Black	Chinese	Other
N Ireland							
Antrim	0.0	29	96.6		3.4		
Belfast	1.4	68	98.5		1.5		
Newry	0.0	23	100.0				
Ulster	0.0	29	96.6			3.4	
West NI	0.0	30	100.0				
Wales							
Bangor	0.0	24	100.0				
Cardff	0.0	169	89.3	7.1	2.4	0.6	0.6
Clwyd	7.1	13	100.0				
Swanse	0.9	109	100.0				
Wrexm	2.7	36	97.2			2.8	
England	**5.2**	**5,653**	**76.8**	**12.3**	**8.2**	**0.7**	**2.0**
N Ireland	**0.6**	**179**	**98.3**		**1.1**	**0.6**	
Wales	**0.8**	**351**	**94.6**	**3.4**	**1.1**	**0.6**	**0.3**
E, W & NI	**4.8**	**6,183**	**78.4**	**11.5**	**7.6**	**0.7**	**1.9**

Blank cells – no reported patients

(9.5% from 6.3%) and was similar in under and over 65 year olds (9.3% and 9.7% respectively). Five centres had missing PRD for more than 25% of incident patients and for these centres the percentages in the diagnostic categories are not shown in table 1.8.

The UKRR continues to be concerned about centres with apparently very high data completeness for PRD but also very high rates of 'uncertain' diagnoses (EDTA code 00: Chronic renal failure; aetiology uncertain). It is accepted that there will inevitably be a number of patients with uncertain aetiology and that the proportion of these patients will vary between clinicians and centres as the definitions of e.g. renal vascular disease and hypertensive renal disease remain relatively subjective. There was again a lot of variability between centres but, as in previous years, a small number of centres had far higher percentages with 'uncertain' diagnosis than other centres. This year, there were three centres with diagnosis 'uncertain' for over 45% of their incident patients – Cambridge (50%), Colchester (67%) and Ipswich (49%). As the numbers with the specific PRDs are likely to be falsely low in these centres, the breakdown into these categories has not been shown in table 1.8 or been used in the country and UK averages. These centres have also been excluded where PRD is used to stratify analyses.

As in previous years, there was a lot of variability between centres in the percentages with the specific diagnoses (partly due to the reasons mentioned above). For example, the percentage with diabetes as PRD varied from about 8% to over 46% of incident patients. The overall percentage with uncertain aetiology continued to decrease (14.5% for 2013 versus 15.9% for 2012 and 17.3% for 2011).

The overall UK distribution of PRDs is shown in table 1.9. Diabetic nephropathy was the most common renal diagnosis in both the under and over 65 year age groups, accounting for 25% of all (non-missing) incident diagnoses. Glomerulonephritis and autosomal dominant polycystic kidney disease (ADPKD) made up higher proportions of the younger than the older incident cohorts (18% vs. 11% and 11% vs. 4% respectively), whilst patients with renal vascular disease comprised a much higher percentage of the older rather than the younger patients (10% vs. 1%). Uncertainty about the underlying diagnosis was also much more likely in the older rather than the younger cohort (18% vs. 11%).

For all primary renal diagnoses except ADPKD, the male to female ratio was 1.3 or greater. This gender difference may relate to factors such as smoking, hypertension, atheroma and renal vascular disease, which are more common in males and may influence the rate of progression of renal failure.

Table 1.10 shows the incidence rates for each PRD per million population for the 2013 cohort. The incidence of RRT due to diabetes as PRD was somewhat higher in Wales than in the other countries. As there were some

Table 1.8. Distribution of primary renal diagnosis by centre in the 2013 incident RRT cohort

Centre	% data not available	*N* with data	Percentage							
			Uncertain aetiology	Diabetes	Glomerulo-nephritis	Hyper-tension	Other	Polycystic kidney	Pyelo-nephritis	Renal vascular disease
England										
B Heart	11.1	88	19.3	46.6	10.2	8.0	6.8	4.6	4.6	0.0
B QEH	1.6	188	10.6	23.4	14.4	10.6	24.5	6.4	3.7	6.4
Basldn	0.0	32	6.3	28.1	25.0	6.3	6.3	3.1	12.5	12.5
Bradfd	0.0	62	9.7	21.0	22.6	9.7	22.6	8.1	3.2	3.2
Brightn	2.9	135	23.0	20.7	15.6	3.7	20.7	7.4	5.2	3.7
Bristol	8.1	159	17.6	23.3	14.5	4.4	15.1	10.7	8.2	6.3
Camb[a]	0.0	139	50.4							
Carlis	4.9	39	2.6	7.7	12.8	12.8	15.4	28.2	12.8	7.7
Carsh[b]	58.0	97								
Chelms	0.0	42	14.3	19.1	11.9	4.8	21.4	7.1	16.7	4.8
Colchr[a]	2.2	30	66.7							
Covnt	0.0	87	16.1	21.8	11.5	12.6	13.8	10.3	8.1	5.8
Derby	0.0	74	18.9	28.4	14.9	5.4	20.3	5.4	4.1	2.7
Donc	0.0	60	21.7	11.7	11.7	10.0	25.0	8.3	6.7	5.0
Dorset	0.0	74	12.2	23.0	17.6	12.2	5.4	6.8	18.9	4.1
Dudley	0.0	47	12.8	19.2	4.3	14.9	40.4	6.4	2.1	0.0
Exeter	2.0	100	3.0	28.0	14.0	12.0	17.0	13.0	6.0	7.0
Glouc	0.0	54	29.6	20.4	24.1	3.7	5.6	9.3	3.7	3.7
Hull	0.0	92	17.4	18.5	20.7	4.4	13.0	9.8	9.8	6.5
Ipswi[a]	0.0	39	48.7							
Kent	0.7	144	15.3	23.6	13.2	4.9	26.4	4.2	9.0	3.5
L Barts	10.0	262	11.5	37.0	9.9	12.6	16.4	5.7	5.3	1.5
L Guys[b]	86.2	18								
L Kings	0.0	162	11.1	35.8	10.5	21.6	7.4	3.7	6.2	3.7
L Rfree	4.4	218	8.3	34.4	11.5	8.7	25.7	5.1	2.8	3.7
L St.G	18.4	62	19.4	25.8	6.5	14.5	17.7	8.1	6.5	1.6
L West	0.0	303	10.2	40.6	17.2	3.3	13.9	4.0	5.0	5.9
Leeds	0.0	184	14.7	19.6	11.4	12.5	19.6	12.5	5.4	4.4
Leic	22.3	226	22.1	20.8	15.0	4.4	14.2	10.2	9.3	4.0
Liv Ain	1.5	65	7.7	24.6	21.5	10.8	9.2	3.1	10.8	12.3
Liv Roy	0.0	94	7.5	25.5	17.0	11.7	18.1	9.6	8.5	2.1
M RI	11.5	177	7.9	31.6	11.9	15.8	15.8	8.5	7.3	1.1
Middlbr	0.0	108	19.4	28.7	6.5	5.6	17.6	4.6	11.1	6.5
Newc	0.0	95	15.8	20.0	19.0	5.3	24.2	8.4	4.2	3.2
Norwch	1.3	75	29.3	14.7	14.7	5.3	20.0	4.0	8.0	4.0
Nottm	0.0	113	15.0	16.8	8.9	7.1	24.8	9.7	13.3	4.4
Oxford	1.2	164	14.0	24.4	18.9	6.1	16.5	9.2	5.5	5.5
Plymth	17.5	52	3.9	13.5	26.9	7.7	15.4	9.6	5.8	17.3
Ports	13.1	172	9.9	22.7	16.9	12.2	15.7	7.6	9.9	5.2
Prestn	2.0	148	14.9	19.6	13.5	12.8	12.2	7.4	10.8	8.8
Redng	2.6	114	15.8	30.7	12.3	1.8	21.9	5.3	5.3	7.0
Salford[b]	85.6	16								
Sheff	0.0	137	19.0	21.9	20.4	5.1	13.9	7.3	8.0	4.4
Shrew	1.6	60	16.7	18.3	15.0	0.0	36.7	6.7	3.3	3.3
Stevng	1.9	156	14.1	18.6	8.3	1.3	48.1	5.1	0.6	3.9
Sthend	2.4	41	22.0	12.2	17.1	2.4	14.6	19.5	7.3	4.9
Stoke[b]	35.0	65								
Sund	2.0	48	2.1	29.2	12.5	14.6	16.7	4.2	8.3	12.5
Truro	0.0	46	4.4	26.1	23.9	8.7	10.9	6.5	8.7	10.9
Wirral[b]	32.4	46								
Wolve	4.6	84	29.8	14.3	11.9	0.0	33.3	6.0	0.0	4.8
York	5.6	34	11.8	14.7	11.8	23.5	20.6	8.8	2.9	5.9

Table 1.8. Continued

Centre	% data not available	*N* with data	Percentage							
			Uncertain aetiology	Diabetes	Glomerulo-nephritis	Hyper-tension	Other	Polycystic kidney	Pyelo-nephritis	Renal vascular disease
N Ireland										
Antrim	0.0	29	34.5	20.7	10.3	3.5	20.7	3.5	6.9	0.0
Belfast	4.4	66	13.6	18.2	9.1	4.6	19.7	15.2	13.6	6.1
Newry	0.0	23	13.0	21.7	13.0	0.0	17.4	17.4	13.0	4.4
Ulster	0.0	29	13.8	24.1	3.5	13.8	10.3	3.5	6.9	24.1
West NI	0.0	30	3.3	23.3	20.0	6.7	10.0	6.7	26.7	3.3
Scotland										
Abrdn	0.0	58	5.2	31.0	13.8	6.9	19.0	10.3	10.3	3.5
Airdrie	0.0	51	23.5	31.4	13.7	2.0	15.7	7.8	3.9	2.0
D & Gall	0.0	9	0.0	44.4	11.1	11.1	22.2	0.0	11.1	0.0
Dundee	0.0	42	9.5	9.5	21.4	7.1	31.0	9.5	7.1	4.8
Edinb	0.0	71	11.3	21.1	15.5	5.6	15.5	12.7	11.3	7.0
Glasgw	0.0	173	19.7	22.0	20.2	0.0	16.2	8.7	5.8	7.5
Inverns	0.0	19	21.1	21.1	21.1	0.0	21.1	0.0	15.8	0.0
Klmarnk	0.0	41	2.4	26.8	7.3	7.3	14.6	4.9	17.1	19.5
Krkcldy	2.6	37	21.6	29.7	13.5	0.0	13.5	2.7	13.5	5.4
Wales										
Bangor	0.0	24	25.0	33.3	0.0	8.3	0.0	4.2	0.0	29.2
Cardff	0.0	169	26.6	26.0	16.6	3.0	11.2	10.1	2.4	4.1
Clwyd	14.3	12	16.7	16.7	16.7	0.0	16.7	8.3	0.0	25.0
Swanse	3.6	106	4.7	32.1	15.1	3.8	17.0	3.8	10.4	13.2
Wrexm	0.0	37	27.0	27.0	24.3	0.0	8.1	2.7	5.4	5.4
England	**11.0**	**5,327**	**14.1**	**25.4**	**14.2**	**8.3**	**18.9**	**7.5**	**6.6**	**4.9**
N Ireland	**1.7**	**177**	**15.3**	**20.9**	**10.7**	**5.7**	**16.4**	**10.2**	**13.6**	**7.3**
Scotland	**0.2**	**501**	**14.8**	**24.2**	**16.6**	**3.2**	**17.6**	**8.2**	**9.0**	**6.6**
Wales	**1.7**	**348**	**19.5**	**28.2**	**15.8**	**3.2**	**12.1**	**6.9**	**4.9**	**9.5**
UK	**9.5**	**6,353**	**14.5**	**25.4**	**14.4**	**7.6**	**18.3**	**7.6**	**6.9**	**5.4**
Min			**0.0**	**7.7**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Max			**34.5**	**46.6**	**26.9**	**23.5**	**48.1**	**28.2**	**26.7**	**29.2**

The percentage in each category has been calculated after excluding those patients with data not available
[a]For those centres judged to have high % uncertain aetiology, the percentages in the other diagnostic categories have not been calculated and these centres have not been included in the country and UK averages or the min/max values
[b]For those centres with >25% missing primary diagnoses, the percentages in the diagnostic categories have not been calculated

Table 1.9. Percentage distribution of primary renal diagnosis by age in the 2013 incident RRT cohort

Diagnosis	Percentage with diagnosis		
	Age <65	Age ⩾65	All patients
Diabetes	27.1	23.5	25.4
Glomerulonephritis	17.8	10.9	14.4
Pyelonephritis	7.7	6.1	6.9
Hypertension	6.4	8.8	7.6
Polycystic kidney	11.2	3.7	7.6
Renal vascular disease	1.3	9.7	5.4
Other	17.5	19.1	18.3
Uncertain aetiology	10.9	18.3	14.5

Percentages calculated after excluding those patients with data not available

missing data, the rates for at least some of the diagnoses will be underestimates.

First established treatment modality

In 2013, the first treatment recorded, irrespective of any later change, was haemodialysis in 72.0% of patients, peritoneal dialysis in 19.4% and pre-emptive transplant in 8.6%. The previous year on year fall seen in the proportion of patients starting on PD levelled off during the last six years (table 1.11). The percentage having a pre-emptive transplant has continued to rise (up by 65% from 2008). Table F.1.3 in appendix F: Additional Data Tables for 2013 New and Existing Patients gives the treatment breakdown at start of RRT by centre.

Table 1.10. Primary renal diagnosis RRT incidence rates (2013) per million population (unadjusted)

Diagnosis	England	N Ireland	Scotland	Wales	UK
Diabetes	25.2	20.2	22.7	31.8	25.1
Glomerulonephritis	14.1	10.4	15.6	17.8	14.3
Pyelonephritis	6.6	13.1	8.4	5.5	6.9
Hypertension	8.3	5.5	3.0	3.6	7.5
Polycystic kidney	7.4	9.8	7.7	7.8	7.5
Renal vascular disease	4.9	7.1	6.2	10.7	5.3
Other	18.7	15.8	16.5	13.6	18.1
Uncertain aetiology	13.9	14.8	13.9	22.1	14.4
Data not available	12.3	1.6	0.2	1.9	10.4
All	**111**	**98**	**94**	**115**	**110**

The overall rates per country may be slightly different to those in table 1.2 as those centres whose PRD data has not been used have been excluded from both the numerator and the denominator here

Many patients undergo a brief period of HD before switches to other modalities are, or can be, considered. Therefore, the established modality at 90 days is more representative of the elective first modality and this modality was used for the remainder of this section. For these analyses, the incident cohort from 1st October 2012 to 30th September 2013 was used so that follow up to 90 days was possible for all patients. By 90 days, 5.1% of incident patients had died and a further 0.2% had stopped treatment, leaving 94.7% of the original cohort still on RRT. Table 1.12 shows the percentages on each treatment modality at 90 days both as percentages of all of those starting RRT and then of those still on treatment at 90 days. Expressed as percentages of the whole incident cohort, 66.1% were on HD at 90 days, 19.0% were on PD and 9.5% had received a transplant. Expressed as percentages of those still receiving RRT at 90 days, 69.8% were on HD, 20.1% on PD and 10.1% had received a transplant.

Table 1.11. Treatment at start and at 90 days by year of start

Start	HD (%)	PD (%)	Transplant (%)
Day 0 treatment			
2008	75.4	19.4	5.2
2009	76.3	18.0	5.7
2010	74.6	18.6	6.8
2011	72.7	20.4	6.9
2012	72.9	19.6	7.5
2013	72.0	19.4	8.6
Day 90 treatment			
Oct 2007 to end Sept 2008	72.2	21.6	6.2
Oct 2008 to end Sept 2009	73.9	19.2	6.9
Oct 2009 to end Sept 2010	72.6	19.4	8.0
Oct 2010 to end Sept 2011	70.8	20.6	8.7
Oct 2011 to end Sept 2012	70.8	20.3	9.0
Oct 2012 to end Sept 2013	69.8	20.1	10.1

Figure 1.8 shows the modality breakdown with the HD patients further subdivided. Of those still on RRT at 90 days, 39% were treated with hospital HD, 31% with satellite HD, and only 0.2% were receiving home HD at this early stage. This 0.2% on home HD was only 13 patients (split between seven centres). Chapter 2 UK Renal Replacement Therapy Prevalence in 2013 shows that prevalent numbers of home HD patients have grown to 4.1% of all dialysis patients.

The percentage of incident patients who had died by 90 days varied considerably between centres (0% to 20%). Differences in the definition of whether patients have acute or chronic renal failure may be a factor in this apparent variation along with possible differences in clinical practice.

The percentage of patients still on RRT at 90 days who had a functioning transplant at 90 days varied between centres from 0% to 31% (between 7% and 31% for transplanting centres and between 0% and 12% for non-transplanting centres). The mean percentage of the incident cohort with a functioning transplant at 90 days was greater in transplanting compared to non-transplanting centres (13.4% vs. 6.0%). One possible reason could be that some patients transplanted pre-emptively were attributed to the incident cohort of the transplanting centre rather than that of the referring centre.

Table 1.13 gives the HD/PD breakdown for those incident patients on dialysis at 90 days. The breakdown is given by age group and overall. The percentage on PD at 90 days was about 65% higher in patients aged

Table 1.12. RRT modality at 90 days by centre (incident cohort 1/10/2012 to 30/09/2013)

		Status at 90 days of all patients who started RRT (%)					Status at 90 days of only those patients still on RRT (%)		
Centre	*N*	HD	PD	Tx	Stopped treatment	Died	HD	PD	Tx
England									
B Heart	96	67.7	17.7	2.1	0.0	12.5	77.4	20.2	2.4
B QEH	203	71.9	15.8	11.3	0.0	1.0	72.6	15.9	11.4
Basldn	39	74.4	23.1	0.0	0.0	2.6	76.3	23.7	0.0
Bradfd	61	67.2	19.7	9.8	0.0	3.3	69.5	20.3	10.2
Brightn	154	62.3	24.7	7.1	0.7	5.2	66.2	26.2	7.6
Bristol	172	68.0	16.3	12.2	0.6	2.9	70.5	16.9	12.7
Camb	135	59.3	7.4	30.4	0.0	3.0	61.1	7.6	31.3
Carlis	38	50.0	39.5	10.5	0.0	0.0	50.0	39.5	10.5
Carsh	227	67.8	21.2	4.9	0.4	5.7	72.3	22.5	5.2
Chelms	41	80.5	14.6	0.0	0.0	4.9	84.6	15.4	0.0
Colchr	32	87.5	0.0	0.0	0.0	12.5	100.0	0.0	0.0
Covnt	99	64.7	22.2	7.1	0.0	6.1	68.8	23.7	7.5
Derby	76	52.6	43.4	1.3	0.0	2.6	54.1	44.6	1.4
Donc	61	60.7	24.6	1.6	0.0	13.1	69.8	28.3	1.9
Dorset	68	60.3	27.9	5.9	1.5	4.4	64.1	29.7	6.3
Dudley	50	72.0	26.0	0.0	0.0	2.0	73.5	26.5	0.0
Exeter	116	72.4	17.2	5.2	0.0	5.2	76.4	18.2	5.5
Glouc	60	66.7	23.3	5.0	0.0	5.0	70.2	24.6	5.3
Hull	91	64.8	30.8	2.2	1.1	1.1	66.3	31.5	2.3
Ipswi	35	74.3	17.1	8.6	0.0	0.0	74.3	17.1	8.6
Kent	146	71.2	16.4	8.2	0.0	4.1	74.3	17.1	8.6
L Barts	284	55.6	32.8	7.0	0.0	4.6	58.3	34.3	7.4
L Guys	128	68.8	9.4	18.8	0.0	3.1	71.0	9.7	19.4
L Kings	141	75.2	23.4	1.4	0.0	0.0	75.2	23.4	1.4
L Rfree	229	64.6	22.3	10.0	0.0	3.1	66.7	23.0	10.4
L St.G	73	53.4	23.3	17.8	0.0	5.5	56.5	24.6	18.8
L West	309	80.9	5.5	11.7	0.3	1.6	82.5	5.6	11.9
Leeds	181	67.4	11.1	15.5	0.0	6.1	71.8	11.8	16.5
Leic	267	65.9	17.6	10.9	0.0	5.6	69.8	18.7	11.5
Liv Ain	64	56.3	21.9	1.6	0.0	20.3	70.6	27.5	2.0
Liv Roy	95	41.1	21.1	27.4	0.0	10.5	45.9	23.5	30.6
M RI	190	58.4	15.3	23.2	0.0	3.2	60.3	15.8	23.9
Middlbr	109	70.6	10.1	11.0	0.0	8.3	77.0	11.0	12.0
Newc	98	66.3	12.2	13.3	0.0	8.2	72.2	13.3	14.4
Norwch	79	76.0	12.7	2.5	3.8	5.1	83.3	13.9	2.8
Nottm	116	45.7	29.3	18.1	0.0	6.9	49.1	31.5	19.4
Oxford	175	56.0	23.4	17.1	0.0	3.4	58.0	24.3	17.8
Plymth	61	57.4	21.3	16.4	1.6	3.3	60.3	22.4	17.2
Ports	176	66.5	17.1	9.1	0.6	6.8	71.8	18.4	9.8
Prestn	158	66.5	15.8	11.4	0.6	5.7	71.0	16.9	12.2
Redng	111	55.9	27.9	9.0	0.0	7.2	60.2	30.1	9.7
Salford	126	68.3	27.0	2.4	0.0	2.4	69.9	27.6	2.4
Sheff	133	72.2	15.0	6.8	0.0	6.0	76.8	16.0	7.2
Shrew	55	67.3	20.0	1.8	0.0	10.9	75.5	22.5	2.0
Stevng	163	71.8	13.5	10.4	0.0	4.3	75.0	14.1	10.9
Sthend	43	69.8	16.3	11.6	0.0	2.3	71.4	16.7	11.9
Stoke	98	56.1	31.6	0.0	0.0	12.2	64.0	36.1	0.0
Sund	54	74.1	14.8	5.6	0.0	5.6	78.4	15.7	5.9
Truro	48	68.8	20.8	4.2	0.0	6.3	73.3	22.2	4.4
Wirral	66	71.2	16.7	0.0	0.0	12.1	81.0	19.0	0.0
Wolve	83	59.0	32.5	1.2	0.0	7.2	63.6	35.1	1.3
York	45	68.9	22.2	4.4	0.0	4.4	72.1	23.3	4.7

Table 1.12. Continued

Centre	*N*	Status at 90 days of all patients who started RRT (%)					Status at 90 days of only those patients still on RRT (%)		
		HD	PD	Tx	Stopped treatment	Died	HD	PD	Tx
N Ireland									
Antrim	30	70.0	16.7	0.0	0.0	13.3	80.8	19.2	0.0
Belfast	76	60.5	15.8	19.7	1.3	2.6	63.0	16.4	20.6
Newry	23	52.2	43.5	0.0	0.0	4.4	54.6	45.5	0.0
Ulster	30	70.0	6.7	0.0	6.7	16.7	91.3	8.7	0.0
West NI	29	51.7	31.0	10.3	3.5	3.5	55.6	33.3	11.1
Scotland									
Abrdn	56	64.3	23.2	3.6	0.0	8.9	70.6	25.5	3.9
Airdrie	55	85.5	14.6	0.0	0.0	0.0	85.5	14.6	0.0
D & Gall	6	83.3	16.7	0.0	0.0	0.0	83.3	16.7	0.0
Dundee	37	86.5	13.5	0.0	0.0	0.0	86.5	13.5	0.0
Edinb	67	71.6	6.0	17.9	0.0	4.5	75.0	6.3	18.8
Glasgw	180	72.8	11.1	13.9	0.0	2.2	74.4	11.4	14.2
Inverns	18	55.6	44.4	0.0	0.0	0.0	55.6	44.4	0.0
Klmarnk	39	71.8	18.0	5.1	0.0	5.1	75.7	18.9	5.4
Krkcldy	39	76.9	12.8	0.0	0.0	10.3	85.7	14.3	0.0
Wales									
Bangor	27	74.1	14.8	0.0	0.0	11.1	83.3	16.7	0.0
Cardff	167	67.1	15.0	12.6	0.0	5.4	70.9	15.8	13.3
Clwyd	16	75.0	18.8	6.3	0.0	0.0	75.0	18.8	6.3
Swanse	118	63.6	21.2	5.9	0.9	8.5	70.1	23.4	6.5
Wrexm	40	70.0	20.0	5.0	0.0	5.0	73.7	21.1	5.3
England	**5,958**	**65.5**	**19.5**	**9.7**	**0.2**	**5.1**	**69.2**	**20.6**	**10.3**
N Ireland	**188**	**61.2**	**20.2**	**9.6**	**2.1**	**6.9**	**67.3**	**22.2**	**10.5**
Scotland	**497**	**73.8**	**14.3**	**8.3**	**0.0**	**3.6**	**76.6**	**14.8**	**8.6**
Wales	**368**	**67.1**	**17.7**	**8.4**	**0.3**	**6.5**	**72.0**	**19.0**	**9.0**
UK	**7,011**	**66.1**	**19.0**	**9.5**	**0.2**	**5.1**	**69.8**	**20.1**	**10.1**

under 65 years than in older patients (27.8% vs. 17.1%). These percentages are similar to those for 2012. In both age groups there was a lot of variability between centres in the percentage on PD.

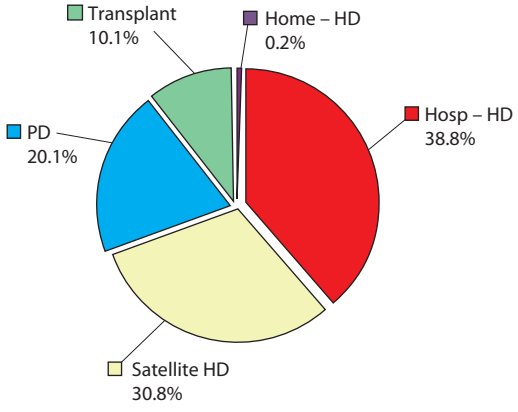

Fig. 1.8. RRT modality at 90 days (incident cohort 1/10/2012 to 30/09/2013)

The median age at start for those on HD at 90 days was 66.7 years compared with 59.3 years for PD. There were eight centres where the percentage of patients treated with PD was the same as or higher in the over 65s than the under 65s (a similar number to the 10 centres for 2012 and 11 centres for 2011).

Modality change over time

Table 1.14 gives the breakdown of status/treatment modality at four subsequent time points by initial treatment type for patients starting RRT in 2008. Fifty-one percent of patients who started on HD had died within five years of starting. This compared to 33% and 5% for those starting on PD or transplant respectively. Of those patients starting on PD, 91% were on PD at 90 days but this percentage dropped sharply at the later time points. As expected and in contrast, 92% of patients starting with a transplant were also transplant patients at the five year time point.

Table 1.13. Modality split of patients on dialysis at 90 days (incident cohort 1/10/2012 to 30/09/2013)

		Age <65 (%)		Age ⩾65 (%)		All patients (%)	
Centre	*N*	HD	PD	HD	PD	HD	PD
England							
B Heart	82	71.8	28.2	86.0	14.0	79.3	20.7
B QEH	178	74.5	25.5	90.5	9.5	82.0	18.0
Basldn	38	68.4	31.6	84.2	15.8	76.3	23.7
Bradfd	53	67.7	32.3	90.9	9.1	77.4	22.6
Brightn	134	62.1	37.9	78.9	21.1	71.6	28.4
Bristol	145	74.6	25.4	85.9	14.1	80.7	19.3
Camb	90	83.3	16.7	91.7	8.3	88.9	11.1
Carlis	34	55.0	45.0	57.1	42.9	55.9	44.1
Carsh	202	69.7	30.3	81.4	18.6	76.2	23.8
Chelms	39	81.8	18.2	85.7	14.3	84.6	15.4
Colchr	28	100.0	0.0	100.0	0.0	100.0	0.0
Covnt	86	65.0	35.0	82.6	17.4	74.4	25.6
Derby	73	50.0	50.0	62.1	37.9	54.8	45.2
Donc	52	62.1	37.9	82.6	17.4	71.2	28.8
Dorset	60	69.6	30.4	67.6	32.4	68.3	31.7
Dudley	49	59.1	40.9	85.2	14.8	73.5	26.5
Exeter	104	74.3	25.7	84.1	15.9	80.8	19.2
Glouc	54	60.9	39.1	83.9	16.1	74.1	25.9
Hull	87	58.7	41.3	78.0	22.0	67.8	32.2
Ipswi	32	80.0	20.0	82.4	17.6	81.3	18.8
Kent	128	72.9	27.1	88.4	11.6	81.3	18.8
L Barts	251	65.0	35.0	59.6	40.4	62.9	37.1
L Guys	100	84.5	15.5	92.9	7.1	88.0	12.0
L Kings	139	70.7	29.3	82.8	17.2	76.3	23.7
L Rfree	199	67.5	32.5	83.5	16.5	74.4	25.6
L St.G	56	64.3	35.7	75.0	25.0	69.6	30.4
L West	267	93.3	6.7	94.1	5.9	93.6	6.4
Leeds	142	80.6	19.4	91.4	8.6	85.9	14.1
Leic	223	69.5	30.5	87.3	12.7	78.9	21.1
Liv Ain	50	69.2	30.8	75.0	25.0	72.0	28.0
Liv Roy	59	68.9	31.1	57.1	42.9	66.1	33.9
M RI	140	79.2	20.8	79.4	20.6	79.3	20.7
Middlbr	88	83.3	16.7	91.3	8.7	87.5	12.5
Newc	77	87.2	12.8	81.6	18.4	84.4	15.6
Norwch	70	80.6	19.4	89.7	10.3	85.7	14.3
Nottm	87	48.7	51.3	70.8	29.2	60.9	39.1
Oxford	139	67.6	32.4	73.8	26.2	70.5	29.5
Plymth	48	50.0	50.0	80.6	19.4	72.9	27.1
Ports	147	78.9	21.1	80.3	19.7	79.6	20.4
Prestn	130	80.6	19.4	81.0	19.0	80.8	19.2
Redng	93	52.2	47.8	80.9	19.1	66.7	33.3
Salford	120	68.1	31.9	76.5	23.5	71.7	28.3
Sheff	116	71.2	28.8	92.2	7.8	82.8	17.2
Shrew	48	72.7	27.3	80.8	19.2	77.1	22.9
Stevng	139	84.0	16.0	84.4	15.6	84.2	15.8
Sthend	37	64.7	35.3	95.0	5.0	81.1	18.9
Stoke	86	51.3	48.7	74.5	25.5	64.0	36.0
Sund	48	69.6	30.4	96.0	4.0	83.3	16.7
Truro	43	62.5	37.5	85.2	14.8	76.7	23.3
Wirral	58	57.1	42.9	94.6	5.4	81.0	19.0
Wolve	76	59.0	41.0	70.3	29.7	64.5	35.5
York	41	72.7	27.3	78.9	21.1	75.6	24.4

Table 1.13. Continued

Centre	*N*	Age <65 (%)		Age ⩾65 (%)		All patients (%)	
		HD	PD	HD	PD	HD	PD
N Ireland							
Antrim	26	80.0	20.0	81.3	18.8	80.8	19.2
Belfast	58	78.6	21.4	80.0	20.0	79.3	20.7
Newry	22	70.0	30.0	41.7	58.3	54.5	45.5
Ulster	23	80.0	20.0	94.4	5.6	91.3	8.7
West NI	24	36.4	63.6	84.6	15.4	62.5	37.5
Scotland							
Abrdn	49	70.8	29.2	76.0	24.0	73.5	26.5
Airdrie	55	84.0	16.0	86.7	13.3	85.5	14.5
D & Gall	6	80.0	20.0	100.0	0.0	83.3	16.7
Dundee	37	82.4	17.6	90.0	10.0	86.5	13.5
Edinb	52	92.7	7.3	90.9	9.1	92.3	7.7
Glasgw	151	87.3	12.7	86.3	13.8	86.8	13.2
Inverns	18	46.2	53.8	80.0	20.0	55.6	44.4
Klmarnk	35	87.5	12.5	73.7	26.3	80.0	20.0
Krkcldy	35	76.9	23.1	90.9	9.1	85.7	14.3
Wales							
Bangor	24	100.0	0.0	77.8	22.2	83.3	16.7
Cardff	137	74.2	25.8	88.0	12.0	81.8	18.2
Clwyd	15	66.7	33.3	88.9	11.1	80.0	20.0
Swanse	100	60.0	40.0	83.1	16.9	75.0	25.0
Wrexm	36	57.1	42.9	90.9	9.1	77.8	22.2
England	**5,065**	**71.4**	**28.6**	**82.7**	**17.3**	**77.1**	**22.9**
N Ireland	**153**	**70.3**	**29.7**	**78.7**	**21.3**	**75.2**	**24.8**
Scotland	**438**	**82.7**	**17.3**	**85.0**	**15.0**	**83.8**	**16.2**
Wales	**312**	**69.1**	**30.9**	**85.7**	**14.3**	**79.2**	**20.8**
UK	**5,968**	**72.2**	**27.8**	**82.9**	**17.1**	**77.6**	**22.4**

Table 1.14. Initial and subsequent modalities for patients starting RRT in 2008

First treatment	*N*	Later modality	Percentage			
			90 days	1 year	3 years	5 years
HD	5,034	HD	88	72	48	30
		PD	2	3	2	1
		Transplant	1	4	12	16
		Other*	0	1	2	1
		Died	8	19	38	51
PD	1,297	HD	6	15	21	18
		PD	91	69	30	11
		Transplant	1	9	28	37
		Other*	0	1	1	1
		Died	2	7	21	33
Transplant	349	HD	1	1	3	4
		PD	0	0	0	0
		Transplant	99	97	94	92
		Died	0	1	3	5

*Other e.g. stopped treatment

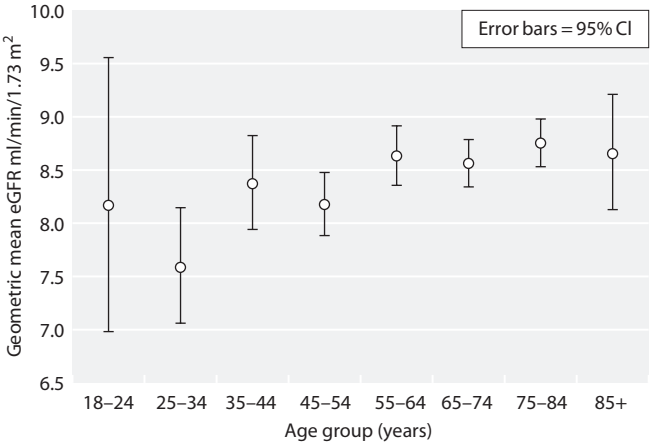

Fig. 1.9. Geometric mean eGFR at start of RRT (2013) by age group

Renal function at the time of starting RRT

The mean eGFR at initiation of RRT in 2013 was 8.5 ml/min/1.73 m^2. This is shown by age group in figure 1.9.

Figure 1.10 shows serial data from centres reporting annually to the UKRR since 2004. For the six years before 2011 there was higher average eGFR at start of RRT for PD than HD patients but the values were more similar between treatments for 2011 to 2013.

Some caution should be applied to the analyses of eGFR at the start of RRT as data was only available for less than half of the incident patients (approximately 3,000 for 2013) and almost half of these came from only 10 centres. Three-quarters of the values came from 22 centres. Further caution should be applied as a review of pre-RRT biochemistry in nine renal centres revealed that up to 18% of patients may have had an incorrect date of starting RRT allocated and thus, the eGFR used for analysis may have been taken whilst they were already receiving RRT. For details see the 12th Annual Report chapter 13: The UK Renal Registry Advanced CKD Study 2009 [4]. In the future the UKRR hopes to address this and related timeline anomalies by more frequent data downloads.

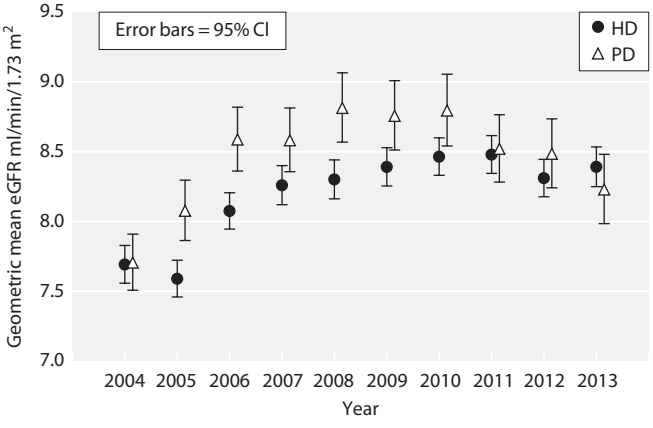

Fig. 1.10. eGFR on starting RRT 2004 to 2013, PD and HD (restricted to centres reporting since 2004)

3. Late presentation and delayed referral of incident patients

Introduction

Late presentation to a nephrologist is regarded as a negative aspect in renal care. It can be defined in a number of ways as it has a range of possible causes. There are many patients with chronic kidney disease who are regularly monitored in primary or secondary care and whose referral to nephrology services is delayed (delayed or late referral). In contrast, other patients present late to medical services due to no particular deficiency in the service; those with either such slowly progressive disease as to have remained asymptomatic for many years or the opposite – those with rapidly progressive CKD. The main analyses presented here do not differentiate between these groups and include any patient first seen by renal services within 90 days of starting RRT as 'late presentation'. One analysis attempts to capture 'late referrals': it shows the percentage presenting within 90 days of starting RRT after excluding an acute renal disease group.

Methods

Date first seen by a nephrologist has not been collected from the Scottish Renal Registry and so Scottish centres were excluded from these analyses. Data were included from all incident patients in English, Welsh or Northern Irish centres in the years 2012 to 2013. This two year cohort was used for most of the analyses in order to make the late presentation percentages more reliably estimated and to allow these to be shown for subgroups of patients. The date first seen in a renal centre and the date of starting RRT were used to define the late presenting cohort. A small amount of data were excluded because of actual or potential inconsistencies. Only data from those centres with 75% or more completeness for the relevant year were used. Data were excluded if 10% or more of the patients were reported to have started RRT on the same date as the first presentation. This was because investigation has shown that this is likely due to misunderstanding on the part of the renal centres resulting in incorrect recording of data. After these exclusions, data on 10,502 patients were available for analysis. Presentation times of 90 days or more before start were defined as early presentation and times of less than 90 days were defined as late presentation.

The 'acute' group was made up of those people with conditions likely to present with rapidly deteriorating renal function: crescentic glomerulonephritis (type I, II, III), renal vascular disease due to

malignant hypertension, renal vascular disease due to polyarteritis, Wegener's granulomatosis, cryoglobulinemic glomerulonephritis, myelomatosis/light chain deposit disease, Goodpasture's syndrome, systemic sclerosis, haemolytic ureaemic syndrome, multi-system disease – other, tubular necrosis (irreversible) or cortical necrosis, kidney tumour(s) and surgical loss of kidney(s).

Results

Table 1.15 shows the percentage completeness of data for 2012 and 2013. The overall average completeness was over 85%.

Late presentation by centre

Figure 1.11 shows that late presentation varied between centres from 6% to 36% in patients starting RRT in 2012 to 2013. The overall rate of late presentation was 18.6% and was 14.0% once those people with diseases likely to present acutely were excluded. Table 1.16 shows the overall percentage presenting late for the combined 2012/2013 incident cohort, the percentages presenting late amongst those patients defined as not having an 'acute diagnosis' and the percentages amongst non-diabetics (as PRD). The table also shows the percentages presenting less than a year before RRT initiation.

Late presentation in 2013 and the trend over time

There has been a steady decline nationally in the proportion of patients presenting late to renal services, with some centres achieving <10% late presentation rates.

Table 1.15. Percentage completeness of time of presentation data (2012 and 2013 incident RRT patients) by centre

	N		Percentage completeness	
Centre	2012	2013	2012	2013
England				
B Heart	102	99	97.1	93.9
B QEH	213	191	100.0	99.5
Basldn	53	32	98.1	100.0
Bradfd	69	62	97.1	100.0
Brightn	135	139	91.7	98.5
Bristol	148	173	96.6	49.7
Camb	125	139	100.0	88.5
Carlis	19	41	94.7	100.0
Carsh	243	231	88.0	68.7
Chelms	46	42	97.8	100.0
Colchr	29	30	100.0	100.0
Covnt	113	87	99.1	97.7
Derby	79	74	100.0	97.3
Donc	40	60	97.5	91.7
Dorset	73	74	98.6	100.0
Dudley	56	47	98.2	100.0
Exeter	135	102	97.0	97.1
Glouc	76	54	96.0	96.2
Hull	97	92	97.9	96.6
Ipswi	43	39	97.7	94.9
Kent	115	145	100.0	100.0
L Barts	268	291	1.5	1.7
L Guys	129	130	22.1	54.3
L Kings	124	162	98.4	98.8
L Rfree	237	228	99.2	98.7
L St.G	90	76	65.6	52.6
L West	355	303	81.6	99.0
Leeds	154	184	98.0	98.3
Leic	236	291	97.0	96.6
Liv Ain	63	66	100.0	97.0
Liv Roy	104	94	99.0	98.9
M RI	161	200	92.5	99.0
Middlbr	120	108	100.0	99.1
Newc	104	95	88.5	94.7
Norwch	74	76	91.9	*
Nottm	101	113	98.0	97.3
Oxford	170	166	98.2	96.4
Plymth	55	63	40.0	68.3
Ports	160	198	96.9	86.2
Prestn	146	151	95.8	99.3
Redng	73	117	97.3	99.2
Salford	134	111	10.6	0.9
Sheff	157	137	98.7	99.2
Shrew	58	61	98.3	100.0
Stevng	109	159	99.1	98.7
Sthend	26	42	100.0	97.6
Stoke	74	100	98.7	78.0
Sund	71	49	98.6	93.9
Truro	49	46	100.0	100.0
Wirral	44	68	95.4	98.5
Wolve	87	88	100.0	98.9
York	53	36	100.0	*
N Ireland				
Antrim	26	29	100.0	96.6
Belfast	93	69	90.3	95.7
Newry	17	23	100.0	100.0
Ulster	29	29	100.0	100.0
West NI	21	30	100.0	100.0
Wales				
Bangor	21	24	90.5	95.8
Cardff	171	169	98.8	97.6
Clwyd	22	14	100.0	*
Swanse	119	110	99.2	100.0
Wrexm	34	37	97.1	100.0
England	**5,795**	**5,962**	**87.0**	**84.4**
N Ireland	**186**	**180**	**95.2**	**97.8**
Wales	**367**	**354**	**98.4**	**94.6**
E, W & NI	**6,348**	**6,496**	**87.9**	**85.3**

*Data not shown as >10% of patients reported as starting RRT on the same date as first presentation

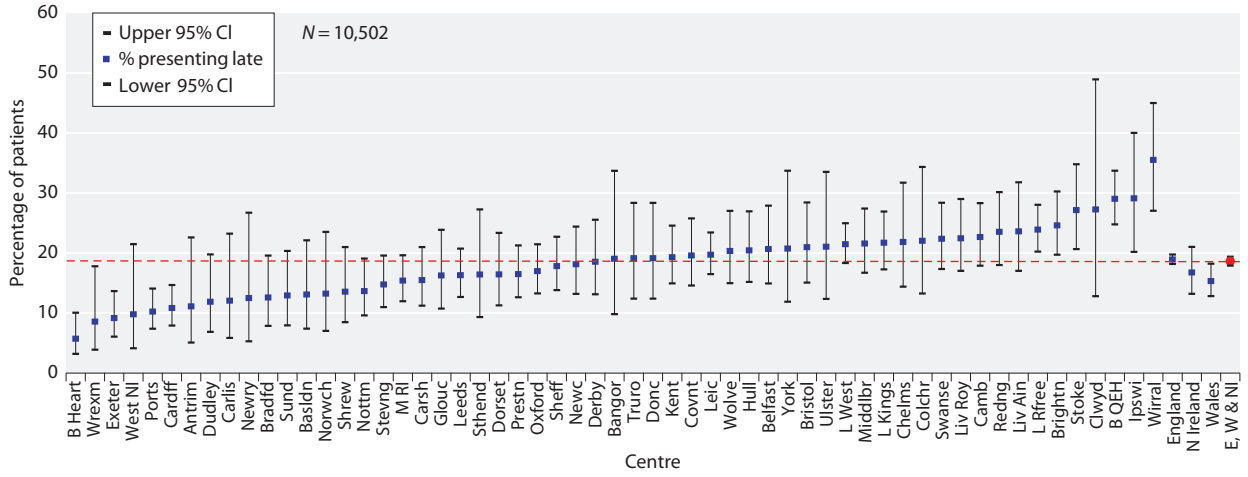

Fig. 1.11. Percentage presenting late (2012/2013)

This may be a consequence of the National CKD guidelines published by the Medical and GP Royal Colleges [5], the Quality and Outcomes Framework (QOF) initiative (www.dh.gov.uk) raising awareness of CKD amongst non-nephrologists and the introduction of estimated GFR reporting.

In 2013, 68.6% of incident patients presented to nephrology services over a year before they started RRT. There were 7.8% of patients presenting within the 6–12 month window before RRT, 5.2% within 3–6 months and 18.4% within three months of RRT start. Figure 1.12 shows this breakdown by year for those 26 centres supplying data over 75% complete for each of the last six years. The figure shows an increase over time in the percentage of patients presenting a year or more before starting RRT. As shown in previous reports this

Table 1.16. Percentage of patients presenting to a nephrologist less than 90 days before RRT initiation and percentage presenting less than a year before initiation (2012/2013 incident patients) by centre

		Percentage presenting <90 days before start				Percentage presenting <1 year before start[b]	
Centre	*N* with data	Overall	(95% CI)	Non-acute[a]	Non-diab PRD		(95% CI)
England							
B Heart	192	5.7	(3.2–10.1)	4.8	7.7	9.9	(6.4–15.0)
B QEH	396	29.0	(24.8–33.7)	24.7	30.1	46.5	(41.6–51.4)
Basldn	84	13.1	(7.4–22.1)	11.3	18.0	34.5	(25.2–45.3)
Bradfd	127	12.6	(7.9–19.6)	9.2	15.8	23.6	(17.0–31.8)
Brightn	256	24.6	(19.7–30.3)	19.4	27.7	38.7	(32.9–44.8)
Bristol	143	21.0	(15.1–28.4)	14.1	24.6	31.5	(24.4–39.5)
Camb	247	22.7	(17.9–28.3)			38.5	(32.6–44.7)
Carlis	58	12.1	(5.9–23.2)	9.3	13.2	20.7	(12.1–33.0)
Carsh	213	15.5	(11.2–21.0)	11.3	15.9	34.3	(28.2–40.9)
Chelms	87	21.8	(14.4–31.7)	16.3	26.6	39.1	(29.4–49.7)
Colchr	59	22.0	(13.3–34.3)	21.4	21.7	33.9	(23.0–46.8)
Covnt	194	19.6	(14.6–25.8)	12.2	22.4	29.9	(23.9–36.7)
Derby	151	18.5	(13.1–25.6)	13.5	23.8	27.8	(21.3–35.5)
Donc	94	19.2	(12.4–28.4)	14.3	22.8	24.5	(16.8–34.1)
Dorset	146	16.4	(11.3–23.4)	15.0	17.9	25.3	(19.0–33.0)
Dudley	101	11.9	(6.9–19.8)	9.7	12.9	21.8	(14.8–30.9)
Exeter	229	9.2	(6.1–13.7)	7.7	11.3	28.8	(23.3–35.0)
Glouc	123	16.3	(10.7–23.9)	13.0	16.0	27.6	(20.5–36.2)
Hull	181	20.4	(15.2–26.9)	14.7	23.6	37.0	(30.3–44.3)
Ipswi	79	29.1	(20.2–40.0)			58.2	(47.1–68.6)
Kent	259	19.3	(15.0–24.6)	17.8	22.0	30.9	(25.6–36.8)

Table 1.16. Continued

		Percentage presenting <90 days before start				Percentage presenting <1 year before start[b]	
Centre	*N* with data	Overall	(95% CI)	Non-acute[a]	Non-diab PRD		(95% CI)
L Kings	281	21.7	(17.3–26.9)	16.5	28.2	34.2	(28.9–39.9)
L Rfree	460	23.9	(20.2–28.0)	20.1	27.9	44.1	(39.7–48.7)
L West	587	21.5	(18.3–25.0)	18.1	23.6	34.4	(30.7–38.4)
Leeds	325	16.3	(12.7–20.7)	9.0	19.2	24.9	(20.5–29.9)
Leic	507	19.7	(16.5–23.4)	12.3	22.4	33.5	(29.6–37.8)
Liv Ain	127	23.6	(17.0–31.8)	21.0	29.9	37.8	(29.8–46.5)
Liv Roy	187	22.5	(17.0–29.0)	13.3	26.7	35.8	(29.3–43.0)
M RI	344	15.4	(12.0–19.6)	12.9	18.4	35.8	(30.9–41.0)
Middlbr	227	21.6	(16.7–27.4)	19.1	26.4	34.4	(28.5–40.8)
Newc	182	18.1	(13.2–24.4)	8.7	21.5	31.3	(25.0–38.4)
Norwch	68	13.2	(7.0–23.5)	11.1	16.1	22.1	(13.8–33.4)
Nottm	205	13.7	(9.6–19.1)	12.3	16.3	25.9	(20.3–32.3)
Oxford	324	17.0	(13.3–21.5)	12.8	22.4	28.7	(24.0–33.9)
Ports	322	10.3	(7.4–14.1)	5.4	11.7	17.7	(13.9–22.3)
Prestn	285	16.5	(12.6–21.3)	12.5	18.4	27.0	(22.2–32.5)
Redng	187	23.5	(18.0–30.1)	17.3	31.0	36.4	(29.8–43.5)
Sheff	286	17.8	(13.8–22.7)	13.4	22.0	27.3	(22.4–32.7)
Shrew	118	13.6	(8.5–21.0)	13.5	15.2	33.9	(25.9–42.9)
Stevng	264	14.8	(11.0–19.6)	11.3	16.2	20.1	(15.7–25.3)
Sthend	67	16.4	(9.3–27.3)	14.1	19.0	28.4	(18.9–40.2)
Stoke	151	27.2	(20.7–34.8)	22.2	29.1	45.0	(37.3–53.0)
Sund	116	12.9	(8.0–20.4)	10.8	11.8	21.6	(15.0–30.0)
Truro	94	19.2	(12.4–28.4)	14.3	22.1	31.9	(23.3–42.0)
Wirral	107	35.5	(27.0–45.0)			52.3	(42.9–61.6)
Wolve	172	20.4	(15.0–27.0)	17.8	21.3	36.6	(29.8–44.1)
York	53	20.8	(11.9–33.7)	15.6	21.4	28.3	(17.8–41.8)
N Ireland							
Antrim	54	11.1	(5.1–22.6)	8.2	15.0	24.1	(14.5–37.2)
Belfast	150	20.7	(14.9–27.9)	14.1	24.0	34.0	(26.9–41.9)
Newry	40	12.5	(5.3–26.7)	10.5	18.5	30.0	(17.9–45.7)
Ulster	57	21.1	(12.4–33.5)	18.2	18.2	28.1	(18.0–41.0)
West NI	51	9.8	(4.1–21.5)	8.7	11.9	21.6	(12.4–34.9)
Wales							
Bangor	42	19.1	(9.8–33.7)	19.5	26.9	28.6	(17.0–43.9)
Cardff	332	10.8	(7.9–14.7)	9.1	13.6	26.5	(22.0–31.5)
Clwyd	22	27.3	(12.8–48.9)	22.2	22.2	36.4	(19.3–57.7)
Swanse	219	22.4	(17.3–28.4)	14.8	27.7	38.8	(32.6–45.4)
Wrexm	70	8.6	(3.9–17.8)	7.6	11.5	25.7	(16.8–37.2)
England	**9,465**	**18.9**	**(18.2–19.8)**	**14.3**	**21.3**	**32.2**	**(31.3–33.2)**
N Ireland	**352**	**16.8**	**(13.2–21.0)**	**12.7**	**19.3**	**29.3**	**(24.7–34.2)**
Wales	**685**	**15.3**	**(12.8–18.2)**	**11.7**	**18.9**	**30.8**	**(27.5–34.4)**
E, W & NI	**10,502**	**18.6**	**(17.9–19.4)**	**14.0**	**21.1**	**32.0**	**(31.2–32.9)**
Min		**5.7**		**4.8**	**7.7**	**9.9**	
Quartile 1		**13.6**		**10.9**	**16.0**	**25.9**	
Quartile 3		**21.7**		**17.1**	**23.9**	**35.8**	
Max		**35.5**		**24.7**	**31.0**	**58.2**	

Blank cells – data for PRD not used due to high % with uncertain aetiology

[a]Non-acute group excludes crescentic (extracapillary) glomerulonephritis (type I, II, III), nephropathy (interstitial) due to cis-platinum, renal vascular disease due to malignant hypertension, renal vascular disease due to polyarteritis, Wegener's granulomatosis, cryoglobulinemic glomerulonephritis, myelomatosis/light chain deposit disease, Goodpasture's syndrome, systemic sclerosis (scleroderma), haemolytic ureaemic syndrome, multi-system disease – other, tubular necrosis (irreversible) or cortical necrosis, Balkan nephropathy, kidney tumour(s), and traumatic or surgical loss of kidney(s)

[b]The remaining patients starting RRT therefore presented over 1 year beforehand

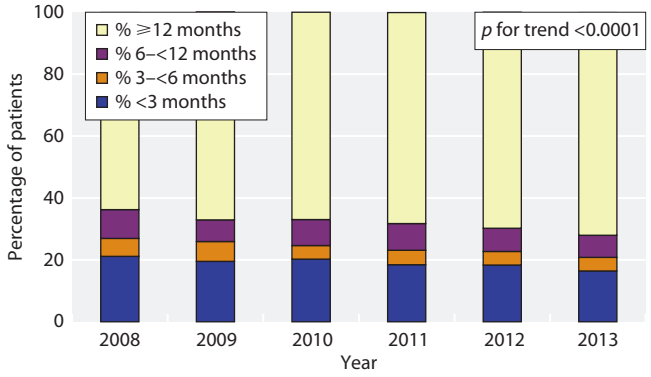

Fig. 1.12. Late presentation rate by year (2008–2013)
Restricted to centres reporting continuous data for 2008–2013

increase was most marked in the years just before those shown in the figure. In 2005, only 52.6% of incident patients presented over a year before they needed to start RRT compared with nearly 70% in 2013.

Age and late presentation

In the combined 2012/2013 incident cohort, patients who presented late were not significantly older or younger than patients who presented earlier (>90 days before RRT initiation) (median age 65.4 vs. 64.5 years: $p = 0.5$). Except for the two youngest age groups, the median duration of pre-RRT care did not vary greatly with age group (figure 1.13).

Gender and late presentation

In the 2012/2013 cohort, there was no significant difference in the ratio of males to females by time of presentation (male : female ratio 1.70 in early presentation, 1.77 in late presentation, $p = 0.4$).

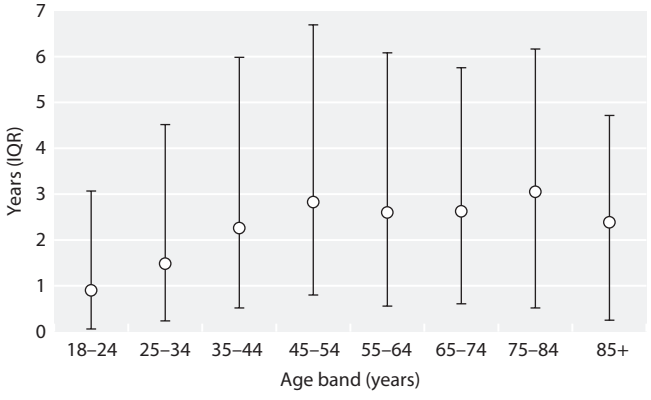

Fig. 1.13. Median duration of pre-RRT care by age group (incident patients 2012/2013)

Ethnicity and late presentation

In the 2012/2013 cohort, the percentage of South Asian and Black patients presenting late (<90 days) was somewhat lower than in Whites (16.3% vs. 18.7%: $p = 0.02$).

Primary renal disease and late presentation

In the 2012/2013 cohort, late presentation differed significantly between primary renal diagnoses (Chi-squared test $p < 0.0001$) (table 1.17). Patients in the acute group or with data not available had high rates of late presentation as anticipated. Those with diabetes and pyelonephritis or adult polycystic kidney disease had low rates in keeping with their longer natural histories of CKD progression. There was a notable decline in the proportion of diabetics presenting late up until 2007. Since then the proportion has been stable. The decline seen earlier likely reflects national initiatives to screen patients with diabetes for proteinuria and falling GFR.

Modality and late presentation

In the 2012/2013 cohort, late presentation was associated with initial modality. The percentage of patients whose first modality was PD was significantly lower in the late presentation group than in those presenting earlier (10.8% vs. 22.2%: $p < 0.0001$). By 90 days after

Table 1.17. Late presentation by primary renal diagnosis (2012/2013 incident patients)

		Late presentation	
Diagnosis	*N*	*N*	%
Uncertain aetiology	1,365	284	20.8
Diabetes	2,473	234	9.5
Glomerulonephritis	1,317	196	14.9
Other identified category	1,092	195	17.9
Polycystic kidney or pyelonephritis	1,366	132	9.7
Renal vascular disease	1,198	196	16.4
Acute group	886	489	55.2
Data not available	264	85	32.2

Unlike elsewhere in the report, the RVD group includes hypertension
Polycystic and pyelonephritis are grouped together
Acute group includes crescentic (extracapillary) glomerulonephritis (type I, II, III), nephropathy (interstitial) due to cis-platinum, renal vascular disease due to malignant hypertension, renal vascular disease due to polyarteritis, Wegener's granulomatosis, cryoglobulinemic glomerulonephritis, myelomatosis/light chain deposit disease, Goodpasture's syndrome, systemic sclerosis (scleroderma), haemolytic ureaemic syndrome, multi-system disease – other, tubular necrosis (irreversible) or cortical necrosis, Balkan nephropathy, kidney tumour(s), and traumatic or surgical loss of kidney(s)

Table 1.18. Percentage prevalence of specific comorbidities amongst patients presenting late (<90 days) compared with those presenting early (⩾90 days) (2012/2013 incident patients)

Comorbidity	<90 days	⩾90 days	*p*-value
Ischaemic heart disease	15.9	19.7	0.003
Cerebrovascular disease	9.4	10.6	0.2
Peripheral vascular disease	10.4	12.0	0.1
Diabetes (not a cause of ERF)	9.2	9.9	0.5
Liver disease	4.3	2.8	0.01
Malignancy	21.3	11.5	<0.0001
COPD	7.7	7.3	0.6
Smoking	15.2	13.6	0.2

RRT initiation this difference was reduced, although it was still highly significant (12.8% vs. 22.0%: $p < 0.0001$).

Comorbidity and late presentation

In the 2012/2013 cohort, the percentage of patients who were assessed as having no comorbidity was similar in those who presented late as in those presenting earlier (45.2% vs. 47.4%: $p = 0.2$). That said however, there were differences in those with comorbidities: ischaemic heart disease was significantly less common and liver disease and malignancy significantly more common in those presenting late compared to those presenting early (table 1.18) perhaps reflecting underlying causes of CKD and its progression. This is in keeping with findings from other studies [6–8].

Haemoglobin and late presentation

In the 2012/2013 cohort, patients presenting late had a significantly lower average haemoglobin concentration at RRT initiation than patients presenting earlier (91 vs. 101 g/L: $p < 0.0001$). This may reflect inadequate predialysis care with limited anaemia management, but alternatively those presenting late may be more likely to have anaemia because of multisystem disease or intercurrent illness. More detailed analyses of haemoglobin at start of RRT and late presentation can be found in chapter 7: Haemoglobin, Ferritin and Erythropoietin amongst UK Adult Dialysis Patients in 2013.

eGFR at start of RRT and late presentation

In the 2012/2013 cohort, eGFR at start of RRT was significantly lower in patients presenting late than those presenting earlier (7.7 vs. 8.6 ml/min/1.73 m^2: $p < 0.0001$). Although these findings are in contrast to some of the studies in the literature, many of those studies pre-date the era of routine use of eGFR [6, 7]. A recent Cochrane review has shown that eGFR was indeed higher in RRT patients [9] referred early (mean difference of 0.42 ml/min/1.73 m^2) compared to those presenting late (definition: up to 6 months before starting RRT) consistent with UKRR data.

International comparisons

Figure 1.14 shows the crude RRT incidence rates (including children) for 2011 for several countries. The data is from the USRDS [10]; 2011 was the latest year available at time of writing. The UK incidence rate was similar to those in many other Northern European countries, Australia and New Zealand but remained markedly lower than in some other countries, most

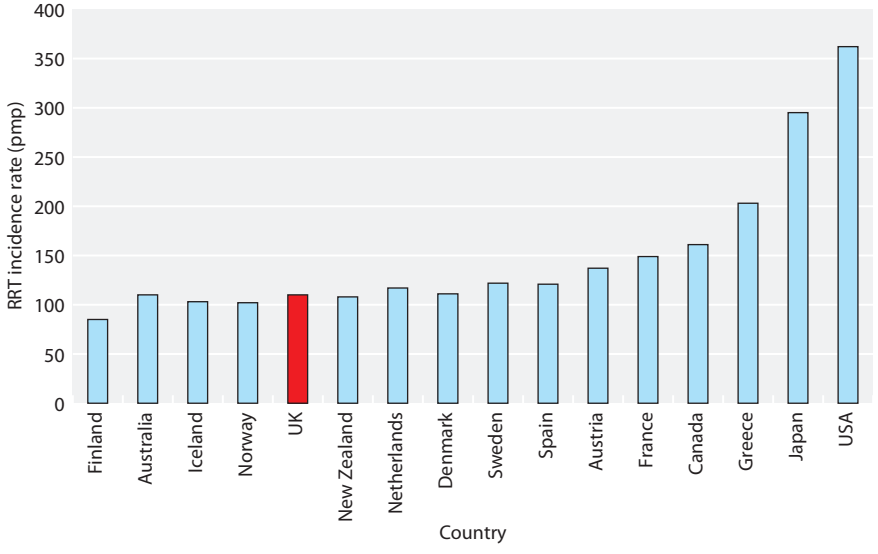

Fig. 1.14. International comparison of RRT incidence rates in 2011
Non UK data from USRDS [10]

notably Greece, Japan and the USA. There are numerous reasons for these differences which have been documented and explored in other ecological studies and summarised by this review [11].

Survival of incident patients

See chapter 5: Survival and Causes of Death of UK Adult Patients on Renal Replacement Therapy in 2013.

Conclusions

Across the UK, as a whole, the renal replacement therapy (RRT) incidence rate for 2013 was similar to those in 2012 and 2011. Partly because of the smaller numbers involved, rates have been more variable over the last few years for Northern Ireland, Scotland and Wales compared with England. Wales continues to have the highest incidence rate and there remains large between centre variation in incidence rates for RRT some of which is likely explained by population differences in ethnicity and age structure. There was a seven-fold variation between CCG/HBs in the rates of older people (>75) starting RRT and also substantial between centre variation in use of different types of RRT modality some of which suggests inefficient use of cheaper and more effective forms of treatment. Although significant numbers of patients continue to present late to renal centres this proportion has dropped substantially in the last eight years. Some centre's lower rates (<10%) suggest that local factors may be worth exploring in improving this aspect of renal care. Plans for more frequent and more detailed data downloads will hopefully allow the UKRR to explore these areas of variation in advanced CKD care.

Conflicts of interest: none

References

1 http://www.renal.org/guidelines/modules/planning-initiating-and-withdrawal-of-renal-replacement-therapy#sthash.IDPHwzZI.dpbs
2 Levey AS, Coresh J, Greene T, Stevens LA, Zhang YL, Hendriksen S, Kusek JW, Van Lente F: Chronic Kidney Disease Epidemiology Collaboration. Using standardized serum creatinine values in the modification of diet in renal disease study equation for estimating glomerular filtration rate. Ann Intern Med. 2006;145(4):247–54
3 http://www.nomisweb.co.uk/census/2011/LC2101EW/view/2092957703?rows=c_ethpuk11&cols=c_age
4 Ford DJ, Fogarty DG, Steenkamp R, Tomson CRV, Ben-Shlomo Y, Ansell D: Chapter 13: The UK Renal Registry Advanced CKD Study: frequency of incorrect reporting of date of start of RRT. Nephron Clinical Practice;115(suppl 1):c271–c78
5 http://www.renal.org/CKDguide/full/UKCKDfull.pdf
6 Kazmi WH et al.: Late nephrology referral and mortality among patients with end-stage renal disease: a propensity score analysis. Nephrology Dialysis Transplantation, 2004;19(7):1808–1814
7 Roubicek C, et al.: Timing of nephrology referral: Influence on mortality and morbidity. American journal of kidney diseases: the official journal of the National Kidney Foundation, 2000;36(1):35–41
8 Winkelmayer WC, et al.: A Propensity Analysis of Late Versus Early Nephrologist Referral and Mortality on Dialysis. Journal of the American Society of Nephrology, 2003;14(2):486–492
9 Cochrane Database Syst Rev: Early referral to specialist nephrology services for preventing the progression to end-stage kidney disease. 2014 Jun 18;6:CD007333. doi: 10.1002/14651858.CD007333.pub2
10 US Renal Data System, USRDS 2013 Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2013
11 Caskey FJ, Jager KJ: A population approach to renal replacement therapy epidemiology: lessons from the EVEREST study. Nephrol Dial Transplant. 2014 Aug;29(8):1494–9. doi: 10.1093/ndt/gft390. Epub 2013 Oct 28

UK Renal Registry 17th Annual Report: Chapter 2 UK Renal Replacement Therapy Prevalence in 2013: National and Centre-specific Analyses

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Key Words
Chronic kidney disease · Clinical Commissioning Group · Comorbidity · Diabetes · Dialysis · End stage renal disease · Established renal failure · Ethnicity · Haemodialysis · Peritoneal dialysis · Prevalence · Renal replacement therapy · Transplantation · Treatment modality

Summary

- There were 56,940 adult patients receiving renal replacement therapy (RRT) in the UK on 31st December 2013, an absolute increase of 4.0 % from 2012.
- The actual number of patients increased 1.2% for haemodialysis (HD), 7.1% for those with a functioning transplant but decreased 3.3% for peritoneal dialysis (PD).
- The UK adult prevalence of RRT was 888 per million population (pmp). The reported prevalence in 2000 was 523 pmp.
- The number of patients receiving home HD increased by 3% from 1,080 patients in 2012 to 1,113 patients in 2013.
- The median age of prevalent patients was 58.4 years (HD 66.9 years, PD 63.7 years, transplant 52.8 years). In 2000 the median age was 55 years (HD 63 years, PD 58 years, transplant 48 years). The percentage of RRT patients aged greater than 70 years increased from 19.2% in 2000 to 25% in 2013.
- For all ages, the prevalence rate in men exceeded that in women, peaking in age group 75–79 years at 3,010 pmp in men and for women at 1,560 pmp.
- The most common identifiable renal diagnosis was glomerulonephritis (19.0%), followed by aetiology uncertain (16.0 %) and diabetes (15.9%).
- Transplantation continued as the most common treatment modality (52%), HD was used in 41.6% and PD in 6.4% of RRT patients.
- Prevalence rates in patients aged >85 years continued to increase between 2012 and 2013 (983 pmarp to 1,020 pmarp).
- In 2013, 21.1% of the prevalent UK RRT population (with ethnicity assigned) were from ethnic minorities compared to 14.9% in 2007.

Introduction

This chapter presents data on all adult patients on RRT in the UK at the end of 2013. The UK Renal Registry (UKRR) received data returns for 2013 from all five renal centres in Wales, all five in Northern Ireland and all 52 in England. Data from all nine centres in Scotland were obtained from the Scottish Renal Registry. Demographic data on children and young adults can be found in chapter 4.

These analyses of prevalent RRT patients are performed annually to aid clinicians and policy makers in planning future RRT requirements in the UK. It is important to understand national, regional and centre level variation in numbers of prevalent patients as part of the planning process. In addition, knowledge about variation in case mix is also reported to improve understanding of where resources should be focussed to improve equity of provision of RRT in the UK.

The term established renal failure (ERF) used within this chapter is synonymous with the terms end stage renal failure and end stage renal disease, which are in more widespread international usage. Patients have disliked the term 'end stage' which reflects the inevitable outcome of this disease.

Methods

Crude prevalence rates were calculated per million population (pmp) and age/gender standardised prevalence ratios were calculated as detailed in appendix D: Methodology used for Analyses of Clinical Commissioning Group (CCG)/Health Board (HB) Incidence and Prevalence Rates and of Standardised Ratios. (www.renalreg.org).

Throughout this chapter, haemodialysis refers to all modes of HD treatment, including haemodiafiltration (HDF). Several centres reported significant numbers of patients on HDF, but other centres did not differentiate this treatment type in their UKRR returns. Where joint care of renal transplant recipients between the referring centre and the transplant centre occurred, the patient was usually allocated to the referring centre (refer to appendix B2 for allocation procedure). Thus the number of patients allocated to a transplant centre is often lower than that recorded by the centre itself and as a converse pre-emptively transplanted patients are sometimes allocated to the transplanting centre rather than the referring centre if no transfer out code had been sent through. Queries and updated information are welcomed by the UKRR at any point during the year if this has occurred.

Prevalent patients on RRT in 2013 were examined by time on RRT, age group, gender, ethnic origin, primary renal disease, presence of diabetes and treatment modality (see appendix H: Coding) (www.renalreg.org). In the analysis of prevalence, only adult patients on RRT contributed to the numerator.

Time on RRT was defined as median time on treatment and was calculated from the most recent start date. Patients without an accurate start date were excluded from this calculation.

Analyses were done for the UK as a whole, by UK country, at centre level and split by treatment modality when appropriate.

Chi-squared test, Fisher's exact test, linear regression and Kruskal Wallis tests were used as appropriate to test for significant differences between groups. The data were analysed using SAS 9.3.

Results

Prevalent patient numbers and changes in prevalence

The number of patients for each country (table 2.1) was calculated by adding the patient numbers in each renal centre and these differ marginally from those quoted elsewhere in this report when patients are allocated to geographical areas by their individual postcodes, as some centres treat patients across national boundaries.

There were 56,940 adult patients receiving RRT in the UK at the end of 2013, giving an adult UK population prevalence of 888 pmp (table 2.1) compared with 861 pmp in 2012. Prevalence rates increased in all of the UK countries in 2013. PD prevalence decreased in the four countries compared with 2012. The decline in PD prevalence in the UK overall noted since 1997 was thought to have plateaued in 2011 and 2012 but has shown a further decline in 2013 with a prevalence rate of 57 pmp. Once more, the prevalence of transplanted patients increased in the UK. Northern Ireland had a higher RRT prevalence rate for patients aged 75 and older compared with the other UK countries (figure 2.1). In the UK, the RRT prevalence rate in patients aged 80–84 continued to rise over time from 1,896 per million age related population (pmarp) in 2012 to 1,922 pmarp in 2013 and in patients aged >85 years from 983 pmarp in 2012 to 1,021 pmarp in 2013. It is likely that this ageing of the prevalent population was due to an increasing number of older patients starting RRT, although improving patient survival will also contribute.

Prevalent patients by RRT modality and centre

The number of prevalent patients in each renal centre and the distribution of their treatment modalities varied widely (table 2.2). Many factors including geography, local population density, age distribution, ethnic

Table 2.1. Prevalence of adult RRT in the UK on 31/12/2013

	England	N Ireland	Scotland	Wales	UK
Number of prevalent patients	48,053	1,546	4,564	2,777	56,940
Total estimated population, mid-2013 (millions)*	53.9	1.8	5.3	3.1	64.1
Prevalence rate HD (pmp)	373	355	349	350	369
Prevalence rate PD (pmp)	59	44	42	59	57
Prevalence rate dialysis (pmp)	432	400	392	409	427
Prevalence rate transplant (pmp)	460	445	465	492	462
Prevalence rate total (pmp)	892	845	857	901	888
95% confidence intervals total (pmp)	884–900	803–887	832–882	867–934	881–896

*Data from the Office for National Statistics, National Records of Scotland and the Northern Ireland Statistics and Research Agency – based on the 2011 census

composition, prevalence of diseases predisposing to kidney disease and the social deprivation index of that population may contribute to this. Patient survival on RRT would also contribute and may be influenced by access to high quality health care for the comorbid conditions seen in these patients.

Changes in prevalence

Overall growth in the prevalent UK RRT population from 2012 to 2013 was 4.0% (table 2.3), an annual growth rate which has been fairly consistent over the last 10–15 years (figure 2.2). The increases in prevalence across Scotland and Wales were similar at 1.4% and 1.6% respectively. The increase in prevalence in England was highest in magnitude at 4.5%. In Northern Ireland the increase in the prevalent RRT population was 2.2% between 2012 and 2013.

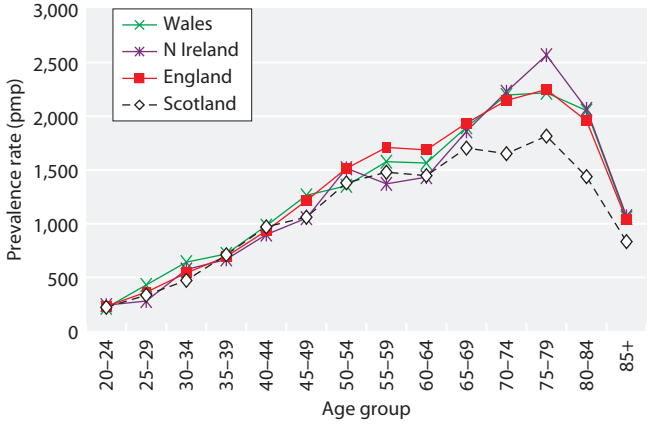

Fig. 2.1. Prevalence rates per million population by age group and UK country on 31/12/2013

From 2012 to 2013, for the first time there was a fall in prevalent HD patients with a 0.1% pmp decrease, a 5.8% pmp increase in those with a functioning transplant and a 4.6% pmp decline in patients on PD.

Between 2008 and 2013 there was an average annual 1.6% pmp growth in HD, 3.7% pmp fall in PD, and 4.9% pmp growth in prevalent transplant patients in the UK (table 2.4). In the same period there was an average annual 13.3% pmp growth in the use of home haemodialysis (data not shown).

Prevalence rates between centres showed marked variation (table 2.2); the long-term (1997–2013) UK prevalence pattern by treatment modality is shown in figure 2.2. The steady growth in transplant numbers was maintained in 2013. The increase in haemodialysis patient numbers has been associated with an increase in home haemodialysis, from 2.1% of the dialysis population in 2004 ($n = 449$) to 4.1% in 2013 ($n = 1{,}113$) with the number of patients doubling over the 10 year period. In contrast PD has fallen by 6.5% between 2004 and 2013.

Prevalence of RRT in Clinical Commissioning Groups in England (CCGs), Health and Social Care Areas in Northern Ireland (HBs), Local Health Boards in Wales (HBs) and Health Boards in Scotland (HBs)

The need for RRT depends on many factors such as predisposing conditions but also on social and demographic factors such as age, gender, social deprivation and ethnicity. Hence, comparison of crude prevalence rates by geographical area can be misleading. This section, as in previous reports, uses age and gender standardisation to compare RRT prevalence rates. The ethnic minority profile is also provided to help understand the differences in standardised prevalence ratios (SPRs).

Table 2.2. Number of prevalent RRT patients by treatment modality and centre on 31/12/2013

	N					Catchment population (millions)	2013 crude rate pmp	(95% CI)
Centre	HD	PD	Dialysis	Transplant	RRT			
England								
B Heart	435	41	476	182	658	0.74	892	(823–960)
B QEH[a]	933	137	1,070	981	2,051	1.70	1,207	(1,155–1,259)
Basldn	160	30	190	80	270	0.42	651	(573–728)
Bradfd	202	30	232	288	520	0.65	798	(729–866)
Brightn	398	79	477	398	875	1.30	675	(630–719)
Bristol[a]	514	67	581	846	1,427	1.44	991	(940–1,043)
Camb[a]	380	25	405	793	1,198	1.16	1,035	(976–1,093)
Carlis	68	28	96	131	227	0.32	708	(616–800)
Carsh	762	122	884	604	1,488	1.91	778	(738–818)
Chelms	123	21	144	95	239	0.51	468	(409–528)
Colchr	115		115		115	0.30	384	(314–454)
Covnt[a,b]	383	86	469	471	940	0.89	1,054	(986–1,121)
Derby	217	85	302	170	472	0.70	672	(611–732)
Donc	163	35	198	61	259	0.41	632	(555–708)
Dorset	267	48	315	313	628	0.86	729	(672–786)
Dudley	175	56	231	81	312	0.44	706	(628–785)
Exeter[b]	410	73	483	413	896	1.09	823	(769–876)
Glouc	211	33	244	168	412	0.59	702	(634–769)
Hull	327	80	407	408	815	1.02	799	(744–854)
Ipswi	122	30	152	202	354	0.40	887	(795–980)
Kent	395	64	459	506	965	1.22	788	(738–838)
L Barts[a]	954	197	1,151	952	2,103	1.83	1,149	(1,100–1,198)
L Guys[a]	630	29	659	1,182	1,841	1.08	1,701	(1,623–1,779)
L Kings	498	105	603	362	965	1.17	824	(772–876)
L Rfree[a]	731	131	862	1,093	1,955	1.52	1,288	(1,231–1,345)
L St.G[a,b]	280	48	328	431	759	0.80	951	(884–1,019)
L West[a]	1,398	61	1,459	1,683	3,142	2.40	1,310	(1,264–1,356)
Leeds[a]	507	69	576	890	1,466	1.67	878	(833–923)
Leic[a]	905	152	1,057	1,015	2,072	2.44	851	(814–887)
Liv Ain	155	30	185	5	190	0.48	393	(337–448)
Liv Roy[a]	359	58	417	852	1,269	1.00	1,269	(1,199–1,339)
M RI[a]	522	83	605	1,259	1,864	1.53	1,217	(1,162–1,272)
Middlbr	351	14	365	471	836	1.00	833	(776–889)
Newc[a]	274	42	316	648	964	1.12	860	(806–914)
Norwch	330	40	370	322	692	0.79	880	(814–945)
Nottm[a]	371	83	454	621	1,075	1.09	988	(929–1,047)
Oxford[a]	435	99	534	1,031	1,565	1.69	926	(880–972)
Plymth[a]	134	37	171	332	503	0.47	1,071	(977–1,164)
Ports[a]	600	85	685	870	1,555	2.02	768	(730–807)
Prestn	547	56	603	487	1,090	1.49	730	(687–773)
Redng	282	76	358	373	731	0.91	803	(745–861)
Salford[b]	399	85	484	411	895	1.49	601	(561–640)
Sheff[a]	589	70	659	670	1,329	1.37	969	(917–1,021)
Shrew	187	32	219	123	342	0.50	683	(611–755)
Stevng[b]	464	40	504	254	758	1.20	630	(585–674)
Sthend	120	18	138	83	221	0.32	698	(606–790)
Stoke	311	87	398	328	726	0.89	816	(757–875)
Sund	197	11	208	215	423	0.62	684	(619–749)
Truro	151	24	175	202	377	0.41	913	(820–1,005)
Wirral	213	35	248	4	252	0.57	441	(386–495)
Wolve	301	82	383	180	563	0.67	842	(772–911)
York	140	27	167	242	409	0.49	831	(750–911)

Table 2.2. Continued

Centre	*N*					Catchment population (millions)	2013 crude rate pmp	(95% CI)
	HD	PD	Dialysis	Transplant	RRT			
Northern Ireland								
Antrim	127	15	142	82	224	0.29	760	(660–860)
Belfast[a]	212	27	239	490	729	0.64	1,145	(1,061–1,228)
Newry	92	18	110	89	199	0.26	762	(656–868)
Ulster	106	6	112	44	156	0.27	586	(494–678)
West NI	113	15	128	110	238	0.35	676	(590–762)
Scotland								
Abrdn	223	25	248	271	519	0.60	865	(791–940)
Airdrie	192	14	206	187	393	0.55	712	(642–782)
D & Gall	45	15	60	57	117	0.15	788	(645–931)
Dundee	172	21	193	210	403	0.46	870	(785–955)
Edinb[a]	276	30	306	433	739	0.96	766	(711–822)
Glasgw[a]	599	44	643	955	1,598	1.62	984	(936–1,032)
Inverns	69	15	84	132	216	0.27	800	(693–907)
Klmarnk	137	43	180	116	296	0.36	819	(726–912)
Krkcldy	147	19	166	117	283	0.32	894	(789–998)
Wales								
Bangor	86	13	99		99	0.22	454	(364–543)
Cardff[a]	486	75	561	1,023	1,584	1.42	1,115	(1,061–1,170)
Clwyd	76	14	90	63	153	0.19	807	(679–935)
Swanse	329	58	387	304	691	0.89	780	(722–839)
Wrexm	101	22	123	127	250	0.24	1,041	(912–1,170)
England	**20,095**	**3,176**	**23,271**	**24,782**	**48,053**			
N Ireland	**650**	**81**	**731**	**815**	**1,546**			
Scotland	**1,860**	**226**	**2,086**	**2,478**	**4,564**			
Wales	**1,078**	**182**	**1,260**	**1,517**	**2,777**			
UK	**23,683**	**3,665**	**27,348**	**29,592**	**56,940**			

Blank cells indicate no patients on that treatment type attending that centre when data were collected
Centres prefixed 'L' are London centres
The numbers of patients calculated for each country quoted above differ marginally from those quoted elsewhere in this report when patients are allocated to areas by their individual post codes, as some centres treat patients from across national boundaries
[a]Transplant centres
[b]Subsequent to closing the 2013 database several centres reporting a variation to the numbers returned. Tables 2.1, 2.3 and 2.4 (but not the remainder of this chapter) reflect these revisions (Covnt (+8), Exeter (+6), L St.G (+5), Salford (+9), Stevng (−7))

The impact of social deprivation was reported in the 2003 UKRR Report [1].

There were substantial variations in the crude CCG/HB prevalence rates pmp, from 474 pmp (Shetland, population 23,200) to 1,656 pmp (NHS Brent, population 314,700). There were similar variations in the standardised prevalence ratios (ratio of observed: expected prevalence rate given the age/gender breakdown of the CCG/HB) from 0.50 (Shetland) to 2.19 (Brent) (table 2.5). Confidence intervals are not presented for the crude rates per million population for 2013 but figures D3 and D4 in appendix D (www.renalreg.org) can be used to determine if a CCG/HB falls within the range representing the 95% confidence limit of the national average prevalence rate.

Factors associated with variation in standardised prevalence ratios in Clinical Commissioning Groups in England, Health and Social Care Trust Areas in Northern Ireland, Local Health Boards in Wales and Health Boards in Scotland

In 2013, there were 78 CCGs/HBs with a significantly low SPR, 112 with a 'normal' SPR and 47 with a significantly high SPR (table 2.5). The areas with high and low SPRs have been fairly consistent over the last few years. They tend to reflect the demographics of the regions in question such that urban, ethnically diverse populations in areas of high social deprivation have the highest prevalence rates of renal replacement therapy. Mean SPRs were significantly higher in the 88 CCGs/HBs with an ethnic minority population greater than

Table 2.3. Number of prevalent patients on RRT by centre at year end 2009–2013

Centre	Date					% change 2012–2013	% annual change 2009–2013
	31/12/2009	31/12/2010	31/12/2011	31/12/2012	31/12/2013		
England							
B Heart	626	635	666	671	658	−1.9	1.3
B QEH	1,821	1,844	1,912	1,971	2,051	4.1	3.0
Basldn	214	214	233	258	270	4.7	6.0
Bradfd	426	455	467	504	520	3.2	5.1
Brightn	737	770	777	831	875	5.3	4.4
Bristol	1,236	1,264	1,317	1,337	1,427	6.7	3.7
Camb	942	1,004	1,076	1,111	1,198	7.8	6.2
Carlis	205	206	215	216	227	5.1	2.6
Carsh	1,302	1,377	1,380	1,460	1,488	1.9	3.4
Chelms	228	238	216	224	239	6.7	1.2
Colchr	116	120	119	117	115	−1.7	−0.2
Covnt	794	844	874	897	940	4.8	4.3
Derby	419	459	467	476	472	−0.8	3.0
Donc	196	222	248	261	259	−0.8	7.2
Dorset	553	585	587	609	628	3.1	3.2
Dudley	292	303	286	314	312	−0.6	1.7
Exeter	731	785	809	842	896	6.4	5.2
Glouc	366	377	381	416	412	−1.0	3.0
Hull	725	725	757	782	815	4.2	3.0
Ipswi	312	316	340	339	354	4.4	3.2
Kent	744	797	864	919	965	5.0	6.7
L Barts	1,638	1,778	1,874	1,956	2,103	7.5	6.4
L Guys	1,616	1,627	1,684	1,741	1,841	5.7	3.3
L Kings	786	837	872	918	965	5.1	5.3
L Rfree	1,546	1,639	1,727	1,854	1,955	5.4	6.0
L St.G	663	684	716	710	759	6.9	3.4
L West	2,736	2,879	3,020	3,100	3,142	1.4	3.5
Leeds	1,348	1,383	1,425	1,413	1,466	3.8	2.1
Leic	1,737	1,809	1,927	1,975	2,072	4.9	4.5
Liv Ain	148	161	190	194	190	−2.1	6.4
Liv Roy	1,223	1,238	1,250	1,237	1,269	2.6	0.9
M RI	1,453	1,557	1,650	1,711	1,864	8.9	6.4
Middlbr	707	711	754	790	836	5.8	4.3
Newc	899	903	919	946	964	1.9	1.8
Norwch	594	617	611	623	692	11.1	3.9
Nottm	981	1,012	1,022	1,012	1,075	6.2	2.3
Oxford	1,343	1,423	1,451	1,533	1,565	2.1	3.9
Plymth	457	462	465	458	503	9.8	2.4
Ports	1,301	1,333	1,394	1,445	1,555	7.6	4.6
Prestn	941	970	1,018	1,078	1,090	1.1	3.7
Redng	618	636	688	672	731	8.8	4.3
Salford	785	837	832	880	895	1.7	3.3
Sheff	1,216	1,254	1,260	1,299	1,329	2.3	2.2
Shrew	337	345	345	357	342	−4.2	0.4
Stevng	584	608	641	668	758	13.5	6.7
Sthend	207	212	208	213	221	3.8	1.6
Stoke	643	659	696	699	726	3.9	3.1
Sund	368	369	388	422	423	0.2	3.5
Truro	320	336	356	377	377	0.0	4.2
Wirral	224	224	234	225	252	12.0	3.0
Wolve	490	532	513	524	563	7.4	3.5
York	321	340	340	396	409	3.3	6.2

Table 2.3. Continued

Centre	Date					% change	% annual change
	31/12/2009	31/12/2010	31/12/2011	31/12/2012	31/12/2013	2012–2013	2009–2013
N Ireland							
Antrim	217	218	225	223	224	0.4	0.8
Belfast	680	682	685	703	729	3.7	1.8
Newry	172	179	190	188	199	5.9	3.7
Ulster	114	115	137	145	156	7.6	8.2
West NI	258	258	270	253	238	−5.9	−2.0
Scotland							
Abrdn	452	462	478	505	519	2.8	3.5
Airdrie	310	326	344	388	393	1.3	6.1
D & Gall	118	118	122	127	117	−7.9	−0.2
Dundee	395	385	400	401	403	0.5	0.5
Edinb	721	731	700	723	739	2.2	0.6
Glasgw	1,469	1,505	1,477	1,555	1,598	2.8	2.1
Inverns	229	232	225	221	216	−2.3	−1.5
Klmarnk	273	284	299	302	296	−2.0	2.0
Krkcldy	241	263	278	278	283	1.8	4.1
Wales							
Bangor	110	113	109	105	99	−5.7	−2.6
Cardff	1,426	1,517	1,534	1,544	1,584	2.6	2.7
Clwyd	147	142	137	173	153	−11.6	1.0
Swanse	618	635	657	662	691	4.4	2.8
Wrexm	219	223	237	248	250	0.8	3.4
England	**41,215**	**42,915**	**44,461**	**45,981**	**48,053**	4.5	3.9
N Ireland	**1,441**	**1,452**	**1,507**	**1,512**	**1,546**	2.2	1.8
Scotland	**4,208**	**4,306**	**4,323**	**4,500**	**4,564**	1.4	2.1
Wales	**2,520**	**2,630**	**2,674**	**2,732**	**2,777**	1.6	2.5
UK	**49,384**	**51,303**	**52,965**	**54,725**	**56,940**	4.0	3.6

10% than in those with lower ethnic minority populations ($p < 0.001$). The SPR was positively correlated with the percentage of the population that are non-White ($r = 0.9$ $p < 0.001$). In 2013 for each 10% increase in ethnic minority population, the standardised prevalence ratio increased by 0.17 (equates to ~17%). In figure 2.3, the relationship between the ethnic composition of a CCG/HB and its SPR is demonstrated.

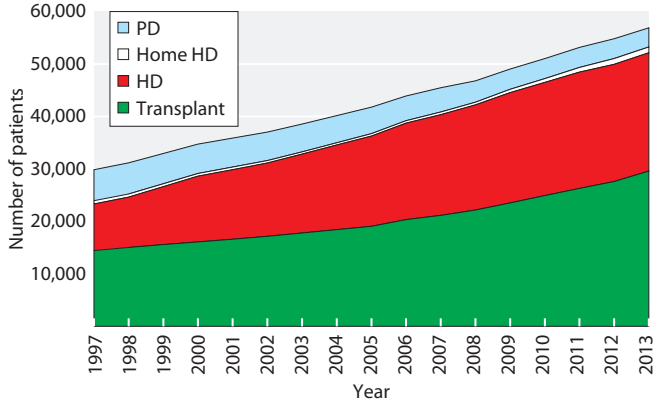

Fig. 2.2. Growth in prevalent patients by treatment modality at the end of each year 1997–2013

Only two of the 149 CCGs/HBs with ethnic minority populations of less than 10% had high SPRs: Abertawe Bro Morgannwg University and Cwm Taf. Forty-five (51.1%) of the 88 CCGs/HBs with ethnic minority populations greater than 10% had high SPRs, whereas nine (10%) (NHS Airedale, Wharfedale and Craven; NHS Brighton & Hove, NHS Chiltern, NHS Havering, NHS East and North Hertfordshire, NHS Leeds North, NHS Leeds West, NHS Richmond, NHS Solihull) had low SPRs. Some of the CCGs/HBs with a high (>15%) ethnic minority population had a normal expected RRT prevalence rate (e.g. NHS Bolton, NHS Oldham, NHS North and South Manchester). The age and gender standardised prevalence ratios in each region of England and in Wales, Northern Ireland and Scotland are presented in table 2.6. These calculations have not taken into account variation in ethnicity between areas. Wales and Northern Ireland previously had higher than expected prevalence rates but in more recent years were

Table 2.4. Change in RRT prevalence rates pmp 2008–2013 by modality*

	Prevalence					% growth in prevalence pmp				
Year	HD pmp	PD pmp	Dialysis pmp	Transplant pmp	RRT pmp	HD	PD	Dialysis	Tx	RRT
2008	342	69	411	363	774					
2009	354	64	417	377	794	3.5	−7.8	1.6	3.7	2.6
2010	359	62	421	397	818	1.5	−3.2	0.8	5.4	3.0
2011	365	60	426	416	841	1.7	−2.2	1.1	4.7	2.9
2012	370	60	430	436	866	1.3	−0.9	1.0	5.0	3.0
2013	369	57	427	462	888	−0.1	−4.6	−0.8	5.8	2.5
Average annual growth 2008–2013						1.6	−3.7	0.8	4.9	2.8

*Differences in the figures for dialysis and RRT prevalence and the sum of the separate modalities are due to rounding
pmp – per million population
Tx = transplant

similar to their expected rates. Scotland had lower than expected prevalence rates of RRT.

Case mix in prevalent RRT patients

Time on RRT (vintage)

Table 2.7 shows the median time, in years, since starting RRT of prevalent RRT patients on 31st December 2013. Median time on RRT for all prevalent patients remained fairly static at 6.0 years. Patients with functioning transplants had survived a median of 10.1 years on RRT whilst the median time on RRT of HD and PD patients was significantly less (3.4 and 1.7 years respectively).

The increase in the time on HD compared to a lesser time spent on PD could reflect early transplantation in the PD group. Time on transplant has decreased since 2008 (median 10.4 years) which may reflect increased use of DCD donors and transplantation of more marginal candidates.

Age

The median age of prevalent UK patients on RRT at 31st December 2013 was static (58.4 years) compared with 2012 (58.3 years) (table 2.8) and significantly higher than in 2005 when it was 55 years. There were marked differences between modalities; the median age of HD patients (66.9 years) was greater than that of those on PD (63.7 years) and substantially higher than that of transplanted patients (52.8 years). Nearly half (49.9%) of the UK prevalent RRT population was in the 40–64 years age group (table 2.9). The proportion of patients aged 75 years and older was 17.4% in Wales, 16.4% in Northern Ireland, 15.8% in England and 13.7% in Scotland (table 2.9). Furthermore, there existed a wide range between centres in the proportion of patients aged over 75 (7.9% in Liverpool Royal Infirmary to 37.4% in Colchester). In most centres the prevalent PD population was younger than the HD population. This is different to the Australian data where PD patients were older on average than HD patients [2]. This highlights the lack of evidence concerning which patients are best treated with PD and a potential area for future research.

Colchester had the highest median age (69.9 years), whilst Manchester RI and Belfast the lowest (54.1 years) (table 2.8). This could reflect either variation in the demography of the catchment populations or follow-up of younger transplant patients (as above in the case of Belfast and Manchester RI). The median age of the non-White dialysis population was lower than the overall dialysis population (61.1 vs. 66.6 years, data not shown). The differing age distributions of the transplant and dialysis populations are illustrated in figure 2.4, demonstrating that the age peak for prevalent dialysis patients is 24 years later than for prevalent transplant patients.

In the UK on 31st December 2013, 65.1% of patients aged less than 65 years on RRT had a functioning transplant (table 2.15), compared with only 28.8% aged 65 years and over. There was a similar pattern in all four UK countries.

Gender

Age profile was very similar for both males and females (data not shown). Standardising the age of the UK RRT prevalent patients, by using the age and gender distribution of the UK population by CCG/HB (from mid-2012 population estimates), allowed estimation of crude prevalence rates by age and gender (figure 2.5). This shows a progressive increase in prevalence rate with age, peaking at 2,218 pmp (a slight increase from 2,138 pmp in 2012) in the age group 75–79 years before showing a reducing prevalence rate in age groups over

Table 2.5. Prevalence of RRT and standardised prevalence ratios in CCG/HB areas

CCG/HB – Clinical Commissioning Groups (England); Health and Social Care Trust Areas (Northern Ireland); Health Board (Scotland) and Local Health Board (Wales)
O/E – standardised prevalence ratio. Ratio of observed : expected rate of RRT given the age and gender breakdown of the area
LCL – lower 95% confidence limit
UCL – upper 95% confidence limit
pmp – per million population
Areas with significantly low prevalence ratios in 2013 are italicised in greyed areas, those with significantly high prevalence ratios in 2013 are bold in greyed areas
Population numbers are the 2012 mid-year estimates by age group and gender (data obtained from the Office of 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
ONS specifies that the populations should be rounded to the nearest 100 when being presented

UK area	Name	Total population	2008 O/E	2009 O/E	2010 O/E	2011 O/E	2012 O/E	2013 O/E	2013 95% LCL	2013 95% UCL	2013 Crude rate pmp	% non-White
Cheshire, Warrington and Wirral	*NHS Eastern Cheshire*	*195,300*	*0.75*	*0.72*	*0.76*	*0.77*	*0.81*	*0.80*	*0.68*	*0.94*	*809*	*3.7*
	NHS South Cheshire	176,800	0.95	0.95	0.93	0.90	0.89	0.90	0.77	1.05	854	2.9
	NHS Vale Royal	*102,100*	*0.72*	*0.76*	*0.73*	*0.75*	*0.71*	*0.77*	*0.61*	*0.97*	*724*	*2.1*
	NHS Warrington	*203,700*	*0.88*	*0.94*	*0.86*	*0.83*	*0.82*	*0.85*	*0.73*	*0.99*	*771*	*4.1*
	NHS West Cheshire	228,100	0.91	0.95	0.96	0.98	0.94	0.97	0.85	1.11	938	2.8
	NHS Wirral	*320,200*	*0.85*	*0.82*	*0.80*	*0.79*	*0.78*	*0.79*	*0.70*	*0.90*	*753*	*3.0*
Durham, Darlington and Tees	NHS Darlington	105,200	0.83	0.85	0.81	0.76	0.81	0.81	0.65	1.01	751	3.8
	NHS Durham Dales, Easington and Sedgefield	273,000	0.95	0.95	0.95	0.99	0.96	0.99	0.88	1.12	960	1.2
	NHS Hartlepool and Stockton-on-Tees	284,600	0.90	0.87	0.86	0.90	0.93	0.93	0.82	1.06	840	4.4
	NHS North Durham	*241,300*	*0.79*	*0.75*	*0.75*	*0.74*	*0.82*	*0.78*	*0.67*	*0.90*	*725*	*2.5*
	NHS South Tees	273,700	1.11	1.06	1.03	1.06	1.05	1.05	0.93	1.19	953	6.7
Greater Manchester	NHS Bolton	279,000	1.03	0.95	1.05	1.09	1.07	1.03	0.91	1.17	896	18.1
	NHS Bury	186,200	0.88	0.95	0.91	0.92	0.92	0.92	0.78	1.08	822	10.8
	NHS Central Manchester	**182,400**	**1.46**	**1.45**	**1.53**	**1.47**	**1.51**	**1.62**	**1.40**	**1.87**	**987**	**48.0**
	NHS Heywood, Middleton & Rochdale	212,000	0.98	1.01	0.95	0.99	1.00	1.04	0.90	1.20	887	18.3
	NHS North Manchester	167,100	0.97	1.12	1.09	1.10	1.14	1.14	0.96	1.35	796	30.8
	NHS Oldham	225,900	0.97	0.96	0.94	0.93	0.94	0.98	0.85	1.13	819	22.5
	NHS Salford	237,100	0.86	0.82	0.84	0.83	0.85	0.88	0.76	1.03	725	9.9
	NHS South Manchester	161,300	0.94	0.94	0.97	0.97	1.01	1.01	0.85	1.21	744	19.6
	NHS Stockport	*283,900*	*0.87*	*0.83*	*0.86*	*0.88*	*0.88*	*0.81*	*0.71*	*0.93*	*761*	*7.9*
	NHS Tameside and Glossop	253,400	0.96	0.95	0.96	0.95	0.95	0.94	0.83	1.08	848	8.2
	NHS Trafford	228,500	0.72	0.76	0.87	0.84	0.86	0.87	0.75	1.01	775	14.5
	NHS Wigan Borough	318,700	0.83	0.82	0.83	0.90	0.93	0.95	0.85	1.07	876	2.7
Lancashire	**NHS Blackburn with Darwen**	**147,700**	**1.23**	**1.24**	**1.23**	**1.27**	**1.24**	**1.23**	**1.05**	**1.45**	**988**	**30.8**
	NHS Blackpool	142,000	0.80	0.87	0.80	0.80	0.91	0.98	0.83	1.17	937	3.3
	NHS Chorley and South Ribble	167,900	0.70	0.81	0.78	0.83	0.89	0.94	0.80	1.11	876	2.9
	NHS East Lancashire	371,600	1.05	1.01	0.98	0.99	0.94	0.95	0.85	1.06	864	11.9
	NHS Fylde & Wyre	*165,000*	*0.79*	*0.81*	*0.79*	*0.79*	*0.80*	*0.79*	*0.67*	*0.93*	*836*	*2.1*
	NHS Greater Preston	202,000	0.91	0.87	0.86	0.82	0.88	0.86	0.73	1.01	748	14.7
	NHS Lancashire North	*158,500*	*0.72*	*0.71*	*0.71*	*0.76*	*0.76*	*0.71*	*0.58*	*0.86*	*650*	*4.0*
	NHS West Lancashire	*110,900*	*0.87*	*0.91*	*0.91*	*0.87*	*0.83*	*0.78*	*0.63*	*0.97*	*748*	*1.9*
Merseyside	NHS Halton	125,700	0.87	0.92	0.94	1.06	1.03	1.01	0.84	1.21	899	2.2
	NHS Knowsley	145,900	1.08	1.04	0.96	0.94	0.97	0.91	0.76	1.09	809	2.8
	NHS Liverpool	469,700	1.07	1.08	1.05	1.05	1.03	1.00	0.91	1.11	830	11.1
	NHS South Sefton	159,400	0.87	0.84	0.86	0.93	0.93	0.92	0.78	1.09	878	2.2
	NHS Southport and Formby	*114,300*	*0.80*	*0.78*	*0.79*	*0.85*	*0.77*	*0.79*	*0.65*	*0.97*	*823*	*3.1*
	NHS St Helens	*176,100*	*0.87*	*0.88*	*0.89*	*0.87*	*0.88*	*0.84*	*0.71*	*0.99*	*795*	*2.0*
Cumbria, Northumberland, Tyne and Wear	*NHS Cumbria*	*505,200*	*0.76*	*0.73*	*0.73*	*0.72*	*0.72*	*0.74*	*0.67*	*0.81*	*748*	*1.5*
	NHS Gateshead	*200,200*	*0.84*	*0.87*	*0.85*	*0.83*	*0.85*	*0.78*	*0.67*	*0.92*	*729*	*3.7*
	NHS Newcastle North and East	141,600	1.01	1.00	0.97	1.00	0.92	0.88	0.72	1.08	678	10.7
	NHS Newcastle West	140,900	1.02	0.99	0.89	0.83	0.89	0.88	0.72	1.06	724	18.3
	NHS North Tyneside	201,400	0.96	0.99	1.00	0.94	0.94	0.96	0.83	1.11	903	3.4

Table 2.5. Continued

UK area	Name	Total population	2008 O/E	2009 O/E	2010 O/E	2011 O/E	2012 O/E	2013 O/E	2013 95% LCL	2013 95% UCL	Crude rate pmp	% non-White
Cumbria cont.	*NHS Northumberland*	*316,100*	*0.85*	*0.81*	*0.76*	*0.77*	*0.76*	*0.74*	*0.65*	*0.84*	*753*	*1.6*
	NHS South Tyneside	148,400	1.01	1.09	1.00	1.02	0.96	0.90	0.76	1.08	856	4.1
	NHS Sunderland	275,700	1.01	0.98	1.00	0.96	0.96	0.91	0.80	1.03	841	4.1
North Yorkshire and Humber	*NHS East Riding of Yorkshire*	*314,500*	*0.87*	*0.88*	*0.84*	*0.83*	*0.82*	*0.80*	*0.70*	*0.90*	*820*	*1.9*
	NHS Hambleton, Richmondshire and Whitby	*153,400*	*0.59*	*0.61*	*0.60*	*0.62*	*0.64*	*0.69*	*0.57*	*0.84*	*697*	*2.7*
	NHS Harrogate and Rural District	*158,600*	*0.83*	*0.87*	*0.84*	*0.83*	*0.87*	*0.84*	*0.71*	*1.00*	*820*	*3.7*
	NHS Hull	257,200	0.99	1.04	1.02	1.00	0.95	0.96	0.84	1.10	797	5.9
	NHS North East Lincolnshire	159,700	1.01	1.00	0.98	1.07	1.03	1.00	0.86	1.18	927	2.6
	NHS North Lincolnshire	168,400	0.89	0.79	0.74	0.82	0.88	0.95	0.81	1.11	903	4.0
	NHS Scarborough and Ryedale	110,500	0.95	0.93	0.86	0.82	0.84	0.82	0.67	1.01	842	2.5
	NHS Vale of York	346,100	0.84	0.85	0.88	0.90	0.95	0.95	0.85	1.06	881	4.0
South Yorkshire and Bassetlaw	NHS Barnsley	233,700	1.07	1.11	1.14	1.11	1.06	1.04	0.91	1.18	967	2.1
	NHS Bassetlaw	113,200	0.91	0.85	0.83	0.83	0.88	0.82	0.67	1.01	804	2.6
	NHS Doncaster	302,700	0.95	0.96	0.93	0.97	0.96	0.92	0.82	1.04	842	4.7
	NHS Rotherham	258,400	1.10	1.07	1.12	1.06	1.05	1.03	0.91	1.17	956	6.4
	NHS Sheffield	**557,400**	**1.11**	**1.11**	**1.14**	**1.11**	**1.12**	**1.11**	**1.02**	**1.21**	**924**	**16.3**
West Yorkshire	*NHS Airedale, Wharfedale and Craven*	*158,200*	*0.77*	*0.83*	*0.82*	*0.78*	*0.78*	*0.80*	*0.67*	*0.95*	*765*	*11.1*
	NHS Bradford City	**82,300**	**2.00**	**1.80**	**1.96**	**1.88**	**1.98**	**2.00**	**1.64**	**2.44**	**1,154**	**72.2**
	NHS Bradford Districts	**333,500**	**1.14**	**1.10**	**1.13**	**1.15**	**1.23**	**1.21**	**1.09**	**1.35**	**977**	**28.7**
	NHS Calderdale	205,300	1.07	1.07	1.09	1.03	0.96	0.90	0.78	1.05	818	10.3
	NHS Greater Huddersfield	238,800	0.98	0.92	0.96	0.94	0.98	0.95	0.82	1.09	842	17.4
	NHS Leeds North	*199,600*	*0.98*	*0.93*	*0.93*	*0.92*	*0.88*	*0.82*	*0.70*	*0.97*	*752*	*17.4*
	NHS Leeds South and East	238,300	0.94	0.95	0.96	0.99	0.97	0.99	0.86	1.14	797	18.3
	NHS Leeds West	*319,800*	*0.85*	*0.86*	*0.86*	*0.83*	*0.82*	*0.88*	*0.77*	*1.00*	*685*	*10.8*
	NHS North Kirklees	**186,700**	**1.11**	**1.20**	**1.19**	**1.21**	**1.16**	**1.24**	**1.08**	**1.43**	**1,039**	**25.3**
	NHS Wakefield	*327,600*	*0.81*	*0.81*	*0.81*	*0.83*	*0.85*	*0.84*	*0.74*	*0.95*	*778*	*4.6*
Arden, Hereford-shire and Worcester-shire	**NHS Coventry and Rugby**	**423,900**	**1.14**	**1.19**	**1.25**	**1.27**	**1.33**	**1.29**	**1.18**	**1.42**	**1,066**	**22.2**
	NHS Herefordshire	*184,900*	*0.81*	*0.83*	*0.78*	*0.79*	*0.78*	*0.77*	*0.65*	*0.91*	*779*	*1.8*
	NHS Redditch and Bromsgrove	178,700	0.94	0.96	0.95	0.93	0.97	0.92	0.79	1.08	867	6.0
	NHS South Warwickshire	*259,200*	*0.93*	*0.94*	*0.90*	*0.91*	*0.87*	*0.86*	*0.75*	*0.98*	*829*	*7.0*
	NHS South Worcestershire	*292,300*	*0.78*	*0.79*	*0.81*	*0.81*	*0.84*	*0.80*	*0.71*	*0.91*	*790*	*3.7*
	NHS Warwickshire North	188,000	1.08	1.09	1.11	1.08	1.00	1.00	0.86	1.16	936	6.5
	NHS Wyre Forest	98,100	0.95	0.92	0.91	0.93	0.88	0.86	0.69	1.06	867	2.8
Birmingham and the Black Country	**NHS Birmingham CrossCity**	**721,400**	**1.50**	**1.51**	**1.46**	**1.46**	**1.47**	**1.44**	**1.35**	**1.55**	**1,123**	**35.2**
	NHS Birmingham South and Central	**199,600**	**1.60**	**1.66**	**1.62**	**1.65**	**1.70**	**1.70**	**1.50**	**1.92**	**1,257**	**40.4**
	NHS Dudley	313,600	0.90	0.96	0.95	0.88	0.93	0.95	0.84	1.07	887	10.0
	NHS Sandwell and West Birmingham	**475,700**	**1.80**	**1.84**	**1.81**	**1.77**	**1.74**	**1.72**	**1.59**	**1.86**	**1,320**	**45.3**
	NHS Solihull	*207,400*	*0.91*	*0.97*	*0.94*	*0.90*	*0.86*	*0.84*	*0.72*	*0.97*	*791*	*10.9*
	NHS Walsall	**270,900**	**1.29**	**1.27**	**1.34**	**1.32**	**1.29**	**1.30**	**1.16**	**1.45**	**1,141**	**21.1**
	NHS Wolverhampton	251,000	1.23	1.25	1.20	1.11	1.12	1.12	0.99	1.27	960	32.0
Derbyshire and Notting-hamshire	NHS Erewash	94,600	0.96	1.00	0.97	1.00	0.97	0.93	0.75	1.15	856	3.2
	NHS Hardwick	*108,900*	*0.93*	*0.91*	*0.85*	*0.78*	*0.79*	*0.77*	*0.62*	*0.95*	*744*	*1.8*
	NHS Mansfield & Ashfield	192,500	1.01	0.96	0.94	0.93	0.89	0.90	0.77	1.05	831	2.5
	NHS Newark & Sherwood	115,900	1.13	1.03	1.01	1.08	1.03	0.99	0.82	1.19	966	2.4
	NHS North Derbyshire	*272,100*	*0.87*	*0.81*	*0.80*	*0.81*	*0.80*	*0.78*	*0.68*	*0.89*	*783*	*2.5*
	NHS Nottingham City	**308,700**	**1.12**	**1.17**	**1.26**	**1.20**	**1.18**	**1.19**	**1.05**	**1.34**	**862**	**28.5**
	NHS Nottingham North & East	*146,200*	*0.89*	*0.84*	*0.84*	*0.86*	*0.85*	*0.82*	*0.68*	*0.98*	*773*	*6.2*
	NHS Nottingham West	110,700	1.00	1.10	1.11	1.05	1.07	1.13	0.94	1.35	1,075	7.3
	NHS Rushcliffe	*111,600*	*0.93*	*0.91*	*0.87*	*0.87*	*0.78*	*0.80*	*0.65*	*0.99*	*771*	*6.9*
	NHS Southern Derbyshire	515,300	1.03	1.05	1.03	1.02	0.98	0.98	0.90	1.08	883	11.0

Table 2.5. Continued

UK area	Name	Total population	2008 O/E	2009 O/E	2010 O/E	2011 O/E	2012 O/E	2013 O/E	2013 95% LCL	2013 95% UCL	Crude rate pmp	% non-White
East Anglia	NHS Cambridgeshire and Peterborough	849,000	0.86	0.90	0.91	0.95	0.91	0.95	0.88	1.02	834	9.5
	NHS Great Yarmouth & Waveney	213,200	0.84	0.93	0.98	0.97	0.94	0.96	0.84	1.10	966	2.7
	NHS Ipswich and East Suffolk	*395,700*	*0.86*	*0.85*	*0.83*	*0.83*	*0.81*	*0.85*	*0.76*	*0.94*	*816*	*5.6*
	NHS North Norfolk	167,900	1.05	0.95	0.91	0.86	0.83	0.92	0.79	1.07	1,012	1.5
	NHS Norwich	193,400	0.97	0.96	0.95	0.89	0.86	0.92	0.79	1.08	802	7.3
	NHS South Norfolk	235,200	0.83	0.83	0.79	0.79	0.82	0.88	0.77	1.01	880	2.6
	NHS West Norfolk	*171,300*	*0.90*	*0.89*	*0.84*	*0.78*	*0.75*	*0.75*	*0.63*	*0.89*	*777*	*2.6*
	NHS West Suffolk	*221,000*	*0.76*	*0.80*	*0.84*	*0.82*	*0.80*	*0.81*	*0.69*	*0.94*	*760*	*4.6*
Essex	NHS Basildon and Brentwood	250,500	0.91	0.92	0.92	0.94	0.92	1.00	0.88	1.14	906	7.1
	NHS Castle Point, Rayleigh and Rochford	172,100	0.88	0.89	0.87	0.82	0.81	0.86	0.73	1.01	866	3.0
	NHS Mid Essex	*379,600*	*0.86*	*0.87*	*0.84*	*0.83*	*0.80*	*0.84*	*0.75*	*0.94*	*790*	*4.4*
	NHS North East Essex	*314,300*	*0.92*	*0.90*	*0.89*	*0.91*	*0.89*	*0.86*	*0.77*	*0.98*	*830*	*5.5*
	NHS Southend	174,800	0.98	0.93	0.90	0.90	0.89	0.96	0.82	1.12	869	8.4
	NHS Thurrock	159500	1.04	0.94	0.98	0.99	0.99	1.00	0.84	1.18	815	14.1
	NHS West Essex	*290,000*	*0.71*	*0.73*	*0.76*	*0.75*	*0.84*	*0.88*	*0.77*	*1.00*	*803*	*8.2*
Hertfordshire and the South Midlands	NHS Bedfordshire	419,200	0.87	0.86	0.90	0.87	0.91	0.92	0.83	1.03	833	11.2
	NHS Corby	63,100	0.70	0.85	0.84	0.91	0.94	0.83	0.62	1.12	698	4.5
	NHS East and North Hertfordshire	*540,700*	*0.83*	*0.84*	*0.85*	*0.88*	*0.87*	*0.89*	*0.81*	*0.98*	*782*	*10.4*
	NHS Herts Valleys	569,900	0.98	0.97	0.98	0.96	0.95	0.94	0.86	1.03	821	14.6
	NHS Luton	**205,800**	**1.26**	**1.23**	**1.27**	**1.36**	**1.38**	**1.46**	**1.28**	**1.67**	**1,098**	**45.3**
	NHS Milton Keynes	257,900	0.92	0.90	0.92	0.94	0.94	0.95	0.83	1.10	768	19.6
	NHS Nene	*621,800*	*0.92*	*0.92*	*0.91*	*0.92*	*0.91*	*0.91*	*0.83*	*0.99*	*811*	*9.1*
Leicestershire and Lincolnshire	*NHS East Leicestershire and Rutland*	*319,500*	*0.86*	*0.82*	*0.82*	*0.81*	*0.81*	*0.80*	*0.71*	*0.91*	*773*	*9.8*
	NHS Leicester City	**331,600**	**1.66**	**1.68**	**1.71**	**1.73**	**1.75**	**1.77**	**1.61**	**1.94**	**1,306**	**49.5**
	NHS Lincolnshire East	*228,100*	*0.87*	*0.83*	*0.82*	*0.83*	*0.85*	*0.87*	*0.76*	*0.99*	*921*	*2.0*
	NHS Lincolnshire West	*227,700*	*0.87*	*0.87*	*0.84*	*0.87*	*0.82*	*0.84*	*0.73*	*0.98*	*782*	*3.0*
	NHS South Lincolnshire	*141,000*	*0.64*	*0.64*	*0.70*	*0.71*	*0.72*	*0.68*	*0.56*	*0.83*	*681*	*2.3*
	NHS South West Lincolnshire	*122,000*	*0.66*	*0.69*	*0.76*	*0.77*	*0.77*	*0.75*	*0.61*	*0.92*	*738*	*2.3*
	NHS West Leicestershire	374,200	0.89	0.91	0.91	0.93	0.90	0.91	0.82	1.02	850	6.9
Shropshire and Staffordshire	NHS Cannock Chase	132,800	1.06	0.96	0.92	0.96	0.87	0.94	0.78	1.13	873	2.4
	NHS East Staffordshire	*123,900*	*0.83*	*0.75*	*0.79*	*0.76*	*0.75*	*0.77*	*0.62*	*0.95*	*710*	*9.0*
	NHS North Staffordshire	213,200	0.89	0.93	0.89	0.94	0.90	0.90	0.78	1.04	877	3.5
	NHS Shropshire	*308,200*	*0.92*	*0.90*	*0.86*	*0.84*	*0.83*	*0.78*	*0.69*	*0.89*	*785*	*2.0*
	NHS South East Staffs and Seisdon & Peninsular	222,800	1.01	0.98	0.97	0.99	0.91	0.89	0.78	1.03	866	3.6
	NHS Stafford and Surrounds	151,100	0.75	0.79	0.85	0.87	0.88	0.86	0.72	1.02	853	4.7
	NHS Stoke on Trent	258,100	1.07	1.12	1.12	1.12	1.08	1.08	0.95	1.22	941	11.0
	NHS Telford & Wrekin	167,700	0.98	1.03	1.04	1.04	1.01	1.04	0.89	1.22	901	7.3
London	**NHS Barking & Dagenham**	**190,600**	**1.15**	**1.24**	**1.33**	**1.45**	**1.52**	**1.52**	**1.33**	**1.75**	**1,055**	**41.7**
	NHS Barnet	**364,000**	**1.44**	**1.41**	**1.48**	**1.48**	**1.52**	**1.50**	**1.37**	**1.65**	**1,195**	**35.9**
	NHS Camden	**225,000**	**1.16**	**1.19**	**1.23**	**1.24**	**1.22**	**1.25**	**1.09**	**1.43**	**942**	**33.7**
	NHS City and Hackney	**259,700**	**1.28**	**1.35**	**1.47**	**1.51**	**1.59**	**1.60**	**1.43**	**1.80**	**1,074**	**44.6**
	NHS Enfield	**317,300**	**1.40**	**1.39**	**1.40**	**1.50**	**1.53**	**1.52**	**1.38**	**1.69**	**1,185**	**39.0**
	NHS Haringey	**258,900**	**1.40**	**1.40**	**1.41**	**1.54**	**1.65**	**1.74**	**1.56**	**1.93**	**1,259**	**39.5**
	NHS Havering	*239,700*	*0.83*	*0.86*	*0.83*	*0.88*	*0.90*	*0.84*	*0.73*	*0.97*	*763*	*12.3*
	NHS Islington	**211,000**	**1.19**	**1.24**	**1.28**	**1.38**	**1.52**	**1.56**	**1.37**	**1.77**	**1,118**	**31.8**
	NHS Newham	**314,100**	**1.45**	**1.50**	**1.69**	**1.80**	**1.85**	**1.95**	**1.77**	**2.16**	**1,242**	**71.0**
	NHS Redbridge	**284,600**	**1.27**	**1.32**	**1.39**	**1.37**	**1.44**	**1.50**	**1.34**	**1.67**	**1,145**	**57.5**
	NHS Tower Hamlets	**263,000**	**1.21**	**1.31**	**1.38**	**1.40**	**1.51**	**1.63**	**1.44**	**1.84**	**992**	**54.8**
	NHS Waltham Forest	**262,600**	**1.41**	**1.38**	**1.45**	**1.54**	**1.50**	**1.54**	**1.37**	**1.73**	**1,127**	**47.8**
	NHS Brent	**314,700**	**1.94**	**2.05**	**2.17**	**2.18**	**2.20**	**2.19**	**2.01**	**2.38**	**1,656**	**63.7**
	NHS Central London (Westminster)	**161,000**	**1.00**	**1.01**	**1.04**	**1.10**	**1.14**	**1.21**	**1.03**	**1.41**	**987**	**36.2**
	NHS Ealing	**340,700**	**1.86**	**1.86**	**1.89**	**1.87**	**1.93**	**1.91**	**1.75**	**2.08**	**1,465**	**51.0**

Table 2.5. Continued

UK area	Name	Total population	2008 O/E	2009 O/E	2010 O/E	2011 O/E	2012 O/E	2013 O/E	2013 95% LCL	2013 95% UCL	Crude rate pmp	% non-White
London cont.	**NHS Hammersmith and Fulham**	**179,900**	**1.22**	**1.29**	**1.27**	**1.29**	**1.32**	**1.26**	**1.08**	**1.47**	**923**	**31.9**
	NHS Harrow	**242,400**	**1.68**	**1.76**	**1.83**	**1.88**	**1.87**	**1.79**	**1.61**	**1.98**	**1,485**	**57.8**
	NHS Hillingdon	**281,800**	**1.31**	**1.35**	**1.37**	**1.45**	**1.47**	**1.49**	**1.34**	**1.66**	**1,182**	**39.4**
	NHS Hounslow	**259,100**	**1.40**	**1.43**	**1.49**	**1.55**	**1.58**	**1.67**	**1.50**	**1.87**	**1,274**	**48.6**
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	**218,800**	**1.17**	**1.24**	**1.26**	**1.28**	**1.26**	**1.23**	**1.08**	**1.41**	**1,001**	**33.4**
	NHS Bexley	**234,300**	**1.17**	**1.23**	**1.25**	**1.27**	**1.26**	**1.25**	**1.10**	**1.41**	**1,080**	**18.1**
	NHS Bromley	314,000	1.05	1.01	1.04	1.02	0.99	0.99	0.88	1.12	888	15.7
	NHS Croydon	**368,900**	**1.30**	**1.34**	**1.32**	**1.36**	**1.41**	**1.47**	**1.33**	**1.61**	**1,168**	**44.9**
	NHS Greenwich	**260,100**	**1.15**	**1.17**	**1.28**	**1.29**	**1.29**	**1.43**	**1.27**	**1.61**	**1,046**	**37.5**
	NHS Kingston	163,900	1.19	1.18	1.15	1.16	1.17	1.10	0.94	1.30	885	25.5
	NHS Lambeth	**310,200**	**1.58**	**1.64**	**1.62**	**1.70**	**1.76**	**1.77**	**1.60**	**1.96**	**1,235**	**42.9**
	NHS Lewisham	**281,600**	**1.52**	**1.63**	**1.59**	**1.64**	**1.67**	**1.68**	**1.51**	**1.87**	**1,232**	**46.5**
	NHS Merton	**202,200**	**1.19**	**1.27**	**1.28**	**1.31**	**1.37**	**1.33**	**1.16**	**1.52**	**1,043**	**35.1**
	NHS Richmond	*189,100*	*0.69*	*0.75*	*0.76*	*0.76*	*0.75*	*0.78*	*0.66*	*0.93*	*666*	*14.0*
	NHS Southwark	**293,500**	**1.67**	**1.67**	**1.74**	**1.82**	**1.86**	**1.92**	**1.74**	**2.12**	**1,349**	**45.8**
	NHS Sutton	**193,600**	**1.20**	**1.19**	**1.21**	**1.21**	**1.23**	**1.18**	**1.02**	**1.35**	**1,002**	**21.4**
	NHS Wandsworth	**308,300**	**1.27**	**1.36**	**1.37**	**1.32**	**1.26**	**1.24**	**1.10**	**1.39**	**882**	**28.6**
Bath, Gloucestershire, Swindon and Wiltshire	*NHS Bath and North East Somerset*	*177,600*	*0.82*	*0.83*	*0.84*	*0.79*	*0.79*	*0.80*	*0.67*	*0.95*	*721*	*5.4*
	NHS Gloucestershire	*602,200*	*0.84*	*0.88*	*0.87*	*0.88*	*0.89*	*0.88*	*0.80*	*0.96*	*837*	*4.6*
	NHS Swindon	217,200	0.86	0.87	0.91	0.94	0.96	0.98	0.85	1.14	847	10.0
	NHS Wiltshire	*476,800*	*0.77*	*0.74*	*0.74*	*0.75*	*0.72*	*0.73*	*0.65*	*0.81*	*686*	*3.4*
Bristol, North Somerset, Somerset and South Gloucestershire	**NHS Bristol**	**432,500**	**1.29**	**1.26**	**1.23**	**1.24**	**1.27**	**1.31**	**1.19**	**1.44**	**1,020**	**16.0**
	NHS North Somerset	204,400	0.94	0.89	0.86	0.86	0.89	0.89	0.77	1.03	881	2.7
	NHS Somerset	*535,000*	*0.84*	*0.84*	*0.87*	*0.87*	*0.84*	*0.82*	*0.74*	*0.90*	*815*	*2.0*
	NHS South Gloucestershire	266,100	0.97	0.92	0.98	0.94	0.94	0.99	0.87	1.12	902	5.0
Devon, Cornwall and Isles of Scilly	NHS Kernow	540,200	1.00	1.01	0.99	0.95	0.94	0.94	0.86	1.02	952	1.8
	NHS North, East, West Devon	*869,400*	*0.96*	*0.95*	*0.94*	*0.93*	*0.93*	*0.92*	*0.86*	*0.99*	*894*	*3.0*
	NHS South Devon and Torbay	273,300	0.96	0.97	1.02	1.00	0.98	1.03	0.92	1.16	1,083	2.1
Kent and Medway	NHS Ashford	120,100	1.03	1.06	1.04	1.02	1.04	1.00	0.83	1.21	907	6.3
	NHS Canterbury and Coastal	200,300	0.90	1.00	0.99	0.96	0.95	0.98	0.85	1.13	894	5.9
	NHS Dartford, Gravesham and Swanley	249,200	1.04	1.08	1.07	1.02	1.04	1.07	0.94	1.22	947	13.0
	NHS Medway	268,200	0.90	0.89	0.89	0.91	0.94	0.99	0.87	1.13	839	10.4
	NHS South Kent Coast	*203,000*	*0.79*	*0.80*	*0.82*	*0.85*	*0.83*	*0.78*	*0.67*	*0.91*	*764*	*4.5*
	NHS Swale	108,200	1.02	1.00	1.00	1.02	1.11	1.11	0.92	1.34	998	3.8
	NHS Thanet	135,700	1.01	0.89	1.01	1.03	1.09	1.15	0.98	1.35	1,106	4.5
	NHS West Kent	*463,700*	*0.82*	*0.82*	*0.77*	*0.79*	*0.81*	*0.79*	*0.71*	*0.88*	*725*	*4.9*
Surrey and Sussex	*NHS Brighton & Hove*	*275,800*	*0.88*	*0.87*	*0.85*	*0.85*	*0.89*	*0.85*	*0.74*	*0.98*	*693*	*10.9*
	NHS Coastal West Sussex	*476,700*	*0.88*	*0.86*	*0.84*	*0.80*	*0.82*	*0.81*	*0.74*	*0.90*	*831*	*3.8*
	NHS Crawley	108,300	1.08	1.08	1.22	1.11	1.05	1.03	0.84	1.27	831	20.1
	NHS East Surrey	175,900	0.81	0.78	0.82	0.76	0.83	0.87	0.74	1.03	790	8.3
	NHS Eastbourne, Hailsham and Seaford	*182,000*	*0.86*	*0.75*	*0.78*	*0.74*	*0.80*	*0.82*	*0.70*	*0.96*	*835*	*4.4*
	NHS Guildford and Waverley	*205,900*	*0.71*	*0.72*	*0.71*	*0.66*	*0.74*	*0.70*	*0.59*	*0.83*	*631*	*7.2*
	NHS Hastings & Rother	*181,400*	*0.82*	*0.76*	*0.79*	*0.75*	*0.73*	*0.77*	*0.66*	*0.91*	*783*	*4.6*
	NHS High Weald Lewes Havens	*167,800*	*0.69*	*0.73*	*0.66*	*0.68*	*0.76*	*0.72*	*0.60*	*0.86*	*721*	*3.1*
	NHS Horsham and Mid Sussex	*223,300*	*0.73*	*0.76*	*0.73*	*0.77*	*0.71*	*0.73*	*0.62*	*0.85*	*681*	*4.9*
	NHS North West Surrey	338,200	1.01	0.98	0.96	0.96	0.96	0.95	0.85	1.06	858	12.5
	NHS Surrey Downs	282,700	0.85	0.90	0.91	0.91	0.89	0.89	0.78	1.01	845	9.1
	NHS Surrey Heath	94,100	1.04	0.98	0.97	0.94	0.94	0.87	0.69	1.09	808	9.3

Table 2.5. Continued

UK area	Name	Total population	2008 O/E	2009 O/E	2010 O/E	2011 O/E	2012 O/E	2013 O/E	2013 95% LCL	2013 95% UCL	2013 Crude rate pmp	% non-White
Thames Valley	NHS Aylesbury Vale	196,400	1.07	1.00	1.00	0.97	0.96	0.94	0.81	1.09	850	9.7
	NHS Bracknell and Ascot	132,900	0.83	0.84	0.86	0.85	0.84	0.95	0.79	1.15	812	9.5
	NHS Chiltern	*317,900*	*0.89*	*0.90*	*0.88*	*0.84*	*0.83*	*0.87*	*0.77*	*0.98*	*799*	*15.8*
	NHS Newbury and District	105,100	1.09	1.10	1.00	1.05	1.00	1.04	0.85	1.26	932	4.4
	NHS North & West Reading	99,300	0.96	0.88	0.87	0.85	0.82	0.84	0.67	1.05	765	10.4
	NHS Oxfordshire	*647,100*	*0.89*	*0.87*	*0.89*	*0.92*	*0.92*	*0.91*	*0.84*	*1.00*	*802*	*9.3*
	NHS Slough	**141,800**	**1.81**	**1.81**	**1.88**	**1.98**	**2.02**	**2.01**	**1.76**	**2.31**	**1,431**	**54.3**
	NHS South Reading	**107,200**	**1.73**	**1.69**	**1.65**	**1.56**	**1.49**	**1.61**	**1.35**	**1.92**	**1,129**	**30.5**
	NHS Windsor, Ascot and Maidenhead	139,000	0.83	0.92	0.96	0.98	0.99	1.01	0.85	1.21	892	14.7
	NHS Wokingham	156,700	0.91	0.93	0.87	0.95	0.92	0.92	0.77	1.09	830	11.6
Wessex	*NHS Dorset*	*750,300*	*0.88*	*0.86*	*0.84*	*0.81*	*0.80*	*0.79*	*0.73*	*0.86*	*794*	*4.0*
	NHS Fareham and Gosport	196,100	0.82	0.85	0.87	0.87	0.86	0.91	0.78	1.06	872	3.4
	NHS Isle of Wight	*138,700*	*0.61*	*0.58*	*0.58*	*0.63*	*0.67*	*0.78*	*0.65*	*0.94*	*814*	*2.7*
	NHS North East Hampshire and Farnham	206,800	0.77	0.85	0.85	0.84	0.85	0.89	0.77	1.04	784	9.7
	NHS North Hampshire	*216,200*	*0.67*	*0.70*	*0.72*	*0.68*	*0.67*	*0.69*	*0.58*	*0.81*	*620*	*6.4*
	NHS Portsmouth	206,800	0.95	0.92	0.90	0.95	0.97	1.02	0.87	1.19	803	11.6
	NHS South Eastern Hampshire	*209,100*	*0.87*	*0.88*	*0.89*	*0.88*	*0.82*	*0.85*	*0.73*	*0.98*	*832*	*3.1*
	NHS Southampton	239,400	0.96	0.93	0.98	1.01	1.04	1.02	0.88	1.17	781	14.1
	NHS West Hampshire	*544,400*	*0.79*	*0.79*	*0.76*	*0.76*	*0.75*	*0.76*	*0.69*	*0.83*	*742*	*3.9*
Wales	*Betsi Cadwaladr University*	*690,400*	*0.95*	*0.93*	*0.90*	*0.86*	*0.87*	*0.80*	*0.73*	*0.87*	*773*	*2.5*
	Powys Teaching	*133,000*	*0.90*	*0.94*	*0.89*	*0.86*	*0.86*	*0.83*	*0.69*	*1.00*	*872*	*1.6*
	Hywel Dda	383,400	1.04	0.99	0.94	0.95	0.89	0.94	0.85	1.04	929	2.2
	Abertawe Bro Morgannwg University	**519,500**	**1.21**	**1.23**	**1.25**	**1.24**	**1.22**	**1.16**	**1.07**	**1.26**	**1,080**	**3.9**
	Cwm Taf	**294,500**	**1.40**	**1.37**	**1.30**	**1.35**	**1.28**	**1.26**	**1.13**	**1.40**	**1,141**	**2.6**
	Aneurin Bevan	578,000	1.11	1.09	1.12	1.11	1.10	1.08	0.99	1.17	997	3.9
	Cardiff and Vale University	475,300	1.05	1.06	1.07	1.06	1.04	1.04	0.95	1.15	863	12.2
Scotland	Ayrshire and Arran	373,200	1.10	1.05	1.04	0.99	0.96	0.92	0.83	1.03	906	1.2
	Borders	*113,700*	*0.86*	*0.89*	*0.94*	*0.84*	*0.80*	*0.77*	*0.63*	*0.95*	*800*	*1.3*
	Dumfries and Galloway	*150,800*	*0.90*	*0.86*	*0.82*	*0.80*	*0.80*	*0.73*	*0.60*	*0.87*	*756*	*1.2*
	Fife	366,200	0.89	0.89	0.91	0.94	0.91	0.90	0.81	1.01	849	2.4
	Forth Valley	*299,100*	*0.90*	*0.89*	*0.92*	*0.86*	*0.84*	*0.84*	*0.74*	*0.96*	*779*	*2.2*
	Grampian	*573,400*	*0.92*	*0.89*	*0.89*	*0.88*	*0.92*	*0.90*	*0.82*	*0.99*	*821*	*4.0*
	Greater Glasgow and Clyde	1,217,000	1.08	1.05	1.02	1.02	1.04	1.02	0.96	1.08	905	7.3
	Highland	*319,800*	*1.00*	*0.97*	*0.93*	*0.85*	*0.81*	*0.78*	*0.69*	*0.88*	*785*	*1.3*
	Lanarkshire	572,500	0.92	0.92	0.93	0.91	0.96	0.93	0.85	1.02	852	2.0
	Lothian	*843,700*	*0.88*	*0.85*	*0.82*	*0.77*	*0.78*	*0.76*	*0.70*	*0.83*	*665*	*5.6*
	Orkney	21,500	1.06	0.96	0.87	0.74	0.76	0.82	0.52	1.31	836	0.7
	Shetland	*23,200*	*0.50*	*0.53*	*0.56*	*0.49*	*0.48*	*0.50*	*0.28*	*0.91*	*474*	*1.5*
	Tayside	411,700	1.02	1.03	1.00	0.99	0.95	0.93	0.84	1.03	882	3.2
	Western Isles	*27,600*	*0.68*	*0.65*	*0.78*	*0.68*	*0.58*	*0.56*	*0.34*	*0.91*	*581*	*0.9*
Northern Ireland	Belfast	348,300	1.20	1.13	1.13	1.10	1.12	1.11	1.00	1.24	919	3.2
	Northern	465,500	1.08	1.02	0.99	1.02	1.00	0.99	0.90	1.09	853	1.2
	Southern	363,100	0.97	0.96	0.98	1.00	0.95	0.95	0.84	1.07	763	1.2
	South Eastern	*350,100*	*0.96*	*0.93*	*0.86*	*0.88*	*0.86*	*0.84*	*0.74*	*0.95*	*740*	*1.3*
	Western	296,600	1.10	1.12	1.10	1.06	0.95	0.93	0.82	1.06	769	1.0

80 years. Crude prevalence rates in males exceeded those of females for all age groups, peaking in age group 75–79 years at 3,010 pmp and for females also in age group 75–79 years at 1,560 pmp. Survival on RRT is described in chapter 5.

Ethnicity

Sixty one of the 71 centres (86%) provided ethnicity data that were at least 90% complete (table 2.10), an improvement compared with 59 of 71 (83.1%) in 2012 and 36 centres in 2006. Ethnicity completeness for

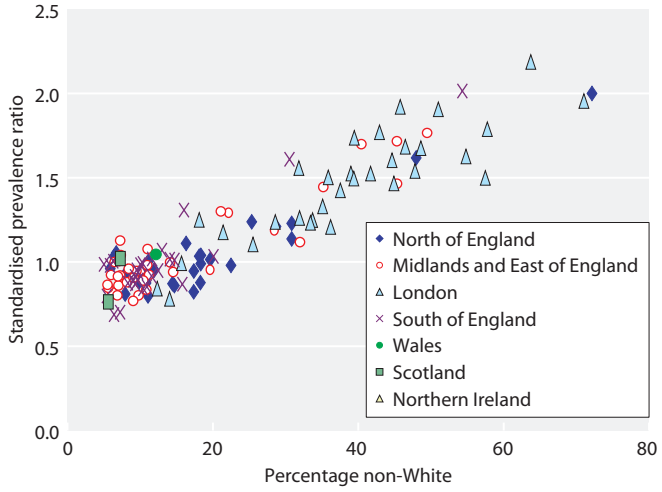

Fig. 2.3. Standardised prevalence ratios for CCG/HB areas by percentage non-White on 31/12/2013 (excluding areas with <5% ethnic minorities)

prevalent RRT patients improved in the UK from 92.0% in 2012 to 92.8% in 2013, with 98.7% ethnicity completeness in England, 99.9% completeness in Wales and 100% in Northern Ireland. Completeness of ethnicity data was highest in prevalent transplant patients. This may relate to the fact that the intensive work-up for transplantation may increase the recording of data. Completeness of ethnicity data from Scotland was low at 24%.

In 2013, 21.1% of the prevalent UK RRT population (with ethnicity assigned) were from ethnic minorities (23.1% in England). The proportion of the prevalent UK RRT population (with ethnicity assigned) from ethnic minorities in Wales, Scotland and Northern Ireland were very small, although it should be noted that there was a high level of missing ethnicity data in Scotland. The ONS estimates that approximately 14% of the UK general population are designated as belonging to an ethnic minority [3]. The relative proportion of patients reported to the UKRR as receiving RRT and belonging to an ethnic minority has increased from 14.9% in 2007 which may be due to improvements in coding and reporting of ethnicity data as well as an increasing incidence of ERF and increased referral rates in these populations.

Amongst the centres with more than 50% returns there was wide variation in the proportion of patients from ethnic minorities, ranging from 0.5% in two centres (Truro and Newry) to over 55% in two centres: London St Bartholemew's (61%) and London West (56.4%).

Primary renal diagnosis

Data for primary renal diagnosis (PRD) were not complete for 2.9% of patients (table 2.11) and there remained a marked inter-centre difference in completeness of data returns. Only one centre had ⩾40% primary renal diagnosis data coded as uncertain and has been excluded from the between centre analysis and other analyses where PRD is included in the case-mix adjustment (Colchester, 52% uncertain PRD); the UK and national totals have been appropriately adjusted. The

Table 2.7. Median time on RRT of prevalent patients on 31/12/2013

Modality	*N*	Median time treated (years)
Haemodialysis	23,290	3.4
Peritoneal dialysis	3,633	1.7
Transplant	28,276	10.1
All RRT	**55,199**	**6.0**

For patients who recovered for >90 days and then subsequently restarted RRT the median time from the start of RRT was calculated from the most recent start date
Patients with an initial treatment modality of transferred in or transferred out were excluded from the calculation of median time on RRT since their treatment start date was not accurately known

Table 2.6. Standardised prevalence rate ratio of RRT for each Strategic Health Authority in England and for Wales, Scotland and Northern Ireland in 2013

UK Area	Total population	O/E	95% LCL	95% UCL	Crude rate pmp
North England	15,149,700	0.93	0.91	0.94	834.9
Midlands and East of England	16,229,200	0.99	0.97	1.00	892.2
London	**8,308,400**	**1.49**	**1.46**	**1.52**	**1,133.4**
South England	13,806,400	0.90	0.88	0.92	836.6
Wales	3,074,100	1.01	0.97	1.05	939.8
Scotland	5,313,600	0.89	0.86	0.91	821.9
Northern Ireland	1,823,600	0.97	0.92	1.01	812.1

O/E – observed/expected prevalence rate ratio given the age/gender breakdown of each region
Bold – higher than expected prevalence rate ratio

Table 2.8. Median age of prevalent RRT patients by treatment modality in renal centres on 31/12/2013

	Median age			
Centre	HD	PD	Transplant	RRT
England				
B Heart	67.3	54.9	51.6	63.5
B QEH	64.0	59.5	51.8	57.4
Basldn	67.5	63.3	52.6	62.8
Bradfd	60.1	53.8	51.4	54.5
Brightn	67.8	66.2	54.8	61.9
Bristol	70.4	56.2	53.8	59.0
Camb	73.6	73.7	53.0	59.2
Carlis	68.2	68.0	53.5	59.5
Carsh	69.0	64.5	53.4	62.1
Chelms	70.9	65.0	59.3	64.8
Colchr	69.9			69.9
Covnt	66.9	67.4	51.7	58.0
Derby	67.6	62.8	55.2	61.9
Donc	66.6	64.9	55.9	64.0
Dorset	72.0	69.6	57.1	65.0
Dudley	70.1	57.3	57.8	63.9
Exeter	73.3	68.2	53.8	62.8
Glouc	70.7	65.8	53.3	64.7
Hull	67.9	62.7	52.4	58.9
Ipswi	66.4	67.6	55.1	60.2
Kent	70.5	63.9	53.8	61.1
L Barts	60.6	61.3	50.6	55.1
L Guys	62.3	64.4	50.5	54.4
L Kings	63.7	60.4	53.3	58.3
L Rfree	67.5	58.7	51.6	56.8
L St.G	66.1	68.7	54.0	59.4
L West	65.8	66.7	54.3	58.9
Leeds	65.6	58.7	52.9	56.8
Leic	66.7	64.8	52.9	59.4
Liv Ain	68.6	56.5	49.6	66.5
Liv Roy	61.6	55.7	52.5	54.8
M RI	61.5	64.5	50.8	54.1
Middlbr	67.1	60.0	53.5	58.0
Newc	63.2	64.9	54.8	56.7
Norwch	71.3	70.7	53.8	61.3
Nottm	70.1	61.6	51.6	57.3
Oxford	66.3	63.9	52.0	56.4
Plymth	71.7	65.8	55.6	60.0
Ports	67.0	66.5	53.3	58.6
Prestn	64.9	64.6	53.3	59.2
Redng	69.5	60.3	56.8	61.1
Salford	63.2	59.7	52.2	58.0
Sheff	66.3	63.4	52.1	58.5
Shrew	66.7	59.7	54.7	61.6
Stevng	67.1	66.6	52.5	60.7
Sthend	72.5	64.1	54.8	64.7
Stoke	67.4	68.7	50.9	59.7
Sund	64.5	68.8	54.0	57.7
Truro	70.8	64.0	57.5	63.9
Wirral	67.1	55.9	61.5	65.6
Wolve	66.8	60.8	50.5	59.4
York	69.1	59.0	52.4	58.2
N Ireland				
Antrim	70.7	67.8	52.4	64.2
Belfast	66.0	61.1	51.2	54.1
Newry	65.2	70.8	53.4	60.1
Ulster	74.3	62.9	53.7	67.7
West NI	68.6	73.0	50.2	59.1
Scotland				
Abrdn	65.5	60.0	51.0	57.6
Airdrie	64.6	67.1	51.9	58.3
D & Gall	67.3	66.6	52.5	56.9
Dundee	67.8	63.5	52.8	60.6
Edinb	58.7	66.2	52.1	54.8
Glasgw	66.9	61.5	52.5	56.7
Inverns	69.0	63.8	49.3	55.4
Klmarnk	65.9	63.6	52.2	58.6
Krkcldy	69.2	65.3	52.3	61.7
Wales				
Bangor	67.2	69.5		67.4
Cardff	68.8	64.9	52.6	57.3
Clwyd	66.9	73.0	58.4	64.5
Swanse	70.2	63.9	57.7	63.9
Wrexm	72.2	57.7	54.3	59.1
England	**66.8**	**63.5**	**52.8**	**58.5**
N Ireland	**68.5**	**66.2**	**51.5**	**58.0**
Scotland	**65.9**	**63.7**	**52.2**	**57.1**
Wales	**69.3**	**65.0**	**53.6**	**60.0**
UK	**66.9**	**63.7**	**52.8**	**58.4**

Blank cells indicate no patients on that treatment modality attending that centre when data were collected

percentage of patients with uncertain aetiology for the remaining 70 centres was between 4.2% and 34.9%, and has shown marked improvement over time. Completeness of PRD data has also continued to improve and no centre had >30% missing data in 2013.

Glomerulonephritis (GN) remained the most common primary renal diagnosis in the 2013 prevalent cohort at 19% (table 2.11). Diabetes accounted for 15.9% of renal disease in prevalent patients on RRT, although it was more common in the ⩾65 year age group compared to the younger group (17.9% vs. 14.8%). This contrasted with incident patients where diabetes was the predominant diagnostic code in 25.4% of new RRT patients. Younger patients (age <65 years) were more likely to have GN (21.6%) or diabetes (14.8%) and less likely to have renal vascular disease (1.0%) or hypertension (5.2%) as the cause of their renal failure. Uncertain aetiology (19.5%) was the most common cause in the over 65s.

Table 2.9. Percentage of prevalent RRT patients in each age group by centre on 31/12/2013

		Percentage of patients			
Centre	*N*	18–39 years	40–64 years	65–74 years	75+ years
England					
B Heart	658	12.2	42.7	21.6	23.6
B QEH	2,051	14.2	53.6	17.7	14.4
Basldn	270	13.0	40.4	21.9	24.8
Bradfd	520	20.8	51.3	16.0	11.9
Brightn	875	11.3	46.3	22.7	19.7
Bristol	1,427	15.1	47.2	20.7	17.0
Camb	1,198	13.8	49.2	19.9	17.0
Carlis	227	12.3	51.1	20.7	15.9
Carsh	1,488	9.7	46.2	23.2	20.8
Chelms	239	7.9	42.7	23.8	25.5
Colchr	115	10.4	22.6	29.6	37.4
Covnt	932	13.1	48.9	20.4	17.6
Derby	472	10.8	46.0	25.4	17.8
Donc	259	10.0	44.4	22.4	23.2
Dorset	628	9.9	40.1	27.9	22.1
Dudley	312	7.4	47.1	19.2	26.3
Exeter	890	10.1	43.4	24.0	22.5
Glouc	412	9.2	42.2	25.0	23.5
Hull	815	13.9	49.8	20.6	15.7
Ipswi	354	9.3	52.8	23.2	14.7
Kent	965	12.0	46.5	24.4	17.1
L Barts	2,103	16.5	56.1	16.9	10.5
L Guys	1,841	20.0	53.4	16.2	10.3
L Kings	965	11.4	52.1	19.4	17.1
L Rfree	1,955	17.5	48.6	18.9	15.0
L St.G	754	13.4	51.5	19.4	15.8
L West	3,142	12.3	52.9	20.7	14.2
Leeds	1,466	16.2	51.0	21.1	11.8
Leic	2,072	13.2	48.7	22.4	15.6
Liv Ain	190	6.8	38.9	20.5	33.7
Liv Roy	1,269	17.6	56.1	18.4	7.9
M RI	1,864	17.9	55.3	17.9	8.9
Middlbr	836	14.2	49.8	19.6	16.4
Newc	964	13.9	54.3	21.0	10.9
Norwch	692	12.0	44.5	21.4	22.1
Nottm	1,075	17.1	48.6	18.7	15.6
Oxford	1,565	14.8	54.5	17.1	13.6
Plymth	503	12.1	48.7	22.9	16.3
Ports	1,555	13.6	49.5	21.6	15.4
Prestn	1,090	11.7	51.5	22.0	14.8
Redng	731	9.8	48.3	23.7	18.2
Salford	886	14.2	52.3	20.2	13.3
Sheff	1,329	13.8	50.8	19.2	16.2
Shrew	342	12.3	44.2	23.4	20.2
Stevng	765	10.3	48.1	20.1	21.4
Sthend	221	12.7	38.5	22.2	26.7
Stoke	726	13.8	46.0	21.5	18.7
Sund	423	13.0	51.5	23.9	11.6
Truro	377	12.5	39.8	23.3	24.4
Wirral	252	9.1	39.3	22.2	29.4
Wolve	563	11.9	49.7	20.2	18.1
York	409	17.6	47.4	20.0	14.9

Table 2.9. Continued

Centre	*N*	Percentage of patients			
		18–39 years	40–64 years	65–74 years	75+ years
N Ireland					
Antrim	224	9.4	41.1	26.8	22.8
Belfast	729	17.8	53.6	17.0	11.5
Newry	199	15.1	48.2	23.1	13.6
Ulster	156	8.3	37.2	21.8	32.7
West NI	238	15.5	45.0	22.7	16.8
Scotland					
Abrdn	519	19.1	48.7	18.7	13.5
Airdrie	393	14.2	50.6	20.1	15.0
D & Gall	117	10.3	48.7	21.4	19.7
Dundee	403	11.4	46.9	24.3	17.4
Edinb	739	16.0	57.6	17.3	9.1
Glasgw	1,598	13.6	55.0	18.6	12.8
Inverns	216	13.0	58.8	13.9	14.4
Klmarnk	296	9.1	53.7	22.3	14.9
Krkcldy	283	12.0	44.5	24.0	19.4
Wales					
Bangor	99	8.1	30.3	32.3	29.3
Cardff	1,584	14.8	51.3	20.1	13.8
Clwyd	153	11.1	41.2	30.7	17.0
Swanse	691	11.0	42.3	25.3	21.4
Wrexm	250	13.6	45.2	16.8	24.4
England	**48,032**	**13.9**	**49.9**	**20.4**	**15.8**
N Ireland	**1,546**	**14.9**	**48.1**	**20.6**	**16.4**
Scotland	**4,564**	**14.0**	**52.9**	**19.5**	**13.7**
Wales	**2,777**	**13.3**	**47.2**	**22.1**	**17.4**
UK	**56,919**	**13.9**	**49.9**	**20.4**	**15.8**
(Min : max)		**(6.8 : 20.8)**	**(22.6 : 58.8)**	**(13.9 : 32.3)**	**(7.9 : 37.4)**

As described before, the male : female ratio was greater than unity for all primary renal diagnoses (table 2.11).

In individuals aged less than 65 years, the renal transplantation to dialysis ratio was greater than 1 in all PRD groups except diabetes and renovascular disease. In those aged >65 years, dialysis was more prevalent than renal transplantation in all PRD groups except polycystic kidney disease (PKD) (table 2.12).

Fig. 2.4. Age profile of prevalent RRT patients by modality on 31/12/2013

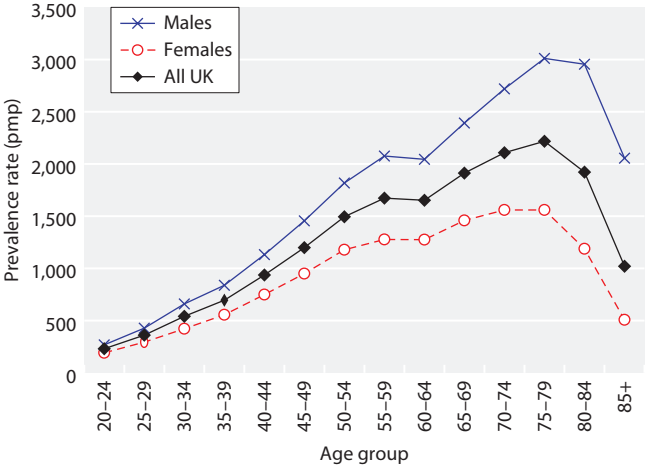

Fig. 2.5. Prevalence rate of RRT patients per million population by age and gender on 31/12/2013

Table 2.10. Ethnicity of prevalent RRT patients by centre on 31/12/2013

Centre	Percentage data not available	*N* with data	Percentage in each ethnic group*				
			White	Black	S Asian	Chinese	Other
England							
B Heart	0.0	658	59.4	8.1	30.9	0.8	0.9
B QEH	0.0	2,051	63.0	9.6	24.3	0.8	2.3
Basldn	0.0	270	87.4	6.3	4.4	0.4	1.5
Bradfd	0.0	520	56.7	1.9	40.2	0.6	0.6
Brightn	1.8	859	92.2	2.2	3.8	0.1	1.6
Bristol	0.3	1,423	89.6	4.6	3.9	0.4	1.5
Camb	1.4	1,181	92.7	1.9	4.5	0.2	0.8
Carlis	0.4	226	98.7	0.0	0.9	0.0	0.4
Carsh	12.2	1,307	73.1	9.3	12.9	1.6	3.1
Chelms	5.0	227	92.1	3.1	2.2	0.9	1.8
Colchr	0.0	115	96.5	0.0	0.9	0.9	1.7
Covnt	0.0	932	80.8	3.9	14.5	0.8	0.1
Derby	1.7	464	81.7	4.1	12.7	0.6	0.9
Donc	0.0	259	95.0	1.2	2.3	0.4	1.2
Dorset	0.0	628	97.3	0.3	0.8	0.5	1.1
Dudley	0.6	310	86.8	2.9	8.4	0.6	1.3
Exeter	0.1	889	98.5	0.6	0.3	0.1	0.4
Glouc	0.0	412	95.1	1.7	2.4	0.0	0.7
Hull	2.8	792	96.8	0.4	1.6	0.3	0.9
Ipswi	1.7	348	93.4	3.4	2.9	0.3	0.0
Kent	0.8	957	95.1	0.9	2.5	0.2	1.3
L Barts	0.0	2,102	39.0	33.5	25.6	1.5	0.4
L Guys	0.9	1,824	65.0	23.1	7.1	1.2	3.6
L Kings	0.1	964	49.6	34.4	10.5	1.9	3.6
L Rfree	3.6	1,884	47.7	22.8	19.3	1.5	8.7
L St.G	4.1	723	49.1	22.4	20.2	2.2	6.1
L West	0.0	3,142	43.6	18.4	34.2	1.1	2.8
Leeds	0.0	1,466	80.8	4.8	13.0	0.6	0.8
Leic	2.6	2,019	76.5	3.4	18.5	0.4	1.1
Liv Ain	2.6	185	94.6	1.6	2.2	0.5	1.1
Liv Roy	1.5	1,250	93.2	2.0	1.7	1.2	1.9
M RI	1.1	1,844	78.9	6.0	12.4	0.8	1.9
Middlbr	0.1	835	94.6	0.4	4.6	0.4	0.1
Newc	0.1	963	93.1	0.9	4.5	0.7	0.7
Norwch	0.0	692	97.4	0.4	0.3	1.6	0.3
Nottm	0.0	1,075	87.1	4.5	6.6	0.0	1.9
Oxford	2.2	1,530	83.0	4.1	9.5	0.7	2.7
Plymth	0.0	503	97.4	0.4	0.6	0.6	1.0
Ports	1.4	1,534	94.2	0.9	3.3	0.0	1.6
Prestn	0.0	1,090	85.8	0.8	13.0	0.0	0.4
Redng	5.1	694	71.9	6.9	19.3	0.4	1.4
Salford	0.0	886	81.9	1.8	14.8	0.5	1.0
Sheff	0.6	1,321	91.3	2.3	4.0	0.7	1.7
Shrew	0.0	342	94.7	1.5	3.2	0.0	0.6
Stevng	1.2	756	70.8	9.1	17.2	0.5	2.4
Sthend	3.2	214	84.6	2.3	4.2	2.3	6.5
Stoke	1.0	719	94.2	0.4	3.6	0.3	1.5
Sund	0.0	423	96.9	0.7	2.1	0.2	0.0
Truro	0.0	377	99.5	0.0	0.3	0.0	0.3
Wirral	0.8	250	95.2	0.8	2.0	1.6	0.4
Wolve	0.2	562	70.1	9.4	19.8	0.5	0.2
York	0.0	409	97.3	0.5	1.5	0.2	0.5

Table 2.10. Continued

Centre	Percentage data not available	*N* with data	Percentage in each ethnic group*				
			White	Black	S Asian	Chinese	Other
N Ireland							
Antrim	0.0	224	99.1	0.4	0.4	0.0	0.0
Belfast	0.0	729	98.4	0.3	1.0	0.3	0.1
Newry	0.0	199	99.5	0.0	0.0	0.5	0.0
Ulster	0.0	156	96.8	0.0	1.9	1.3	0.0
West NI	0.0	238	98.3	0.4	0.8	0.4	0.0
Scotland							
Abrdn	62.2	196					
Airdrie	65.6	135					
D & Gall	83.8	19					
Dundee	56.8	174					
Edinb	90.8	68					
Glasgw	90.5	152					
Inverns	20.8	171	98.8	0.0	1.2	0.0	0.0
Klmarnk	56.4	129					
Krkcldy	81.3	53					
Wales							
Bangor	0.0	99	98.0	0.0	1.0	0.0	1.0
Cardff	0.0	1,584	93.2	1.2	4.5	0.5	0.6
Clwyd	2.0	150	99.3	0.0	0.7	0.0	0.0
Swanse	0.0	691	97.8	0.3	1.6	0.0	0.3
Wrexm	0.0	250	98.8	0.4	0.4	0.4	0.0
England	**1.3**	**47,406**	**76.9**	**8.2**	**12.3**	**0.7**	**1.9**
N Ireland	**0.0**	**1,546**	**98.4**	**0.3**	**0.8**	**0.4**	**0.1**
Scotland	**76.0**	**1,097**	**96.0**	**0.4**	**2.8**	**0.5**	**0.4**
Wales	**0.1**	**2,774**	**95.3**	**0.8**	**3.1**	**0.3**	**0.4**
UK	**7.2**	**52,823**	**78.9**	**7.5**	**11.3**	**0.7**	**1.7**

*Percentage breakdown is not shown for centres with less than 50% data completeness, but these centres are included in national averages
See appendix H for ethnicity coding

Diabetes

Diabetes included all prevalent patients with type 1 or type 2 diabetes as the primary renal diagnosis (ERA-EDTA coding) and did not include patients with diabetes as a comorbidity. This analysis did not differentiate between type 1 and type 2 diabetes as this distinction was not made in the data submitted by most centres.

The male : female ratio for diabetes as PRD was 1.6. The number of prevalent patients with diabetes as a primary renal diagnosis increased 7.0% to 9,052 in

Table 2.11. Primary renal diagnosis in prevalent RRT patients by age and gender on 31/12/2013

Primary diagnosis*	*N*	% all patients	Inter-centre range %	Age <65		Age ⩾65		M : F ratio
				N	%	*N*	%	
Aetiology uncertain	9,062	16.0	4.3–33.9	5,059	13.9	4,003	19.5	1.6
Glomerulonephritis	10,812	19.0	8.1–26.8	7,829	21.6	2,983	14.5	2.1
Pyelonephritis	6,220	11.0	5.3–19.3	4,629	12.8	1,591	7.8	1.1
Diabetes	9,052	15.9	10.0–27.3	5,369	14.8	3,683	17.9	1.6
Polycystic kidney	5,634	9.9	4.7–18.1	3,705	10.2	1,929	9.4	1.1
Hypertension	3,439	6.1	1.5–15.9	1,880	5.2	1,559	7.6	2.4
Renal vascular disease	1,722	3.0	0.7–9.3	350	1.0	1,372	6.7	2.0
Other	9,213	16.2	6.1–28.9	6,442	17.8	2,771	13.5	1.3
Not sent	1,650	2.9	0.1–28.6	1,013	2.8	637	3.1	1.6

*See appendix H: ERA-EDTA coding
Excluded centre: ⩾40% primary renal diagnosis aetiology uncertain (Colchr)

Table 2.12. Transplant : dialysis ratios by age and primary renal disease in the prevalent RRT population on 31/12/2013

	Transplant : dialysis ratio	
Primary diagnosis*	<65	⩾65
Aetiology uncertain	2.1	0.3
Glomerulonephritis	2.4	0.8
Pyelonephritis	2.7	0.5
Diabetes	0.9	0.1
Polycystic kidney	2.7	1.6
Hypertension	1.2	0.3
Renal vascular disease	1.0	0.1
Other	2.1	0.4
Not sent	1.3	0.2

*See appendix H ERA-EDTA coding
Excluded centre: ⩾40% primary renal diagnosis aetiology uncertain (Colchr)

2013, from 8,456 in 2012, representing 15.9% of all prevalent patients (compared with 13.5% in 2006) (table 2.13). The median age at start of RRT for patients with diabetes (56 years) was nine years higher compared with patients without diabetes (47 years), although the median age at the end of 2013 for prevalent diabetic patients was only three years higher than for individuals without diabetes. This reflects reduced survival for patients with diabetes compared with patients without diabetes on RRT.

Table 2.13. Age relationships in patients with diabetes and patients without diabetes and modality in prevalent RRT patients on 31/12/2013

	Patients with diabetes[a]	Patients without diabetes[b]
N	9,052	46,102
M : F ratio	1.61	1.54
Median age on 31/12/13	61	58
Median age at start of RRT[c,d]	56	47
Median years on RRT[d]	3.7	7.0
% HD	59	38
% PD	8	6
% transplant	33	56

Excluded centre: ⩾40% primary renal diagnosis aetiology uncertain (Colchr)
[a]Patients with diabetes: patients with a primary renal disease code of diabetes
[b]Patients without diabetes: all patients excluding patients with diabetes as a PRD and patients with a missing primary renal disease code
[c]Median age at start of RRT was calculated from the most recent RRT start date
[d]Patients with an initial treatment modality of transferred in or transferred out were excluded from the calculation of median age at start of RRT and median years on RRT, since their treatment start date was not accurately known

Median time on RRT for patients with diabetes was less when compared with patients without diabetes (3.7 years vs. 7.0 years) and this difference in survival between patients with diabetes and patients without diabetes has not changed over the last five years (2.9 years vs. 6.2 years in 2008). Patients with diabetes starting RRT in Scotland were four years younger compared with the UK average age of patients with diabetes starting RRT (data not shown).

Fifty nine percent of patients with diabetes as primary renal diagnosis were undergoing HD compared to just 38% of patients with any other primary renal diagnosis (table 2.13). The percentage of patients with a functioning transplant was much lower in prevalent patients with diabetes than in prevalent patients without diabetes (33% vs. 56%). However, the proportion of patients with diabetes as PRD with a functioning transplant has increased since 2004 when only 26% of patients with diabetes had a functioning transplant. For older patients with diabetes (age ⩾65 years), 12.1% had a functioning transplant compared with 33.3% of their peers without diabetes (table 2.14). In Northern Ireland, 28% of prevalent patients with diabetes had a functioning transplant compared with the UK average of 33%. A higher proportion of prevalent patients without diabetes (18.3%) were on home dialysis therapies (home HD and PD) compared with prevalent patients with diabetes (14.4%).

Modalities of treatment

Transplantation was the most common treatment modality (52%) for prevalent RRT patients in 2013, followed closely by centre-based HD (39.6%) in either hospital centre (18.5%) or satellite unit (21.1%) (figure 2.6). Satellite HD was again more prevalent than

Table 2.14. Treatment modalities by age and diabetes status on 31/12/2013

	<65 years		⩾65 years	
	Diabetes[a]	All other causes[b]	Diabetes[a]	All other causes[b]
N	5,369	29,894	3,683	16,208
% HD	44.9	26.5	79.0	58.7
% PD	7.9	4.8	9.0	8.0
% transplant	47.3	68.7	12.1	33.3

Excluded centre with ⩾40% PRD aetiology uncertain (Colchr)
[a]Patients with diabetes are patients with a primary renal disease code of diabetes
[b]Patients without diabetes are calculated as all patients excluding patients with diabetes as a PRD and patients with a missing primary renal disease code

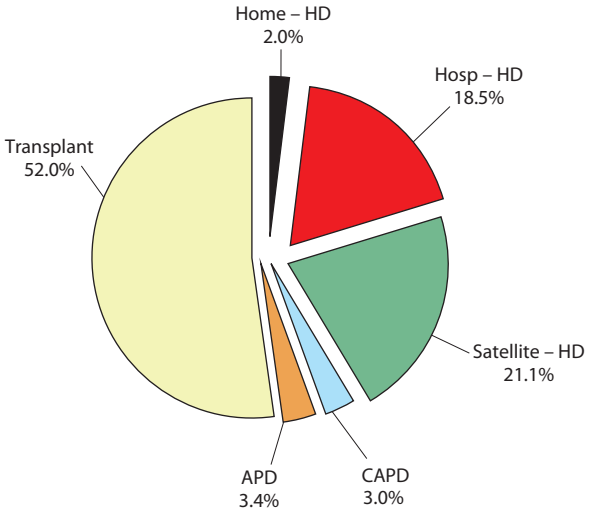

Fig. 2.6. Treatment modality in prevalent RRT patients on 31/12/2013

in centre which was similar to 2012 when this was first noted. Home therapies made up the remaining 8.4% of treatment therapies, largely PD in its different formats (6.4%) which was similar to 2012. The proportion on continuous ambulatory peritoneal dialysis (CAPD) and automated PD (APD) was 3.0% and 3.4% respectively, although the proportion on APD may be an underestimate due to centre level coding issues which mean the UKRR cannot always distinguish between these therapies.

As mentioned earlier, treatment modality was related to patient age. Younger patients (age <65 years), were more likely to have a functioning transplant (65.1%) when compared with patients aged over 65 years (28.8%) (table 2.15). HD was the principal modality in the older patients (62.9%). However, in the elderly, interpreting the proportion of patients on renal replacement therapy who are transplanted is not straight forward as this depends on approaches to dialysis and conservative care in this age group.

Figure 2.7 shows the association between age and RRT modality. Beyond 54 years of age, transplant prevalence declined, whilst HD prevalence increased. The proportion of each age group treated by PD remained more stable across the age spectrum.

The proportion of prevalent dialysis patients receiving HD, ranged from 70.8% in Carlisle to 100% in Colchester (table 2.16).

Overall, the proportion of dialysis patients treated in a satellite haemodialysis unit has increased to 44.0% this year compared to 39.9% in 2010. Although there are satellite units in Scotland, the data provided for 2013 did not distinguish between main centre and satellite unit haemodialysis. In 2013, the number of centres that had more than 50% of their haemodialysis activity taking place in satellite units was 30 (figure 2.8). There was also wide variation between centres in the proportion of dialysis patients on APD treatment, ranging from 0% to 21.7% (table 2.16). Ten of the 70 centres with a PD programme did not report having any patients on APD, whilst in the Northern Ireland centres the majority of PD patients were on this form of the modality.

Home haemodialysis

The use of home HD as a RRT peaked in 1982 when almost 2,200 patients were estimated to be on this modality, representing 61% of HD patients reported to the ERA-EDTA Registry at that time. The fall in the use of this modality to just 445 patients (2.4% of HD patients) in 2006 was probably due to an increase in availability and uptake of renal transplantation, and also the expansion of hospital HD provision with the introduction of satellite units. In the last seven years there has been renewed interest in home HD and a target of 15% of HD patients on this modality has been suggested [4]. Equipment changes and patient choice has helped drive this change. Since 2006 there has been a gradual increase in the proportion of prevalent patients receiving haemodialysis in their own homes so that in 2013 it reached

Table 2.15. Percentage of prevalent RRT patients by dialysis and transplant modality by UK country on 31/12/2013

	<65 years				⩾65 years			
UK country	*N*	% HD	% PD	% transplant	*N*	% HD	% PD	% transplant
England	30,607	29.8	5.6	64.6	17,425	62.9	8.4	28.8
N Ireland	975	26.8	3.9	69.3	571	68.1	7.5	24.3
Scotland	3,053	29.1	3.8	67.1	1,511	64.3	7.3	28.3
Wales	1,679	25.6	5.4	69.0	1,098	59.0	8.3	32.7
UK	**36,314**	**29.5**	**5.4**	**65.1**	**20,605**	**62.9**	**8.3**	**28.8**

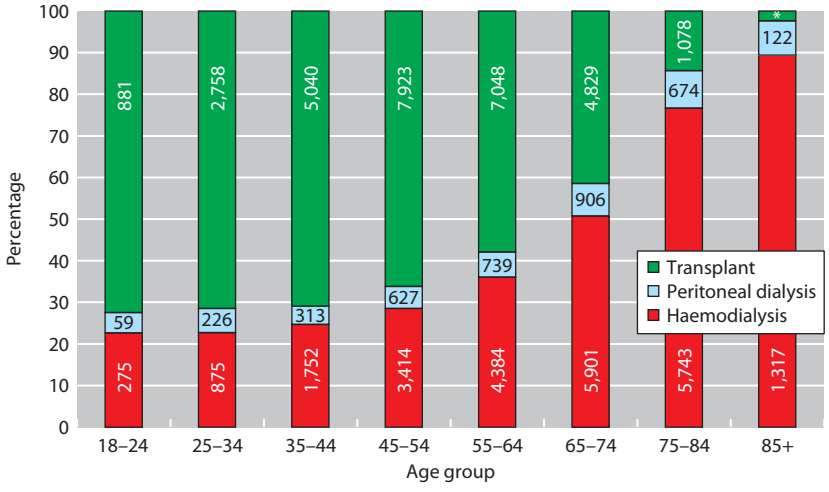

Fig. 2.7. Treatment modality distribution by age in prevalent RRT patients on 31/12/2013
$N = 35$

4.7% of HD patients ($n = 1{,}113$, figure 2.2). These numbers may be an underestimate as some centres have been unable to submit data for patients coded as home HD and work is ongoing to address this.

Some patients are sent by their parent renal centre to centres known to have a strong programme for home HD. In order to avoid the possibility of the parent renal centre being wrongly penalised, we measured the

Table 2.16. Percentage of prevalent dialysis patients by dialysis modality by postcode centre on 31/12/2013

		% haemodialysis					% peritoneal dialysis	
Centre	*N*	Total	Home	Geo-HHD	Hospital	Satellite	CAPD	APD
England								
B Heart	476	91.4	4.8	4.8	80.3	6.3	5.7	2.9
B QEH	1,070	87.2	5.1	4.6	10.2	72.0	4.8	8.0
Basldn	190	84.2	0.0	0.5	80.5	3.7	6.8	9.0
Bradfd	232	87.1	1.3	2.9	71.1	14.7	4.3	8.6
Brightn	477	83.4	9.6	9.7	42.4	31.5	10.1	6.5
Bristol	581	88.5	4.5	3.6	16.2	67.8	5.5	6.0
Camb	405	93.8	4.7	4.0	39.5	49.6	0.0	0.0
Carlis	96	70.8	0.0	0.0	46.9	24.0	13.5	15.6
Carsh	884	86.2	2.6	2.9	20.6	63.0	3.7	10.1
Chelms	144	85.4	1.4	2.0	84.0	0.0	11.8	2.8
Colchr	115	100.0	0.0	0.0	100.0	0.0	0.0	0.0
Covnt	461	81.8	4.1	3.5	77.7	0.0	18.2	0.0
Derby	302	71.9	9.6	9.6	62.3	0.0	18.2	9.9
Donc	198	82.3	0.5	4.4	45.0	36.9	0.5	17.2
Dorset	315	84.8	1.3	2.2	19.4	64.1	7.6	7.3
Dudley	231	75.8	5.6	6.1	56.3	13.9	15.2	9.1
Exeter	477	84.7	0.6	0.6	9.6	74.4	7.6	7.6
Glouc	244	86.5	0.4	2.0	74.2	11.9	4.1	9.4
Hull	407	80.4	2.2	2.2	37.4	40.8	10.1	9.6
Ipswi	152	80.3	1.3	0.7	67.1	11.8	12.5	7.2
Kent	459	86.1	4.4	5.0	22.0	59.7	12.4	1.5
L Barts	1,151	82.9	1.3	1.2	39.4	42.2	3.8	13.3
L Guys	659	95.6	6.8	2.9	14.0	74.8	1.8	2.6
L Kings	603	82.6	0.8	3.1	14.1	67.7	7.0	10.5
L Rfree	862	84.8	2.3	2.1	3.5	79.0	5.7	9.5
L St.G	323	85.1	1.6	2.5	37.2	46.4	4.0	10.2
L West	1,459	95.8	1.0	1.1	20.2	74.6	1.9	2.3
Leeds	576	88.0	3.3	2.5	16.5	68.2	3.1	8.9

Table 2.16. Continued

Centre	*N*	% haemodialysis					% peritoneal dialysis	
		Total	Home	Geo-HHD	Hospital	Satellite	CAPD	APD
Leic	1,057	85.6	6.6	6.9	16.3	62.7	4.0	10.4
Liv Ain	185	83.8	4.9	7.3	3.8	75.1	3.8	12.4
Liv Roy	417	86.1	8.6	7.2	38.4	39.1	8.4	5.5
M RI	605	86.3	10.3	9.5	26.3	49.8	3.8	9.9
Middlbr	365	96.2	3.6	3.8	25.5	67.1	3.8	0.0
Newc	316	86.7	7.3	6.8	79.4	0.0	1.0	11.7
Norwch	370	89.2	7.0	7.1	48.4	33.8	8.1	2.7
Nottm	454	81.7	6.4	6.7	38.6	36.8	6.6	11.7
Oxford	534	81.5	4.9	3.9	31.1	45.5	4.5	14.0
Plymth	171	78.4	3.5	4.1	71.9	2.9	8.2	13.5
Ports	685	87.6	3.9	3.5	18.1	65.6	12.4	0.0
Prestn	603	90.7	5.6	5.6	21.1	64.0	2.0	7.3
Redng	358	78.8	2.0	3.6	36.0	40.8	14.0	7.3
Salford	475	82.5	5.7	6.3	33.3	43.6	8.6	8.8
Sheff	659	89.4	6.5	5.3	37.5	45.4	10.6	0.0
Shrew	219	85.4	8.2	8.6	45.7	31.5	14.6	0.0
Stevng	511	91.2	5.5	6.2	30.3	55.4	8.8	0.0
Sthend	138	87.0	0.7	1.4	86.2	0.0	13.0	0.0
Stoke	398	78.1	0.0	0.5	52.5	25.6	3.3	14.6
Sund	208	94.7	0.5	1.0	60.1	34.1	1.9	2.9
Truro	175	86.3	4.0	4.0	42.9	39.4	6.3	7.4
Wirral	248	85.9	3.6	4.4	35.1	47.2	2.4	11.7
Wolve	383	78.6	3.7	5.4	24.8	50.1	15.1	6.0
York	167	83.8	7.2	7.7	31.7	44.9	13.8	2.4
N Ireland								
Antrim	142	89.4	2.1	2.1	87.3	0.0	2.1	8.5
Belfast	239	88.7	6.3	6.0	82.4	0.0	0.8	10.5
Newry	110	83.6	1.8	1.8	81.8	0.0	0.0	16.4
Ulster	112	94.6	4.5	4.4	90.2	0.0	0.9	3.6
West NI	128	88.3	4.7	4.7	83.6	0.0	0.0	10.2
Scotland								
Abrdn	248	89.9	2.8	2.0	87.1	0.0	7.3	2.8
Airdrie	206	93.2	0.5	1.9	92.7	0.0	4.4	2.4
D & Gall	60	75.0	3.3	3.5	71.7	0.0	11.7	13.3
Dundee	193	89.1	1.6	1.6	87.6	0.0	3.1	7.8
Edinb	306	90.2	1.6	1.7	88.6	0.0	1.6	8.2
Glasgw	643	93.2	4.2	3.8	89.0	0.0	2.3	4.5
Inverns	84	82.1	2.4	2.4	79.8	0.0	9.5	8.3
Klmarnk	180	76.1	3.9	3.9	72.2	0.0	2.2	21.7
Krkcldy	166	88.6	0.0	0.0	88.6	0.0	0.6	10.8
Wales								
Bangor	99	86.9	14.1	13.9	54.6	18.2	10.1	3.0
Cardff	561	86.6	7.1	6.9	13.6	66.0	10.2	3.2
Clwyd	90	84.4	3.3	2.3	81.1	0.0	7.8	0.0
Swanse	387	85.0	5.2	5.6	58.9	20.9	9.8	5.2
Wrexm	123	82.1	1.6	1.7	64.2	16.3	17.9	0.0
England	**23,250**	**86.3**	**4.1**		**32.7**	**49.6**	**6.5**	**7.0**
N Ireland[a]	**731**	**88.9**	**4.2**		**84.7**	**0.0**	**0.8**	**9.9**
Scotland[b]	**2,086**	**89.2**	**2.6**		**86.6**	**0.0**	**3.5**	**7.3**
Wales	**1,260**	**85.6**	**6.3**		**40.5**	**38.8**	**10.6**	**3.3**
UK	**27,327**	**86.6**	**4.1**		**38.5**	**44.0**	**6.3**	**6.9**

[a]There are no satellite units in Northern Ireland
[b]All haemodialysis patients in Scotland are shown as receiving treatment at home or in centre as no data was available regarding satellite dialysis

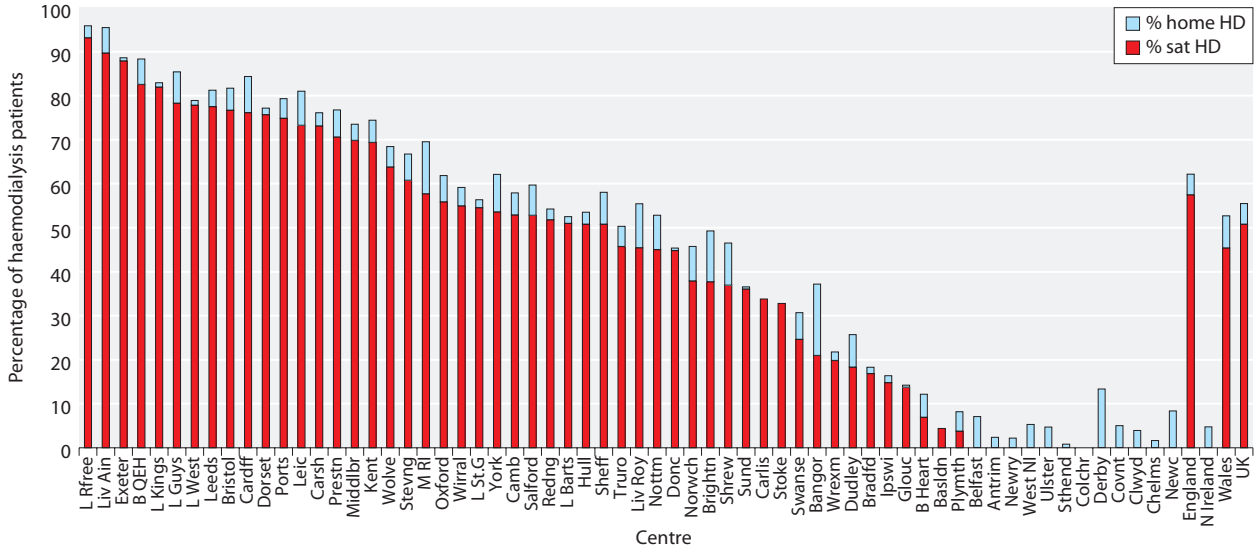

Fig. 2.8. Percentage of prevalent haemodialysis patients treated with satellite or home haemodialysis by centre on 31/12/2012 Scottish centres excluded as information on satellite HD was not available. No centres in Northern Ireland have satellite dialysis units

proportion of patients on home HD by centre, by assigning the patients to a given centre based on the patient postcode, rather than to the centre that is returning data to the UKRR (table 2.16 – Geo-HHD). This showed an increase in the prevalence of >1% of the Home HD for some centres (Bradford, Doncaster, Gloucester, London Kings, Liverpool Aintree, Reading, Wolverhampton, Airdrie).

In 2013, the percentage of dialysis patients receiving home HD varied from 0% in five centres, to greater than 5% in 21 centres (table 2.16). In the UK, the overall percentage of dialysis patients receiving home haemodialysis has increased from 3.4% in 2011 to 4.1% in 2013.

The proportion of dialysis patients receiving home haemodialysis was greatest in Wales at 6.3%, compared with 4.2% in Northern Ireland, 4.1% in England and 2.6% in Scotland (figure 2.8, table 2.16). The proportion on home haemodialysis has increased in each of the four countries since 2011. Forty-seven renal centres across the UK had an increase in the proportion of individuals on home haemodialysis compared with 2011. By comparison, in 2007, the proportion of patients receiving home haemodialysis was 2% in each of the four UK countries.

Change in modality

The relative proportion of RRT modalities in prevalent patients has changed dramatically over the past decade. The main features are depicted in figure 2.9, which describes a year on year decline in the proportion of

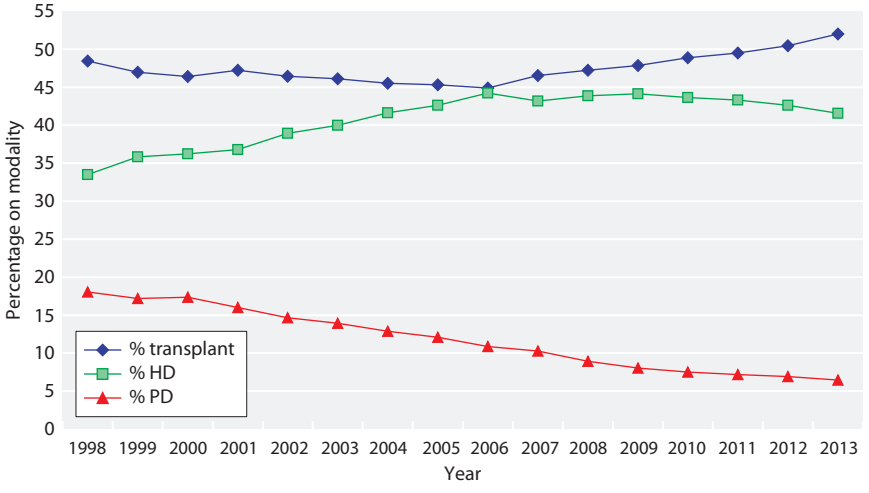

Fig. 2.9. Modality changes in prevalent RRT patients from 1998–2013

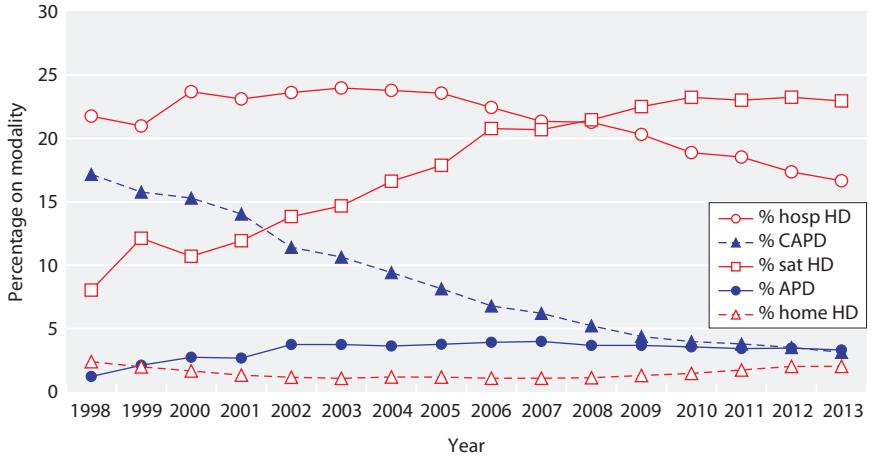

Fig. 2.10. Detailed dialysis modality changes in prevalent RRT patients from 1998–2013
Scottish centres excluded as information on satellite HD was not available

patients treated by PD since 2000 and a drop of 6.5% over the last 10 years. The absolute number of patients on PD decreased from 5,185 patients in 2004 to 3,666 patients in 2013. Time on PD has decreased marginally over the last six years, from a median of 2.0 years in 2007 to 1.7 years in 2013 probably reflecting increased transplantation rates in this largely younger patient group (table 2.7). The percentage of patients undergoing PD for more than seven years has significantly reduced over time (2.3% PD patients starting in 2000 to 0.7% patients starting in 2006) which might reflect increased awareness of complications associated with long PD use or increased access to transplantation for these patients.

The proportion of patients treated with HD has remained stable over the last three years. The downward trend seen in the proportion of patients with a functioning transplant has reversed since 2007 and was up by 1.6% from 2012, probably due to continued increases in living organ and non-heart beating donation [5].

Figure 2.10 depicts in more detail the modality changes in the prevalent dialysis population during this time and highlights a sustained reduction in the proportion of patients treated by CAPD. There was a sustained increase in the proportion of prevalent HD patients treated at satellite units with a steady decline in hospital centre haemodialysis since 2004.

International comparisons

Prevalence rates in the UK are similar to those in most other Northern European countries but lower than Southern Europe and far lower than the USA. This probably reflects differences in incidence rates and conservative care practices between countries in addition to other healthcare system differences (figure 2.11).

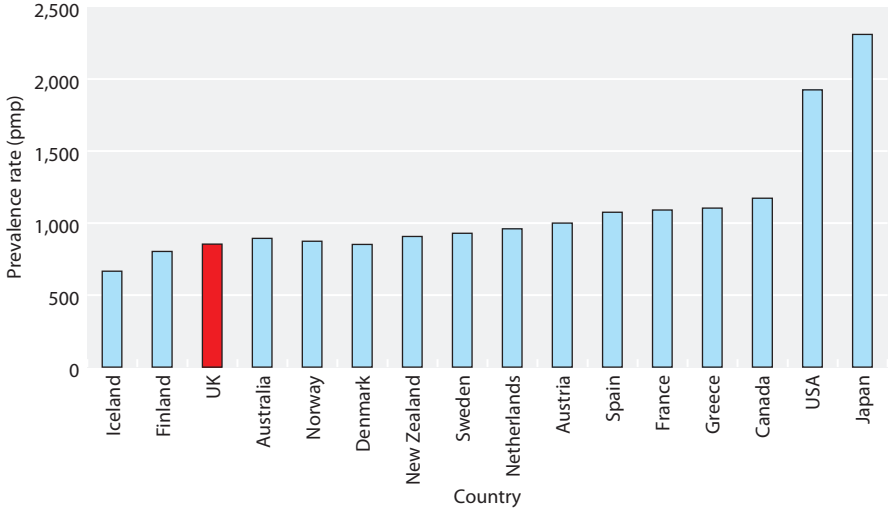

Fig. 2.11. RRT prevalence rates (pmp) by country in 2011
Non-UK data from USRDS
The UK data include paediatric patients to agree with the data from the other countries.
All rates unadjusted. Japan is dialysis only.
Data for France include 25 regions in 2011.

Conclusions

This year's report has once again seen an increase in the age of prevalent patients on RRT in the UK with over 75 year olds making up 15.8% of all RRT patients. There is increasing recognition of the specific needs for this population with several recent publications examining this [6–8]. In addition the American Society of Nephrology has recently developed a specific Geriatric Nephrology curriculum to address this issue [9].

There is again 4% growth in the population undergoing RRT, due at least in part, to improving survival of patients. Inclusion of these patients in well-designed studies such as the recently published CREDO-Kyoto study may further improve the quality of evidence available to inform the treatment of these patients and hopefully further improvements in survival in the future [10].

In general, areas with large ethnic minority populations had higher standardised prevalence ratios and this pattern has remained similar for many years. There was no real difference in prevalence rates between the four nations of the UK once adjustment was made for background population characteristics. There were increasing numbers of patients on HD and those with a functioning transplant. Patient numbers on PD continues to fall between 0.3%–0.5% every year. There have been substantial increases in home HD use in some areas although several centres are still unable to offer this modality.

Finally, it is hoped that the new codes for primary renal disease and comorbidity soon to be introduced will lead to increased understanding of patient outcomes and will strengthen the analyses in this chapter and beyond.

Conflicts of interest: none

References

1 Ansell D, Feest T: The sixth annual report. Chapter 17: Social deprivation on renal replacement therapy. Bristol, UK Renal Registry, 2003
2 McDonald SP, et al.: Relationship between Dialysis Modality and Mortality. Journal of the American Society of Nephrology, 2009; 20(1):155–163
3 Office for National Statistics: www.statistics.gov.uk
4 NICE 2002. Technology appraisal No 48. National Institute Clinical Excellence. www.nice.org.uk
5 NHS Blood and Transplant activity report 2009/2010: Transplant activity in the UK. http://www.organdonation.nhs.uk/ukt/statistics/transplant_activity_report/current_activity_reports/ukt/activity_report_2009_10.pdf
6 Branka Sladoje-Martinovic IM, Ivan Bubic, Sanjin Racki and Lidija Orlic: Survival of chronic hemodialysis patients over 80 years of age. Clin Interv Aging, 2014;9:689–696
7 Foote C, et al.: Survival of elderly dialysis patients is predicted by both patient and practice characteristics. Nephrology Dialysis Transplantation, 2012
8 Brown PE: http://public.ukcrn.org.uk/search/StudyDetail.aspx?StudyID=12386. 2014
9 https://www.asn-online.org/education/distancelearning/curricula/geriatrics/. 2014
10 Marui A, et al.: Percutaneous Coronary Intervention Versus Coronary Artery Bypass Grafting in Patients With End-Stage Renal Disease Requiring Dialysis (5-Year Outcomes of the CREDO-Kyoto PCI/CABG Registry Cohort-2). American Journal of Cardiology, 2014; 114(4):555–561

UK Renal Registry 17th Annual Report: Chapter 3 Demographic and Biochemistry Profile of Kidney Transplant Recipients in the UK in 2013: 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 12% increase in overall renal transplant numbers in 2013, with a significant rise in kidney donation from donors after brainstem death (20%).
- In 2013, 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 2.4 per 100 patient years.
- The median age of incident and prevalent renal transplant patients in the UK was 50.3 and 52.8 years respectively.
- The median eGFR of prevalent renal transplant recipients was 51.8 ml/min/1.73 m^2.
- The median eGFR of patients one year after transplantation was 56.9 ml/min/1.73 m^2 post live transplant, 53.0 ml/min/1.73 m^2 post brainstem death transplant and 49.7 ml/min/1.73 m^2 post circulatory death transplant.
- In 2013, 13.4% 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 $-$0.58 ml/min/1.73 m^2/year.
- In 2013, infection (26%) and malignancy (24%) remained the commonest causes of death in patients with a functioning renal transplant.

Introduction

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

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

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

Unless otherwise specified, prevalent transplant patients were defined as patients with a functioning renal transplant on the 31st December 2013.

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 2013, 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 2013, 3,257 kidney or kidney plus other organ transplants were performed. The absolute number of living kidney donors showed a 6% rise in 2013 representing 33.8% of all transplants performed whilst donor after circulatory death transplants continued to increase and comprised 24.4% of all kidney transplants performed. A 20% rise in the number of transplants from donors after brainstem death was also noted in 2013 (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 2013, the death rate during 2013 was 2.4/100 patient years (CI 2.2–2.6) when censored for return to dialysis and 2.5/100 patient years (CI 2.3–2.7) 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.

During 2013, 2.4% of prevalent transplant patients experienced graft failure (excluding death as a cause of graft failure) maintaining the fall in graft failure rates

Table 3.1. UK kidney and kidney plus other organ transplant numbers in the UK (including paediatric), 1/1/2011–31/12/2013

Organ	2011	2012	2013	% change 2012–2013
Donor after brainstem death[a]	950	967	1,160	20
Donor after circulatory death[b]	594	708	794	12
Living donor kidney	1,026	1,034	1,100	6
Kidney and liver[c]	17	17	11	−35
Kidney and heart	0	3	1	
Kidney and pancreas[d]	163	172	190	10
Small bowel (inc kidney)	2	0	1	
Total kidney transplants	**2,752**	**2,901**	**3,257**	**12**

[a]Includes en bloc kidney transplants (7 in 2011, 4 in 2012, 4 in 2013) and double kidney transplants (5 in 2011, 7 in 2012, 18 in 2013)
[b]Includes en bloc kidney transplants (2 in 2011, 4 in 2012, 6 in 2013) and double kidney transplants (32 in 2011, 52 in 2012, 53 in 2013)
[c]Includes DCD transplants (2 in 2013)
[d]Includes DCD transplants (28 in 2011, 35 in 2012, 36 in 2013)

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 2013, the increased number of kidney transplants performed was mostly due to an increase in organs from donors after brainstem death. The graft failure

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
B QEH	89	97	83	90	97	100	89	95
Belfast	95	94	89	89	97	100	90	94
Bristol	93	95	85	86	98	99	95	97
Camb	92	97	85	92	98	99	93	98
Cardff	97	97	85	88	96	98	86	96
Covnt	87	92	89	89	94	99	86	94
Edin	91	95	83	86	96	98	89	95
Glasgw	95	96	86	90	96	97	93	97
L Barts	90	90	89	88	96	98	92	94
L Guys	93	96	83	88	97	98	92	95
L Rfree	94	96	90	93	98	99	96	96
L St.G	94	98	86	94	99	100	94	95
L West	95	98	88	91	96	99	82	95
Leeds	93	96	85	90	94	100	91	98
Leic	92	96	86	79	97	98	93	94
Liv Roy	92	94	81	91	95	100	91	94
M RI	95	96	87	89	99	98	95	96
Newc	93	95	83	87	100	99	91	98
Nottm	95	96	84	85	96	100	91	95
Oxford	93	96	89	87	97	97	96	94
Plymth	87	96	86	90	96	100	88	94
Ports	95	95	80	87	98	99	84	95
Sheff	92	96	83	93	97	100	92	98
All centres	**93**	**96**	**85**	**89**	**97**	**99**	**91**	**96**

Cohorts for survival rate estimation: 1 year survival: 1/1/2008–31/12/2012; 5 year survival: 1/1/2004–31/12/2008; 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
[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.asp)

rate of 2.4% per annum and patient death rate of 2.4 per 100 patient years were similar to those noted in 2012.

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

Two centres (Bangor and Colchester) 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.

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 2013. 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 http://www.renalreg.org.

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 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 been relatively stable over the last decade.

Age and gender

The gender ratio amongst incident and prevalent transplant patients has remained stable for at least the last ten years (table 3.6, figure 3.1). Note, absolute patient numbers differ from those published in previous reports as a result of additional data validation and reallocation of patients. The average age of incident transplant patients has steadily increased during the same time period. There has also been a gradual increase in the average age of prevalent transplant patients, which

Table 3.3. The prevalence per million population (pmp) of renal transplants in adults in the UK on 31/12/2013, by country

	England	N Ireland	Scotland	Wales	UK
Number of prevalent transplant patients	24,782	815	2,478	1,517	29,592
Total population, mid-2013 estimates from ONS* (millions)	53.9	1.8	5.3	3.1	64.1
Prevalence pmp transplant	460	445	465	492	462

*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 2009–2013, by CCG/HB

[a]CCG/HB – Clinical Commissioning Group (England); Health and Social Care Trust Areas (Northern Ireland); Health Board (Scotland) and Local Health Board (Wales)
[b]Population numbers based on the 2012 mid-year estimates by age group and gender (data obtained from the Office of National Statistics, National Records of Scotland and the Northern Ireland Statistics and Research Agency – based on the 2011 Census)
[c]O/E – age and gender standardised prevelence rate ratio
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
LCL – lower 95% confidence limit
UCL – upper 95% confidence limit
% non-White – percentage of the CCG/HB population that is non-White, from 2011 Census

UK Area	CCG/HB[a]	Total population[b]	Crude rate pmp					Age and gender standardised rate ratio 2013			% non-White
			2009	2010	2011	2012	2013	O/E[c]	95% LCL	95% UCL	
Cheshire, Warrington and Wirral	NHS Eastern Cheshire	195,300	307	363	394	415	450	0.89	0.72	1.10	3.7
	NHS South Cheshire	176,800	345	396	396	413	452	0.93	0.75	1.15	2.9
	NHS Vale Royal	*102,100*	*274*	*274*	*284*	*303*	*352*	*0.72*	*0.52*	*1.00*	*2.1*
	NHS Warrington	203,700	403	368	393	417	476	0.99	0.82	1.21	4.1
	NHS West Cheshire	228,100	355	377	403	430	469	0.96	0.80	1.16	2.8
	NHS Wirral	*320,200*	*328*	*334*	*340*	*340*	*350*	*0.73*	*0.61*	*0.88*	*3.0*
Durham, Darlington and Tees	NHS Darlington	105,200	314	333	390	390	428	0.90	0.67	1.21	3.8
	NHS Durham Dales, Easington and Sedgefield	273,000	421	429	469	476	520	1.05	0.89	1.24	1.2
	NHS Hartlepool and Stockton-on-Tees	284,600	411	432	425	450	485	1.04	0.88	1.22	4.4
	NHS North Durham	241,300	369	394	390	410	431	0.89	0.74	1.08	2.5
	NHS South Tees	**273,700**	**511**	**515**	**548**	**559**	**563**	**1.21**	**1.04**	**1.42**	**6.7**
Greater Manchester	**NHS Bolton**	**279,000**	**423**	**452**	**498**	**527**	**548**	**1.20**	**1.03**	**1.41**	**18.1**
	NHS Bury	186,200	397	397	414	440	440	0.94	0.76	1.17	10.8
	NHS Central Manchester	182,400	285	329	351	367	422	1.19	0.95	1.49	48.0
	NHS Heywood, Middleton & Rochdale	212,000	382	396	429	453	486	1.07	0.89	1.30	18.3
	NHS North Manchester	167,100	245	293	317	359	389	0.98	0.77	1.25	30.8
	NHS Oldham	225,900	363	390	407	425	483	1.09	0.90	1.32	22.5
	NHS Salford	237,100	299	337	363	413	418	0.95	0.78	1.16	9.9
	NHS South Manchester	161,300	229	273	316	353	378	0.93	0.72	1.20	19.6
	NHS Stockport	283,900	373	398	409	423	451	0.94	0.79	1.12	7.9
	NHS Tameside and Glossop	253,400	403	430	470	478	497	1.05	0.88	1.25	8.2
	NHS Trafford	228,500	289	328	359	390	416	0.90	0.73	1.10	14.5
	NHS Wigan Borough	318,700	342	383	449	483	543	1.12	0.97	1.30	2.7
Lancashire	NHS Blackburn with Darwen	147,700	311	311	359	386	433	1.00	0.78	1.28	30.8
	NHS Blackpool	142,000	373	359	359	416	479	0.99	0.78	1.26	3.3
	NHS Chorley and South Ribble	167,900	298	345	393	393	435	0.89	0.71	1.12	2.9
	NHS East Lancashire	371,600	409	404	436	441	474	1.00	0.87	1.16	11.9
	NHS Fylde & Wyre	165,000	315	315	321	364	400	0.79	0.62	1.01	2.1
	NHS Greater Preston	202,000	317	327	337	376	396	0.87	0.70	1.08	14.7
	NHS Lancashire North	158,500	328	334	347	347	366	0.79	0.61	1.02	4.0
	NHS West Lancashire	110,900	316	370	388	415	406	0.83	0.62	1.12	1.9
Merseyside	NHS Halton	125,700	342	382	406	446	453	0.96	0.74	1.24	2.2
	NHS Knowsley	145,900	370	384	377	397	418	0.90	0.70	1.16	2.8
	NHS Liverpool	469,700	326	349	381	398	422	0.96	0.83	1.10	11.1
	NHS South Sefton	159,400	332	351	370	414	445	0.92	0.73	1.16	2.2
	NHS Southport and Formby	*114,300*	*254*	*306*	*315*	*289*	*350*	*0.71*	*0.52*	*0.97*	*3.1*
	NHS St Helens	176,100	307	335	346	352	397	0.82	0.65	1.03	2.0
Cumbria, Northumberland, Tyne and Wear	NHS Cumbria	505,200	368	394	402	426	455	0.90	0.79	1.02	1.5
	NHS Gateshead	200,200	385	385	415	445	440	0.92	0.75	1.14	3.7
	NHS Newcastle North and East	141,600	431	445	480	445	466	1.13	0.89	1.44	10.7
	NHS Newcastle West	140,900	348	326	341	362	383	0.89	0.68	1.16	18.3

Table 3.4. Continued

UK Area	CCG/HB[a]	Total population[b]	Crude rate pmp					Age and gender standardised rate ratio 2013			% non-White
			2009	2010	2011	2012	2013	O/E[c]	95% LCL	95% UCL	
Cumbria, Northumberland, Tyne and Wear	**NHS North Tyneside**	**201,400**	**526**	**571**	**586**	**586**	**586**	**1.21**	**1.01**	**1.44**	**3.4**
	NHS Northumberland	316,100	414	389	437	446	481	0.94	0.81	1.11	1.6
	NHS South Tyneside	148,400	472	472	505	512	559	1.16	0.93	1.43	4.1
	NHS Sunderland	275,700	417	439	482	497	519	1.08	0.92	1.27	4.1
North Yorkshire and Humber	NHS East Riding of Yorkshire	314,500	385	394	410	426	493	0.96	0.82	1.13	1.9
	NHS Hambleton, Richmondshire and Whitby	*153,400*	*274*	*274*	*300*	*313*	*352*	*0.70*	*0.54*	*0.92*	*2.7*
	NHS Harrogate and Rural District	158,600	435	467	479	530	536	1.09	0.88	1.35	3.7
	NHS Hull	257,200	369	385	404	435	478	1.08	0.91	1.29	5.9
	NHS North East Lincolnshire	159,700	363	369	419	445	470	1.00	0.80	1.25	2.6
	NHS North Lincolnshire	*168,400*	*267*	*267*	*279*	*291*	*315*	*0.65*	*0.49*	*0.85*	*4.0*
	NHS Scarborough and Ryedale	110,500	407	425	453	434	425	0.85	0.64	1.13	2.5
	NHS Vale of York	346,100	387	407	433	488	526	1.11	0.96	1.28	4.0
South Yorkshire and Bassetlaw	NHS Barnsley	233,700	389	407	411	419	441	0.91	0.75	1.10	2.1
	NHS Bassetlaw	*113,200*	*292*	*318*	*318*	*336*	*345*	*0.69*	*0.50*	*0.94*	*2.6*
	NHS Doncaster	302,700	334	344	380	406	413	0.87	0.73	1.04	4.7
	NHS Rotherham	258,400	356	399	434	457	492	1.03	0.86	1.22	6.4
	NHS Sheffield	557,400	319	355	382	395	418	0.96	0.85	1.10	16.3
West Yorkshire	NHS Airedale, Wharfedale and Craven	158,200	417	455	436	449	474	0.98	0.78	1.23	11.1
	NHS Bradford City	**82,300**	**377**	**389**	**401**	**486**	**522**	**1.56**	**1.16**	**2.10**	**72.2**
	NHS Bradford Districts	**333,500**	**429**	**462**	**471**	**525**	**570**	**1.32**	**1.15**	**1.52**	**28.7**
	NHS Calderdale	205,300	434	472	507	536	531	1.11	0.92	1.34	10.3
	NHS Greater Huddersfield	238,800	373	398	431	461	473	1.01	0.84	1.22	17.4
	NHS Leeds North	199,600	351	366	406	416	421	0.90	0.73	1.12	17.4
	NHS Leeds South and East	238,300	348	378	394	407	466	1.09	0.90	1.31	18.3
	NHS Leeds West	319,800	294	328	350	403	441	1.05	0.89	1.24	10.8
	NHS North Kirklees	**186,700**	**477**	**487**	**509**	**514**	**595**	**1.34**	**1.11**	**1.61**	**25.3**
	NHS Wakefield	*327,600*	*314*	*339*	*354*	*375*	*397*	*0.82*	*0.69*	*0.97*	*4.6*
Arden, Herefordshire and Worcestershire	NHS Coventry and Rugby	423,900	361	392	418	439	455	1.05	0.91	1.21	22.2
	NHS Herefordshire	*184,900*	*297*	*292*	*303*	*324*	*341*	*0.68*	*0.53*	*0.87*	*1.8*
	NHS Redditch and Bromsgrove	178,700	353	369	369	408	420	0.86	0.69	1.08	6.0
	NHS South Warwickshire	259,200	363	405	409	455	471	0.96	0.81	1.15	7.0
	NHS South Worcestershire	*292,300*	*291*	*325*	*339*	*346*	*373*	*0.76*	*0.63*	*0.91*	*3.7*
	NHS Warwickshire North	188,000	378	399	441	436	452	0.93	0.75	1.15	6.5
	NHS Wyre Forest	98,100	357	357	357	377	408	0.81	0.59	1.10	2.8
Birmingham and the Black Country	NHS Birmingham CrossCity	721,400	352	371	391	413	438	1.06	0.95	1.19	35.2
	NHS Birmingham South and Central	199,600	361	381	371	366	431	1.09	0.88	1.34	40.4
	NHS Dudley	*313,600*	*297*	*303*	*309*	*290*	*328*	*0.69*	*0.57*	*0.84*	*10.0*
	NHS Sandwell and West Birmingham	475,700	349	357	368	397	454	1.10	0.96	1.26	45.3
	NHS Solihull	*207,400*	*285*	*299*	*313*	*338*	*342*	*0.72*	*0.57*	*0.91*	*10.9*
	NHS Walsall	270,900	376	388	413	428	469	1.04	0.87	1.24	21.1
	NHS Wolverhampton	251,000	299	303	299	315	379	0.85	0.70	1.04	32.0
Derbyshire and Nottinghamshire	NHS Erewash	94,600	264	285	285	296	412	0.86	0.63	1.18	3.2
	NHS Hardwick	*108,900*	*257*	*266*	*257*	*257*	*257*	*0.52*	*0.36*	*0.75*	*1.8*
	NHS Mansfield & Ashfield	192,500	322	358	400	452	473	0.98	0.80	1.20	2.5
	NHS Newark & Sherwood	115,900	380	431	440	492	535	1.08	0.84	1.39	2.4
	NHS North Derbyshire	*272,100*	*320*	*334*	*364*	*404*	*401*	*0.79*	*0.66*	*0.96*	*2.5*
	NHS Nottingham City	308,700	233	314	330	353	395	1.00	0.84	1.19	28.5
	NHS Nottingham North & East	146,200	301	342	383	410	438	0.90	0.70	1.15	6.2
	NHS Nottingham West	110,700	379	443	461	470	533	1.09	0.85	1.41	7.3
	NHS Rushcliffe	111,600	332	341	385	403	457	0.93	0.71	1.23	6.9
	NHS Southern Derbyshire	515,300	311	357	390	411	444	0.95	0.84	1.08	11.0

Table 3.4. Continued

UK Area	CCG/HB[a]	Total population[b]	Crude rate pmp					Age and gender standardised rate ratio 2013			% non-White
			2009	2010	2011	2012	2013	O/E[c]	95% LCL	95% UCL	
East Anglia	NHS Cambridgeshire and Peterborough	849,000	346	375	399	410	435	0.94	0.85	1.04	9.5
	NHS Great Yarmouth & Waveney	213,200	305	300	314	338	436	0.90	0.73	1.10	2.7
	NHS Ipswich and East Suffolk	395,700	306	331	364	369	427	0.88	0.76	1.03	5.6
	NHS North Norfolk	167,900	369	369	393	375	500	0.96	0.78	1.19	1.5
	NHS Norwich	193,400	300	300	336	321	409	0.92	0.74	1.14	7.3
	NHS South Norfolk	235,200	332	361	336	357	455	0.92	0.77	1.12	2.6
	NHS West Norfolk	171,300	327	339	344	391	426	0.86	0.68	1.08	2.6
	NHS West Suffolk	221,000	348	371	380	416	430	0.90	0.74	1.11	4.6
Essex	NHS Basildon and Brentwood	250,500	307	347	363	375	467	1.00	0.84	1.20	7.1
	NHS Castle Point, Rayleigh and Rochford	172,100	378	372	378	389	436	0.87	0.69	1.09	3.0
	NHS Mid Essex	379,600	369	387	424	414	477	0.98	0.85	1.14	4.4
	NHS North East Essex	314,300	321	340	379	395	433	0.91	0.77	1.08	5.5
	NHS Southend	174,800	286	320	332	366	435	0.94	0.75	1.17	8.4
	NHS Thurrock	159,500	295	307	338	357	370	0.83	0.64	1.07	14.1
	NHS West Essex	290,000	334	372	379	407	417	0.88	0.74	1.06	8.2
Hertfordshire and the South Midlands	NHS Bedfordshire	419,200	375	396	403	465	480	1.01	0.88	1.16	11.2
	NHS Corby	63,100	285	317	349	333	317	0.70	0.45	1.08	4.5
	NHS East and North Hertfordshire	540,700	324	355	375	409	436	0.95	0.83	1.08	10.4
	NHS Herts Valleys	569,900	344	395	419	439	467	1.02	0.90	1.15	14.6
	NHS Luton	**205,800**	**335**	**374**	**432**	**471**	**525**	**1.29**	**1.07**	**1.55**	**45.3**
	NHS Milton Keynes	257,900	341	380	415	450	450	1.00	0.84	1.21	19.6
	NHS Nene	621,800	370	397	420	417	439	0.93	0.83	1.05	9.1
Leicestershire and Lincolnshire	NHS East Leicestershire and Rutland	319,500	369	379	401	422	435	0.89	0.75	1.05	9.8
	NHS Leicester City	**331,600**	**516**	**516**	**549**	**570**	**630**	**1.56**	**1.36**	**1.78**	**49.5**
	NHS Lincolnshire East	228,100	342	364	373	386	425	0.83	0.68	1.01	2.0
	NHS Lincolnshire West	227,700	329	329	347	365	395	0.84	0.68	1.03	3.0
	NHS South Lincolnshire	*141,000*	*213*	*255*	*255*	*269*	*269*	*0.54*	*0.39*	*0.74*	*2.3*
	NHS South West Lincolnshire	122,000	287	287	344	361	377	0.76	0.57	1.01	2.3
	NHS West Leicestershire	374,200	393	430	454	470	497	1.03	0.90	1.19	6.9
Shropshire and Staffordshire	*NHS Cannock Chase*	*132,800*	*339*	*331*	*316*	*316*	*354*	*0.73*	*0.55*	*0.97*	*2.4*
	NHS East Staffordshire	*123,900*	*218*	*242*	*266*	*258*	*339*	*0.71*	*0.52*	*0.96*	*9.0*
	NHS North Staffordshire	213,200	347	356	385	413	446	0.90	0.74	1.10	3.5
	NHS Shropshire	*308,200*	*337*	*344*	*357*	*344*	*363*	*0.73*	*0.60*	*0.88*	*2.0*
	NHS South East Staffs and Seisdon and Peninsular	222,800	355	395	390	381	426	0.86	0.70	1.05	3.6
	NHS Stafford and Surrounds	151,100	324	324	351	377	423	0.85	0.66	1.08	4.7
	NHS Stoke on Trent	258,100	384	411	407	434	434	0.95	0.79	1.14	11.0
	NHS Telford & Wrekin	*167,700*	*274*	*280*	*292*	*286*	*352*	*0.76*	*0.59*	*0.98*	*7.3*
London	NHS Barking & Dagenham	190,600	320	346	404	409	462	1.20	0.97	1.47	41.7
	NHS Barnet	**364,000**	**462**	**497**	**555**	**618**	**643**	**1.50**	**1.32**	**1.71**	**35.9**
	NHS Camden	225,000	396	413	453	476	502	1.19	0.99	1.43	33.7
	NHS City and Hackney	259,700	316	339	339	362	408	1.03	0.85	1.25	44.6
	NHS Enfield	**317,300**	**435**	**463**	**526**	**580**	**611**	**1.45**	**1.26**	**1.66**	**39.0**
	NHS Haringey	**258,900**	**398**	**436**	**483**	**529**	**560**	**1.34**	**1.14**	**1.57**	**39.5**
	NHS Havering	239,700	300	313	325	334	388	0.84	0.69	1.03	12.3
	NHS Islington	**211,000**	**455**	**469**	**507**	**554**	**602**	**1.44**	**1.21**	**1.72**	**31.8**
	NHS Newham	314,100	274	309	325	366	423	1.12	0.95	1.33	71.0
	NHS Redbridge	**284,600**	**362**	**429**	**453**	**513**	**548**	**1.31**	**1.12**	**1.53**	**57.5**
	NHS Tower Hamlets	263,000	240	293	297	342	369	1.01	0.83	1.23	54.8
	NHS Waltham Forest	262,600	377	415	438	449	487	1.18	0.99	1.40	47.8
	NHS Brent	**314,700**	**566**	**597**	**610**	**658**	**734**	**1.73**	**1.52**	**1.97**	**63.7**

Table 3.4. Continued

UK Area	CCG/HB[a]	Total population[b]	Crude rate pmp					Age and gender standardised rate ratio 2013			% non-White
			2009	2010	2011	2012	2013	O/E[c]	95% LCL	95% UCL	
London	NHS Central London (Westminster)	161,000	391	435	428	466	503	1.11	0.89	1.38	36.2
	NHS Ealing	**340,700**	**543**	**578**	**596**	**628**	**643**	**1.50**	**1.31**	**1.71**	**51.0**
	NHS Hammersmith and Fulham	179,900	400	434	428	450	484	1.14	0.93	1.41	31.9
	NHS Harrow	**242,400**	**656**	**710**	**710**	**734**	**747**	**1.69**	**1.46**	**1.95**	**57.8**
	NHS Hillingdon	**281,800**	**472**	**518**	**568**	**596**	**600**	**1.40**	**1.21**	**1.63**	**39.4**
	NHS Hounslow	**259,100**	**471**	**510**	**525**	**548**	**618**	**1.45**	**1.24**	**1.69**	**48.6**
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	218,800	421	494	494	498	507	1.11	0.93	1.34	33.4
	NHS Bexley	**234,300**	**465**	**516**	**529**	**538**	**581**	**1.29**	**1.09**	**1.53**	**18.1**
	NHS Bromley	**314,000**	**452**	**494**	**494**	**516**	**541**	**1.17**	**1.00**	**1.36**	**15.7**
	NHS Croydon	368,900	317	331	358	377	412	0.95	0.81	1.11	44.9
	NHS Greenwich	260,100	342	369	404	446	481	1.16	0.97	1.38	37.5
	NHS Kingston	163,900	390	397	409	451	470	1.07	0.86	1.34	25.5
	NHS Lambeth	310,200	326	335	374	416	464	1.13	0.96	1.33	42.9
	NHS Lewisham	**281,600**	**391**	**380**	**391**	**408**	**497**	**1.19**	**1.00**	**1.40**	**46.5**
	NHS Merton	**202,200**	**405**	**415**	**455**	**499**	**559**	**1.28**	**1.07**	**1.54**	**35.1**
	NHS Richmond	189,100	291	307	333	360	391	0.84	0.67	1.06	14.0
	NHS Southwark	**293,500**	**453**	**480**	**511**	**555**	**596**	**1.44**	**1.24**	**1.67**	**45.8**
	NHS Sutton	193,600	418	444	454	491	511	1.12	0.92	1.37	21.4
	NHS Wandsworth	308,300	318	334	373	405	441	1.07	0.90	1.26	28.6
Bath, Gloucestershire, Swindon and Wiltshire	NHS Bath and North East Somerset	177,600	304	293	287	293	360	0.79	0.62	1.01	5.4
	NHS Gloucestershire	*602,200*	*345*	*354*	*384*	*380*	*425*	*0.88*	*0.78*	*0.99*	*4.6*
	NHS Swindon	217,200	350	414	437	447	488	1.05	0.87	1.27	10.0
	NHS Wiltshire	*476,800*	*323*	*354*	*382*	*394*	*398*	*0.83*	*0.72*	*0.95*	*3.4*
Bristol, North Somerset, Somerset and South Gloucestershire	**NHS Bristol**	**432,500**	**451**	**476**	**486**	**511**	**550**	**1.31**	**1.15**	**1.49**	**16.0**
	NHS North Somerset	204,400	396	421	431	465	484	0.98	0.81	1.20	2.7
	NHS Somerset	535,000	363	383	413	415	436	0.89	0.78	1.01	2.0
	NHS South Gloucestershire	266,100	436	455	466	481	507	1.07	0.90	1.27	5.0
Devon, Cornwall and Isles of Scilly	NHS Kernow	540,200	441	452	476	515	546	1.09	0.97	1.22	1.8
	NHS North, East, West Devon	869,400	428	435	444	468	504	1.05	0.96	1.15	3.0
	NHS South Devon and Torbay	273,300	428	461	483	487	545	1.08	0.92	1.27	2.1
Kent and Medway	NHS Ashford	120,100	425	441	466	516	516	1.11	0.86	1.42	6.3
	NHS Canterbury and Coastal	200,300	374	399	419	479	494	1.09	0.89	1.32	5.9
	NHS Dartford, Gravesham and Swanley	249,200	465	474	457	478	510	1.11	0.93	1.32	13.0
	NHS Medway	268,200	380	406	414	447	492	1.08	0.91	1.29	10.4
	NHS South Kent Coast	203,000	310	345	374	394	419	0.86	0.69	1.06	4.5
	NHS Swale	**108,200**	**416**	**425**	**517**	**545**	**601**	**1.28**	**1.00**	**1.63**	**3.8**
	NHS Thanet	**135,700**	**361**	**405**	**450**	**538**	**597**	**1.27**	**1.02**	**1.58**	**4.5**
	NHS West Kent	463,700	354	358	377	403	421	0.89	0.77	1.02	4.9
Surrey and Sussex	NHS Brighton & Hove	275,800	305	348	363	370	388	0.88	0.73	1.06	10.9
	NHS Coastal West Sussex	476,700	386	399	424	424	462	0.94	0.83	1.08	3.8
	NHS Crawley	108,300	286	286	314	332	342	0.78	0.57	1.08	20.1
	NHS East Surrey	175,900	313	313	318	335	370	0.78	0.62	1.00	8.3
	NHS Eastbourne, Hailsham and Seaford	*182,000*	*302*	*319*	*330*	*346*	*368*	*0.77*	*0.60*	*0.98*	*4.4*
	NHS Guildford and Waverley	*205,900*	*306*	*301*	*291*	*345*	*354*	*0.77*	*0.61*	*0.97*	*7.2*
	NHS Hastings & Rother	*181,400*	*303*	*325*	*353*	*342*	*364*	*0.74*	*0.58*	*0.94*	*4.6*
	NHS High Weald Lewes Havens	167,800	328	334	352	411	417	0.83	0.66	1.05	3.1
	NHS Horsham and Mid Sussex	*223,300*	*313*	*331*	*336*	*336*	*367*	*0.76*	*0.61*	*0.95*	*4.9*
	NHS North West Surrey	338,200	411	417	423	444	467	0.99	0.85	1.16	12.5
	NHS Surrey Downs	282,700	368	389	393	407	432	0.89	0.75	1.07	9.1
	NHS Surrey Heath	94,100	446	468	489	521	499	1.03	0.78	1.38	9.3

Table 3.4. Continued

UK Area	CCG/HB[a]	Total population[b]	Crude rate pmp					Age and gender standardised rate ratio 2013			% non-White
			2009	2010	2011	2012	2013	O/E[c]	95% LCL	95% UCL	
Thames Valley	NHS Aylesbury Vale	196,400	484	494	525	545	555	1.16	0.96	1.40	9.7
	NHS Bracknell and Ascot	132,900	376	414	451	481	504	1.09	0.86	1.38	9.5
	NHS Chiltern	317,900	396	425	425	469	497	1.05	0.90	1.23	15.8
	NHS Newbury and District	**105,100**	**561**	**542**	**618**	**618**	**628**	**1.32**	**1.03**	**1.67**	**4.4**
	NHS North & West Reading	99,300	332	403	403	433	493	1.04	0.78	1.37	10.4
	NHS Oxfordshire	647,100	400	423	436	473	487	1.06	0.95	1.19	9.3
	NHS Slough	**141,800**	**585**	**642**	**649**	**684**	**818**	**2.02**	**1.69**	**2.43**	**54.3**
	NHS South Reading	**107,200**	**560**	**560**	**579**	**569**	**607**	**1.52**	**1.19**	**1.94**	**30.5**
	NHS Windsor, Ascot and Maidenhead	139,000	338	410	439	511	561	1.22	0.98	1.53	14.7
	NHS Wokingham	156,700	389	389	402	434	440	0.92	0.73	1.17	11.6
Wessex	*NHS Dorset*	*750,300*	*396*	*407*	*415*	*409*	*425*	*0.87*	*0.78*	*0.98*	*4.0*
	NHS Fareham and Gosport	196,100	403	403	418	423	479	0.99	0.81	1.21	3.4
	NHS Isle of Wight	*138,700*	*346*	*360*	*368*	*382*	*375*	*0.74*	*0.57*	*0.97*	*2.7*
	NHS North East Hampshire and Farnham	206,800	329	368	368	387	416	0.89	0.72	1.11	9.7
	NHS North Hampshire	*216,200*	*314*	*328*	*356*	*370*	*379*	*0.79*	*0.64*	*0.99*	*6.4*
	NHS Portsmouth	206,800	348	396	392	406	435	1.03	0.84	1.26	11.6
	NHS South Eastern Hampshire	209,100	387	416	411	445	459	0.94	0.77	1.15	3.1
	NHS Southampton	239,400	338	338	384	418	464	1.12	0.93	1.35	14.1
	NHS West Hampshire	544,400	373	393	406	417	435	0.89	0.78	1.01	3.9
Wales	*Betsi Cadwaladr University*	*690,400*	*343*	*359*	*359*	*352*	*336*	*0.69*	*0.61*	*0.79*	*2.5*
	Powys Teaching	*133,000*	*361*	*399*	*391*	*354*	*369*	*0.72*	*0.55*	*0.95*	*1.6*
	Hywel Dda	383,400	412	409	438	436	503	1.03	0.90	1.19	2.2
	Abertawe Bro Morgannwg University	**519,500**	**449**	**485**	**541**	**576**	**603**	**1.27**	**1.14**	**1.42**	**3.9**
	Cwm Taf	**294,500**	**567**	**628**	**662**	**686**	**740**	**1.58**	**1.38**	**1.80**	**2.6**
	Aneurin Bevan	**578,000**	**469**	**500**	**523**	**587**	**599**	**1.26**	**1.14**	**1.40**	**3.9**
	Cardiff and Vale University	**475,300**	**406**	**440**	**467**	**501**	**515**	**1.18**	**1.04**	**1.34**	**12.2**
Scotland	*Ayrshire and Arran*	*373,200*	*386*	*383*	*375*	*402*	*426*	*0.86*	*0.73*	*1.00*	*1.2*
	Borders	113,700	361	413	413	466	484	0.93	0.72	1.22	1.3
	Dumfries and Galloway	*150,800*	*351*	*345*	*371*	*365*	*378*	*0.74*	*0.57*	*0.95*	*1.2*
	Fife	*366,200*	*306*	*319*	*344*	*355*	*388*	*0.80*	*0.68*	*0.94*	*2.4*
	Forth Valley	*299,100*	*294*	*311*	*334*	*364*	*395*	*0.81*	*0.68*	*0.97*	*2.2*
	Grampian	573,400	351	359	373	398	427	0.89	0.78	1.01	4.0
	Greater Glasgow and Clyde	**1,217,000**	**412**	**423**	**440**	**487**	**522**	**1.11**	**1.03**	**1.20**	**7.3**
	Highland	319,800	450	472	463	466	485	0.95	0.81	1.11	1.3
	Lanarkshire	572,500	384	402	423	459	479	0.99	0.88	1.11	2.0
	Lothian	*843,700*	*316*	*333*	*351*	*361*	*370*	*0.80*	*0.71*	*0.89*	*5.6*
	Orkney	21,500	418	372	372	372	372	0.72	0.36	1.44	0.7
	Shetland	23,200	259	259	215	259	259	0.52	0.24	1.16	1.5
	Tayside	411,700	398	401	415	425	447	0.93	0.80	1.07	3.2
	Western Isles	27,600	254	254	290	290	327	0.63	0.33	1.21	0.9
Northern Ireland	Belfast	348,300	359	393	405	434	465	1.07	0.92	1.25	3.2
	Northern	465,500	335	352	367	378	410	0.90	0.78	1.04	1.2
	Southern	363,100	286	303	341	386	416	0.96	0.81	1.12	1.2
	South Eastern	350,100	363	360	388	394	426	0.92	0.78	1.08	1.3
	Western	296,600	324	344	351	354	438	0.99	0.83	1.17	1.0

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 29,592 patients at the end of 2013. The continued expansion of this patient group means there is a need for careful planning by renal centres for future service provision and resource allocation.

Table 3.5. Distribution of prevalent patients on RRT by centre and modality on 31/12/2013

Centre	*N*	% HD	% PD	% Transplant
Transplant centres				
B QEH	2,051	45	7	48
Belfast	729	29	4	67
Bristol	1,427	36	5	59
Camb	1,198	32	2	66
Cardff	1,584	31	5	65
Covnt	940	41	9	50
Edinb	739	37	4	59
Glasgw	1,598	37	3	60
L Barts	2,103	45	9	45
L Guys	1,841	34	2	64
L Rfree	1,955	37	7	56
L St.G	759	37	6	57
L West	3,142	44	2	54
Leeds	1,466	35	5	61
Leic	2,072	44	7	49
Liv Roy	1,269	28	5	67
M RI	1,864	28	4	68
Newc	964	28	4	67
Nottm	1,075	35	8	58
Oxford	1,565	28	6	66
Plymth	503	27	7	66
Ports	1,555	39	5	56
Sheff	1,329	44	5	50
Dialysis centres				
Abrdn	519	43	5	52
Airdrie	393	49	4	48
Antrim	224	57	7	37
B Heart	658	66	6	28
Bangor	99	87	13	
Basldn	270	59	11	30
Bradfd	520	39	6	55
Brightn	875	45	9	45
Carlis	227	30	12	58
Carsh	1,488	51	8	41
Chelms	239	51	9	40
Clwyd	153	50	9	41
Colchr	115	100		
D & Gall	117	38	13	49
Derby	472	46	18	36
Donc	259	63	14	24
Dorset	628	43	8	50
Dudley	312	56	18	26
Dundee	403	43	5	52
Exeter	896	46	8	46
Glouc	412	51	8	41
Hull	815	40	10	50
Inverns	216	32	7	61
Ipswi	354	34	8	57
Kent	965	41	7	52
Klmarnk	296	46	15	39
Krkcldy	283	52	7	41
L Kings	965	52	11	38
Liv Ain	190	82	16	3
Middlbr	836	42	2	56
Newry	199	46	9	45

Table 3.5. Continued

Centre	*N*	% HD	% PD	% Transplant
Norwch	692	48	6	47
Prestn	1,090	50	5	45
Redng	731	39	10	51
Salford	895	45	9	46
Shrew	342	55	9	36
Stevng	758	61	5	34
Sthend	221	54	8	38
Stoke	726	43	12	45
Sund	423	47	3	51
Swanse	691	48	8	44
Truro	377	40	6	54
Ulster	156	68	4	28
West NI	238	47	6	46
Wirral	252	85	14	2
Wolve	563	53	15	32
Wrexm	250	40	9	51
York	409	34	7	59
England	**48,053**	**42**	**7**	**52**
N Ireland	**1,546**	**42**	**5**	**53**
Scotland	**4,564**	**41**	**5**	**54**
Wales	**2,777**	**39**	**7**	**55**
UK	**56,940**	**42**	**6**	**52**

Blank cells: no patients on that modality

Table 3.6. Median age and gender ratio of incident and prevalent transplant patients 2008–2013

	Incident transplants			Prevalent transplants*		
Year	*N*	Median age	M : F ratio	*N*	Median age	M : F ratio
2008	2,345	46.4	1.5	22,287	50.4	1.5
2009	2,496	48.3	1.6	23,508	50.8	1.5
2010	2,585	49.6	1.7	24,903	51.2	1.6
2011	2,633	49.1	1.7	26,197	51.7	1.6
2012	2,790	50.5	1.6	27,605	52.2	1.6
2013	3,117	50.3	1.6	29,592	52.8	1.6

*As on 31st December for given year

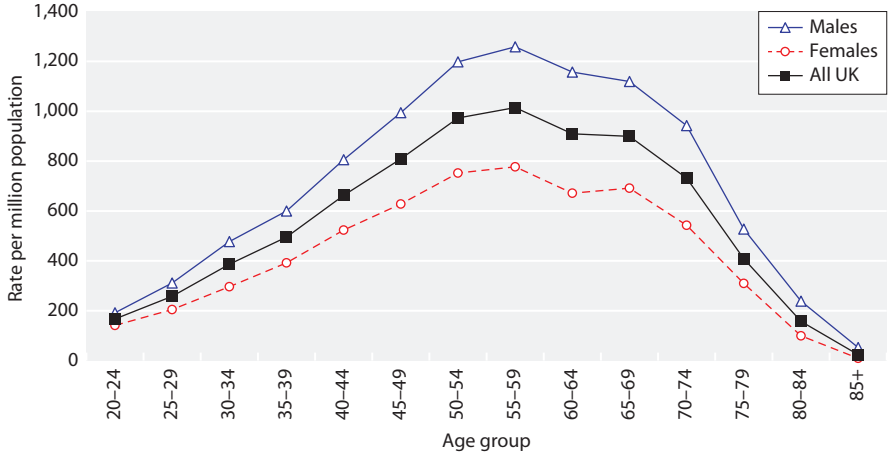

Fig. 3.1. Transplant prevalence rate per million population by age and gender on 31/12/2013

Table 3.7. Primary renal diagnosis in renal transplant recipients 2008–2013

	New transplants by year							Established transplants on 01/01/2013	
	2008	2009	2010	2011	2012	2013			
Primary diagnosis	%	%	%	%	%	%	*N*	%	*N*
Aetiology uncertain	14.6	14.1	14.2	14.7	11.9	12.3	374	15.4	4,243
Diabetes	13.1	13.3	12.5	13.0	15.2	13.3	407	9.9	2,737
Glomerulonephritis	21.9	23.5	20.4	23.1	22.6	22.3	680	23.4	6,460
Polycystic kidney disease	13.4	13.4	14.0	12.5	13.3	13.7	419	12.9	3,555
Pyelonephritis	12.1	11.4	10.2	10.1	10.0	9.9	302	13.5	3,733
Reno-vascular disease	6.7	6.2	7.3	6.5	7.0	8.1	247	5.7	1,582
Other	16.8	15.7	16.4	17.2	17.5	16.0	488	17.3	4,769
Not available	1.4	2.4	5.0	3.0	2.5	4.3	132	1.9	526

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 2008 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.

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. Two centres (Bangor and Colchester) were reported as having no transplanted patients and were therefore excluded. After exclusion of these two centres, prevalent patient data from 69 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 2006–2012, with patients attributed to the transplant centre that performed the procedure.

Table 3.8. Ethnicity of patients who received a transplant in the years 2008–2013

Year	% White	% S Asian	% Black	% Other	% Unknown
2008	76.2	9.0	6.2	1.9	6.6
2009	74.6	10.5	6.8	2.2	6.0
2010	75.2	10.5	5.8	2.3	6.1
2011	74.8	9.7	6.2	2.6	6.7
2012	72.3	9.9	7.2	3.0	7.6
2013	70.0	12.3	7.5	2.0	8.1

Table 3.9a. Percentage completeness of ethnicity, eGFR and blood pressure by centre for prevalent transplant patients on 31/12/2013

Centre	*N*	Ethnicity[a]	eGFR	Blood pressure[b]
B Heart	177	100	92	0
B QEH	950	100	93	93
Basldn	79	100	99	3
Bradfd	278	100	89	75
Brightn	387	98	89	0
Bristol	812	100	100	73
Camb	744	99	99	97
Carlis	129	100	96	0
Carsh	587	96	86	0
Chelms	92	100	98	92
Covnt	455	100	96	80
Derby	158	100	97	96
Donc	61	100	98	97
Dorset	297	100	88	78
Dudley	79	100	97	15
Exeter	403	100	98	89
Glouc	160	100	97	86
Hull	396	98	89	1
Ipswi	190	100	96	0
Kent	492	99	64	88
L Barts	910	100	99	0
L Guys	1,147	99	96	0
L Kings	349	100	97	99
L RFree	1,064	98	96	77
L St.G	403	95	96	0
L West	1,640	100	98	0
Leeds	860	100	98	98
Leic	976	97	97	49
Liv Ain	4	100	75	0
Liv Roy	832	99	93	0
M RI	1,188	99	98	0
Middlbr	449	100	88	42
Newc	621	100	99	0
Norwch	316	100	98	31
Nottm	592	100	99	86
Oxford	990	97	98	15
Plymth	310	100	93	82
Ports	825	100	95	20
Prestn	468	100	98	0
Redng	361	99	99	0
Salford	401	100	98	0
Sheff	660	100	99	91
Shrew	122	100	65	0
Stevng	248	100	71	23
Sthend	78	100	99	59
Stoke	318	100	99	0
Sund	212	100	99	0
Truro	199	100	98	2
Wirral	4	100	75	0
Wolve	177	100	98	88
York	240	100	94	42
N Ireland				
Antrim	82	100	100	74
Belfast	470	100	100	59
Newry	86	100	100	88
Ulster	41	100	100	95
West NI	107	100	99	92
Scotland				
Abrdn	259	58	97	n/a
Airdrie	184	47	67	n/a
D & Gall	56	23	89	n/a
Dundee	204	71	99	n/a
Edinb	415	13	96	n/a
Glasgw	921	13	79	n/a
Inverns	131	92	82	n/a
Klmarnk	115	74	69	n/a
Krkcldy	114	31	96	n/a
Wales				
Cardff	1,000	100	98	97
Clwyd	63	97	0	0
Swanse	287	100	99	100
Wrexm	127	100	74	0
England	**23,890**	**99**	**95**	**38**
N Ireland	**786**	**100**	**100**	**70**
Scotland	**2,399**	**34**	**85**	**n/a**
Wales	**1,477**	**100**	**92**	**85**
UK	**28,552**	**94**	**94**	**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

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 centre were included in the analyses. The cohort consisted of

Table 3.9b. Percentage completeness of haemoglobin, serum cholesterol, serum calcium, serum phosphate and serum PTH by centre for prevalent transplant patients on 31/12/2013

Centre	*N*	Haemoglobin	Total serum cholesterol[a]	Adjusted serum calcium[a,b]	Serum phosphate	Serum PTH[a]
England						
B Heart	177	92	65	89	88	23
B QEH	950	92	90	93	92	72
Basldn	79	99	49	99	94	44
Bradfd	278	87	73	78	62	46
Brightn	387	88	29	82	81	31
Bristol	812	100	94	100	99	99
Camb	744	98	97	99	99	97
Carlis	129	95	61	95	91	9
Carsh	587	80	60	86	86	19
Chelms	92	96	89	98	93	26
Covnt	455	96	0	95	70	40
Derby	158	96	94	96	96	92
Donc	61	97	44	93	93	64
Dorset	297	87	77	83	65	28
Dudley	79	97	92	97	96	70
Exeter	403	98	86	97	97	25
Glouc	160	96	66	96	96	24
Hull	396	89	27	89	88	7
Ipswi	190	95	57	96	96	67
Kent	492	97	77	95	95	17
L Barts	910	98	99	99	99	92
L Guys	1,147	0	55	90	90	40
L Kings	349	97	79	97	97	32
L RFree	1,064	95	81	95	95	77
L St.G	403	96	81	95	95	84
L West	1,640	98	45	98	98	36
Leeds	860	98	99	98	98	49
Leic	976	97	97	96	96	52
Liv Ain	4	75	25	75	75	50
Liv Roy	832	92	77	90	90	74
M RI	1,188	98	65	98	98	64
Middlbr	449	88	50	86	85	10
Newc	621	99	87	99	99	62
Norwch	316	98	97	95	98	30
Nottm	592	98	84	96	93	88
Oxford	990	98	74	98	98	34
Plymth	310	92	56	88	87	39
Ports	825	95	57	93	88	24
Prestn	468	97	71	95	94	58
Redng	361	99	92	98	85	48
Salford	401	98	87	97	97	80
Sheff	660	99	65	98	98	26
Shrew	122	81	79	72	72	14
Stevng	248	96	81	92	80	57
Sthend	78	99	35	99	96	8
Stoke	318	99	100	99	98	69
Sund	212	98	96	98	97	95
Truro	199	97	61	97	97	34
Wirral	4	75	75	75	75	75
Wolve	177	96	86	93	83	64
York	240	94	64	89	86	20

Table 3.9b. Continued

Centre	*N*	Haemoglobin	Total serum cholesterol[a]	Adjusted serum calcium[a,b]	Serum phosphate	Serum PTH[a]
N Ireland						
Antrim	82	100	100	95	100	98
Belfast	470	99	100	98	98	26
Newry	86	100	100	98	99	99
Ulster	41	100	100	98	98	39
West NI	107	97	99	96	96	92
Scotland						
Abrdn	259	96	n/a	n/a	95	n/a
Airdrie	184	98	n/a	n/a	97	n/a
D & Gall	56	95	n/a	n/a	88	n/a
Dundee	204	99	n/a	n/a	98	n/a
Edinb	415	95	n/a	n/a	93	n/a
Glasgw	921	97	n/a	n/a	97	n/a
Inverns	131	79	n/a	n/a	63	n/a
Klmarnk	115	97	n/a	n/a	96	n/a
Krkcldy	114	96	n/a	n/a	96	n/a
Wales						
Cardff	1,000	99	97	99	98	23
Clwyd	63	95	98	95	95	78
Swanse	287	96	88	96	96	70
Wrexm	127	95	98	95	95	98
England	**23,890**	**91**	**73**	**95**	**93**	**52**
N Ireland	**786**	**99**	**100**	**97**	**98**	**51**
Scotland[a]	**2,399**	**96**	**n/a**	**n/a**	**94**	**n/a**
Wales	**1,477**	**98**	**95**	**98**	**97**	**41**
UK	**28,552**	**92**	**75[c]**	**95[c]**	**93**	**52[c]**

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

prevalent patients as on 31st December 2013. Patients were considered as having a functioning transplant if 'transplant' was listed as the last mode of RRT in the last quarter of 2013. 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 2013 was used.

Estimated glomerular filtration rate (eGFR)

For the purpose of eGFR calculation, the original 4-variable MDRD formula was used (with a constant of 186) to calculate eGFR from the serum creatinine concentration as reported by the centre (unless otherwise stated). A wide variety of creatinine assays are in use in clinical biochemistry laboratories in the UK, and it is not possible to ensure that all measurements of creatinine concentration collected by the UKRR are harmonised. Although many laboratories are now reporting assay results that have been aligned to the isotope dilution-mass spectrometry standard (which would necessitate use of the modified MDRD formula), this was not the case at the end of 2013. 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 2006 and 31st December 2012 were assigned according to the renal centre in which they were transplanted. In a small number of instances, the first documented evidence of transplantation in a patient's record is from a timeline entry in data returned from a non-transplant centre, in these instances the patient was re-assigned to the nearest transplant centre (table 3.10).

Patients who had died or experienced graft failure within 12 months of transplantation were excluded from the analyses. Patients with more than one transplant during 2006–2012 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.

Table 3.10. Number of patients per transplant centre after allocation of patients at non-transplant centres (transplanted between 2006–2012)

Transplant centre	Total number of patients per transplant centre	Non-transplant centre	Number of patients rellocated to a transplant centre
B QEH	899	Stoke	2
Belfast	381	Antrim	2
		Newry	4
		Ulster	3
		West NI	4
Bristol	678	Dorset	3
Camb	1,115		
Cardff	790	Swansea	2
Covnt	369		
Edinb	644	Abrdn	1
		Dundee	6
		Inverns	2
Glasgw	635	Airdrie	2
L Barts	731		
L Guys	1,276	L Kings	3
L Rfree	647		
L St.G	581	Brightn	1
		Carsh	1
L West	1,129		
Leeds	949		
Leic	540		
Liv Roy	594	Prestn	1
M RI	1,087		
Newc	809	Middlbr	1
Nottm	414		
Oxford	1,151		
Plymth	421		
Ports	438		
Sheff	410		
Total	**16,688**		**38**

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 51.8 ml/min/1.73 m^2, with 13.4% of prevalent transplant recipients having an eGFR <30 ml/min/1.73 m^2. Table 3.11 summarises the proportion of transplant patients with an eGFR <30 ml/min/1.73 m^2 by centre. Whilst local repatriation policies on timing of transfer of care for patients with failing transplants from transplant centres to referring centres might explain some of the differences, it is notable that both transplanting and non-transplanting centres feature at both ends of the scale. The accuracy of the 4-variable MDRD equation in estimating GFR $\geqslant 60$ 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 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% limits.

There continued to be variation between centres; these data show over-dispersion with 16 centres falling outside the 95% CI of which six centres were outside the 99.9% CI. Three centres (Newry, London St Georges, London

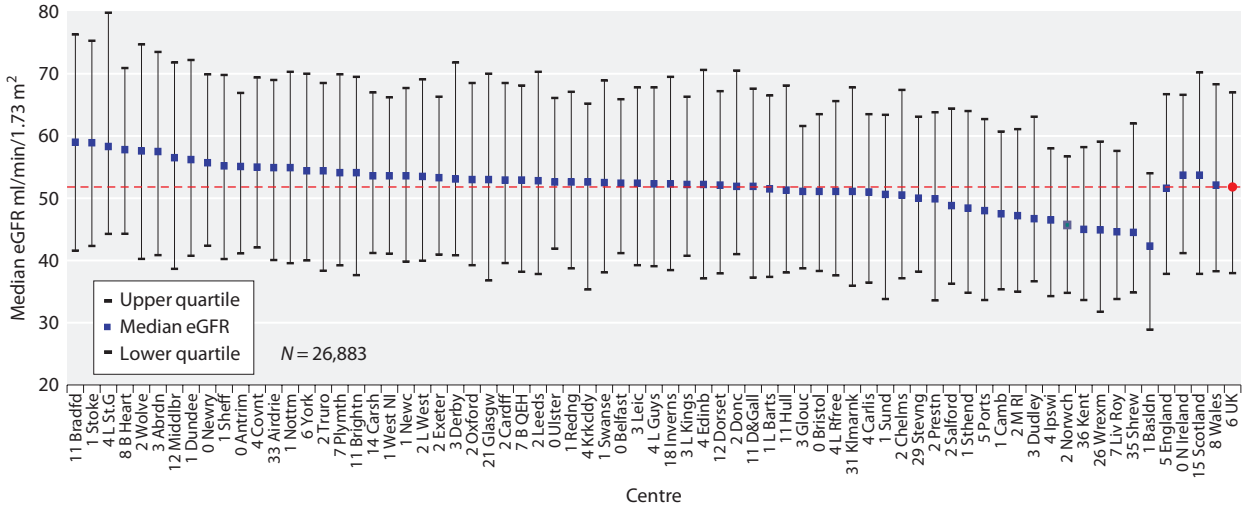

Fig. 3.2. Median eGFR in prevalent transplant patients by centre on 31/12/2013

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

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 2006–2012, by transplant type. Living kidney donation had the highest median eGFR at one year (56.9 ml/min/1.73 m^2), followed by donation after brainstem death (53 ml/min/1.73 m^2) and donation after circulatory death (49.7 ml/min/1.73 m^2).

Figures 3.6a, 3.6b and 3.6c show one year post-transplant eGFR by donor type and year of transplantation. An upward trend in eGFR ($p = 0.001$) over the time period was noticed with both live and donation after brainstem death transplant, but not with donation after circulatory death ($p = 0.4$).

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

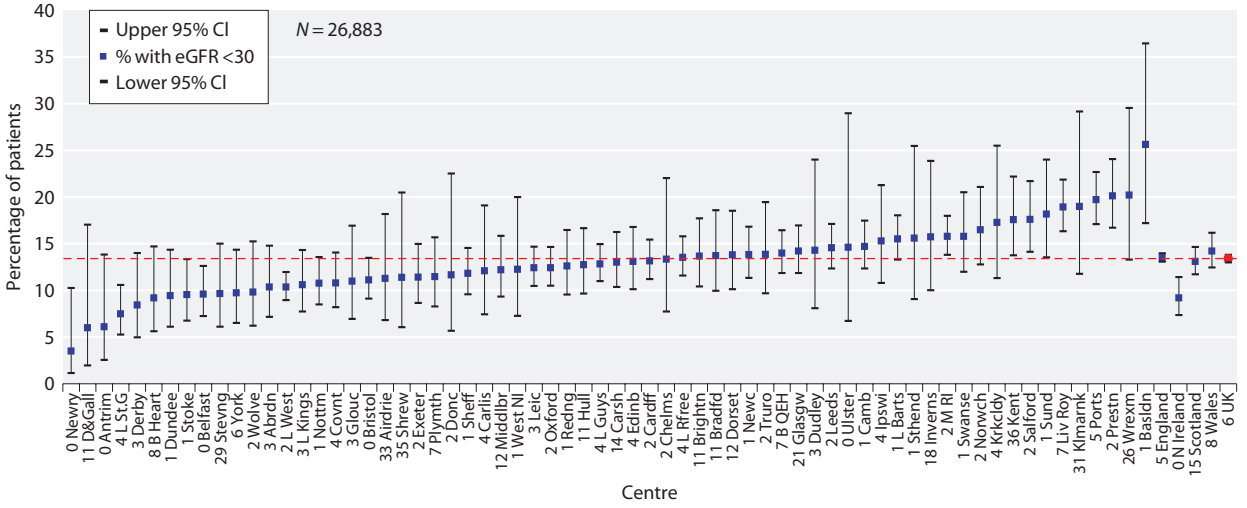

Fig. 3.3. Percentage of prevalent transplant patients by centre on 31/12/2013 with eGFR <30 ml/min/1.73 m^2

Table 3.11. Percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 on 31/12/2013

Centre	Patients with eGFR data *N*	Percentage with eGFR <30	Centre	Patients with eGFR data *N*	Percentage with eGFR <30
Ulster	41	14.6	Kent	313	17.6
D & Gall	50	6	Stoke	314	9.6
Donc	60	11.7	L Kings	340	10.6
Sthend	77	15.6	Brightn	344	13.7
Dudley	77	14.3	Hull	353	12.7
Basldn	78	25.6	Redng	357	12.6
Shrew	79	11.4	L St.G	387	7.5
Klmarnk	79	19.0	Salford	392	17.6
Antrim	82	6.1	Middlbr	393	12.2
Newry	86	3.5	Exeter	394	11.4
Chelms	90	13.3	Edinb	397	13.1
Wrexm	94	20.2	Covnt	436	10.8
West NI	106	12.3	Prestn	457	20.1
Inverns	108	15.7	Belfast	469	9.6
Krkcldy	110	17.3	Carsh	507	13.0
Carlis	124	12.1	Nottm	585	10.8
Airdrie	124	11.3	Newc	614	13.8
Derby	154	8.4	Sheff	651	11.8
Glouc	155	11.0	Glasgw	725	14.2
B Heart	163	9.2	Camb	734	14.7
Wolve	173	9.8	Liv Roy	771	18.9
Stevng	176	9.7	Ports	781	19.7
Ipswi	183	15.3	Bristol	810	11.1
Truro	195	13.8	Leeds	844	14.6
Dundee	201	9.5	B QEH	886	14.0
Sund	209	18.2	L Barts	896	15.5
York	226	9.7	Leic	951	12.4
Bradfd	248	13.7	Oxford	974	12.4
Abrdn	251	10.4	Cardff	980	13.2
Dorset	261	13.8	L Rfree	1,019	13.5
Swanse	285	15.8	L Guys	1,099	12.8
Plymth	288	11.5	M RI	1,160	15.8
Norwch	309	16.5	L West	1,602	10.4

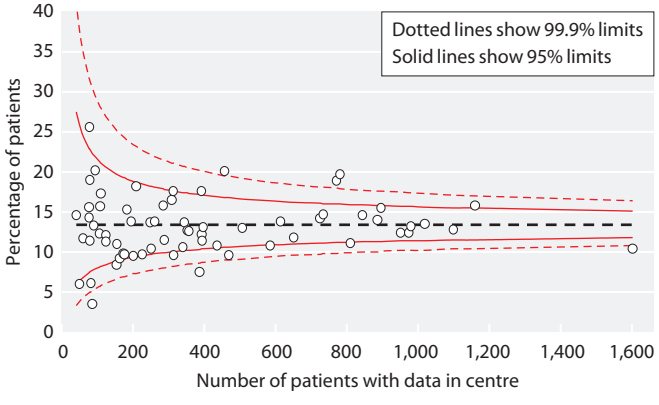

Fig. 3.4. Funnel plot of percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 by centre size on 31/12/2013

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

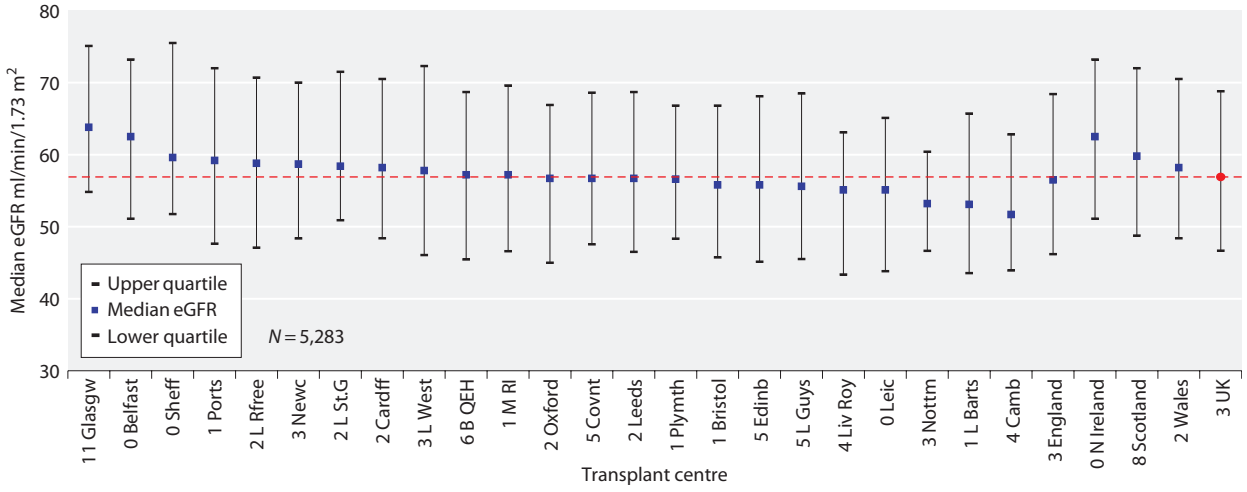

Fig. 3.5a. Median eGFR one year post-live donor transplant by transplant centre 2006–2012

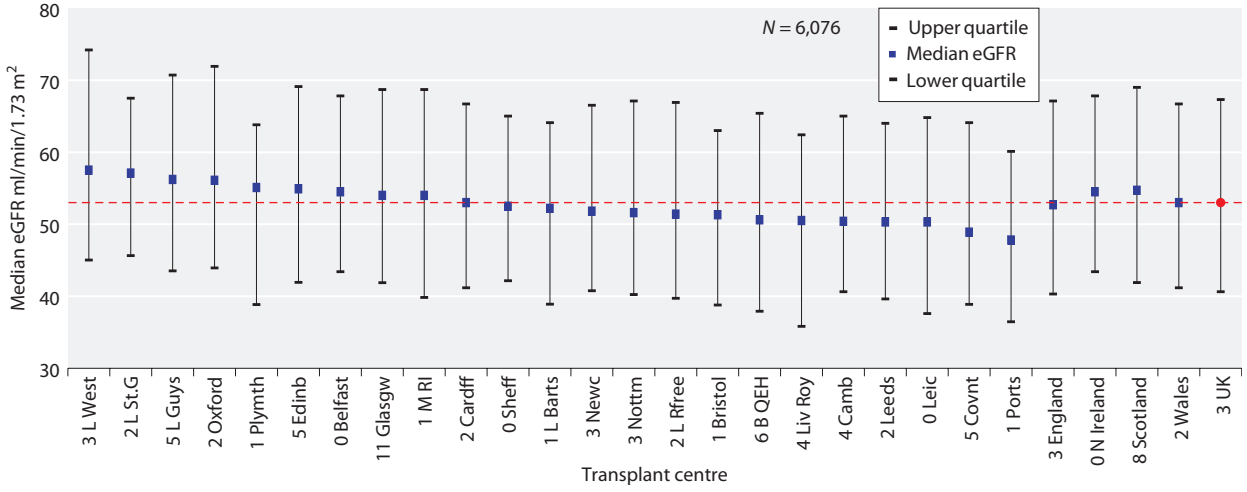

Fig. 3.5b. Median eGFR one year post-brainstem death donor transplant by transplant centre 2006–2012

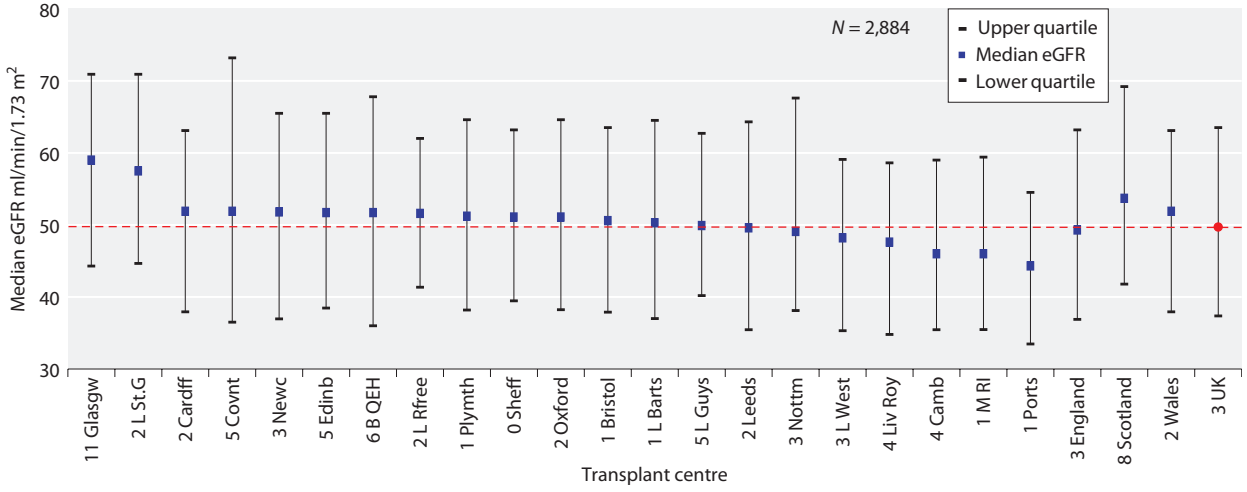

Fig. 3.5c. Median eGFR one year post-circulatory death donor transplant by transplant centre 2006–2012

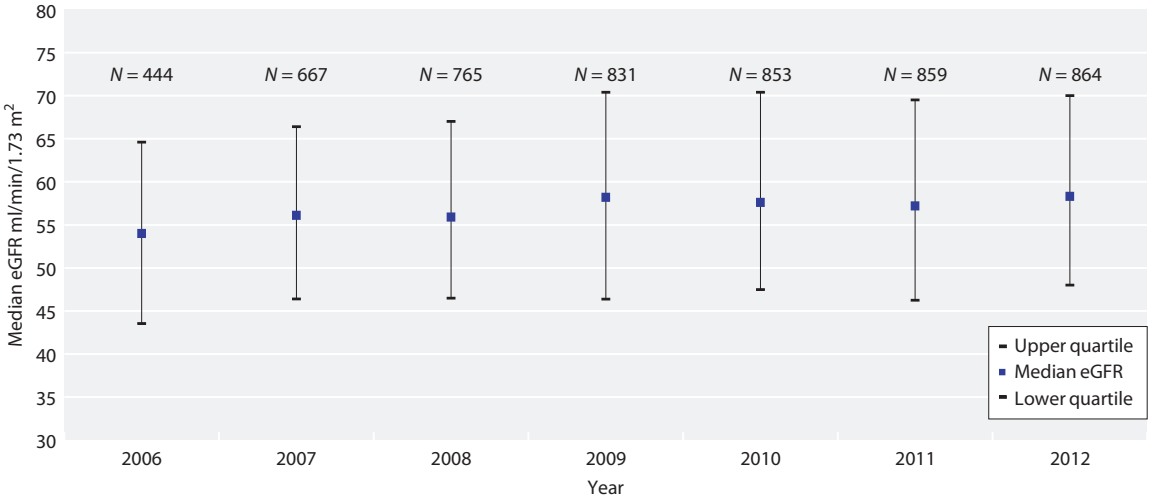

Fig. 3.6a. Median eGFR one year post-live donor transplant by year of transplantation 2006–2012

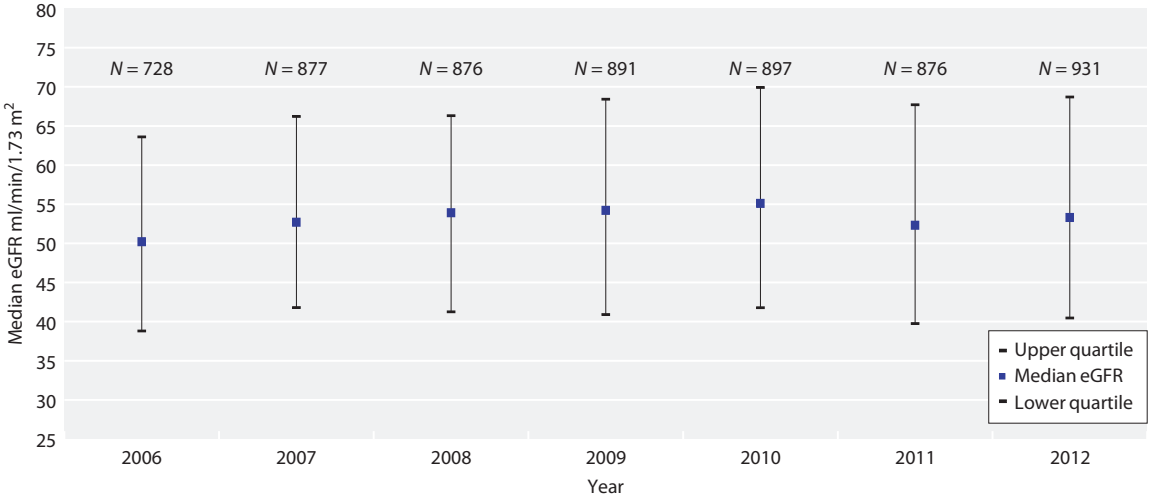

Fig. 3.6b. Median eGFR one year post-brainstem death donor transplant by year of transplantation 2006–2012

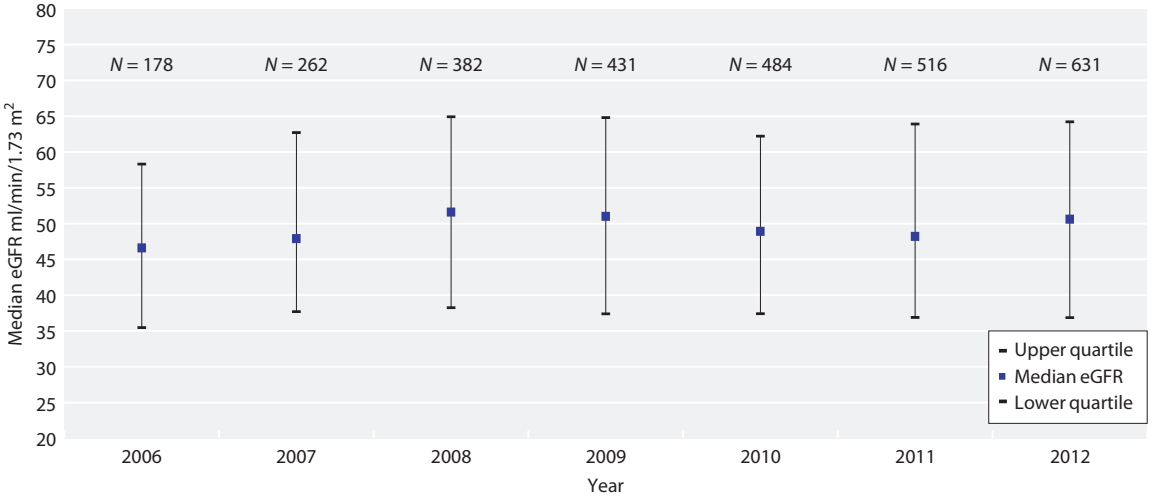

Fig. 3.6c. Median eGFR one year post-circulatory death donor transplant by year of transplantation 2006–2012

by the UKRR and therefore caution must be used when interpreting analyses of haemoglobin attainment. Figures 3.7a and 3.7b report centre results stratified according to graft function as estimated by eGFR. The percentage of prevalent transplant patients achieving Hb $\geqslant$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.

Two centres (London St Bartholemews and London Royal Free) fell outside the upper 99.9% CI and two further centres (Leeds and Oxford) fell outside the upper 95% CI indicating a higher than 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***

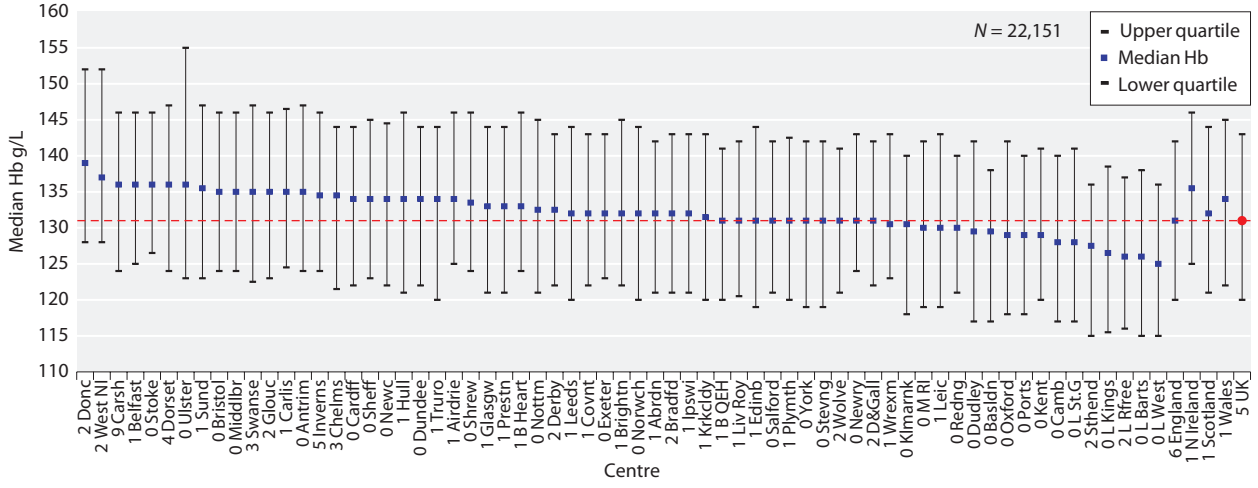

Fig. 3.7a. Median haemoglobin for prevalent transplant patients with eGFR $\geqslant$30 ml/min/1.73 m^2 by centre on 31/12/2013

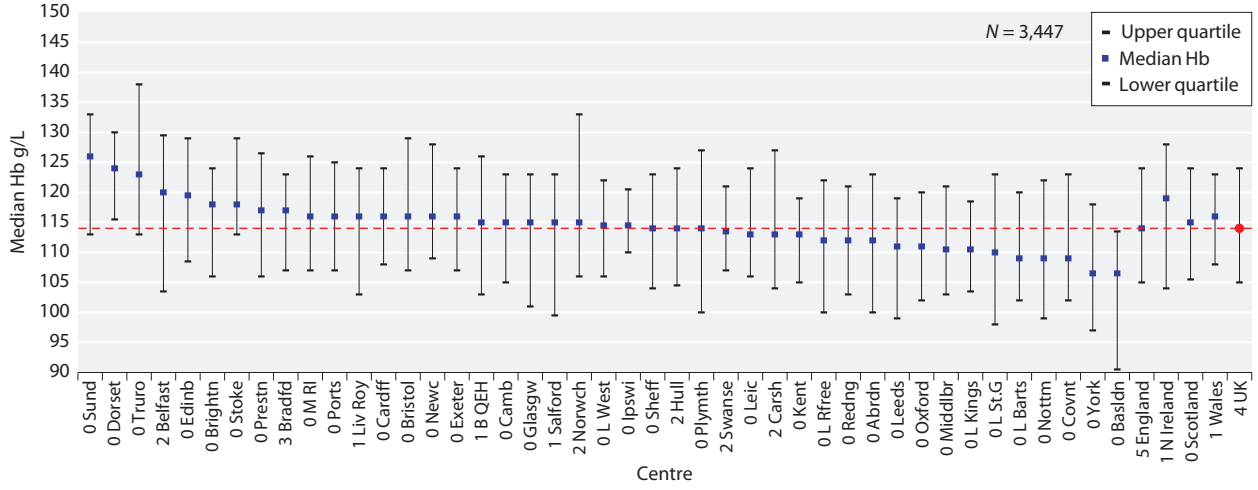

Fig. 3.7b. Median haemoglobin for prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 by centre on 31/12/2013

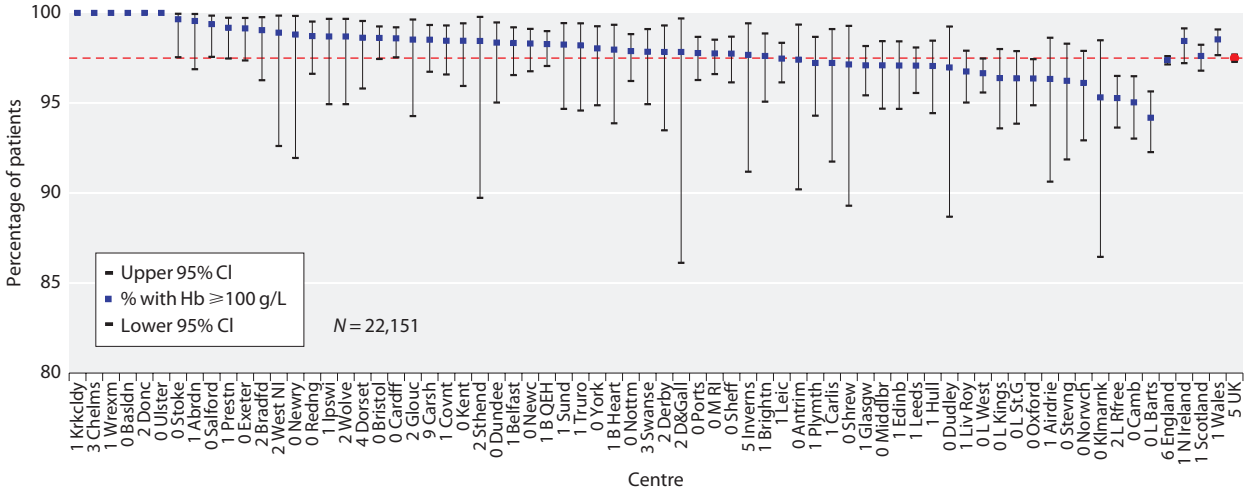

Fig. 3.8a. Percentage of prevalent transplant patients with eGFR ⩾30 ml/min/1.73 m^2 achieving haemoglobin ⩾100 g/L by centre on 31/12/2013

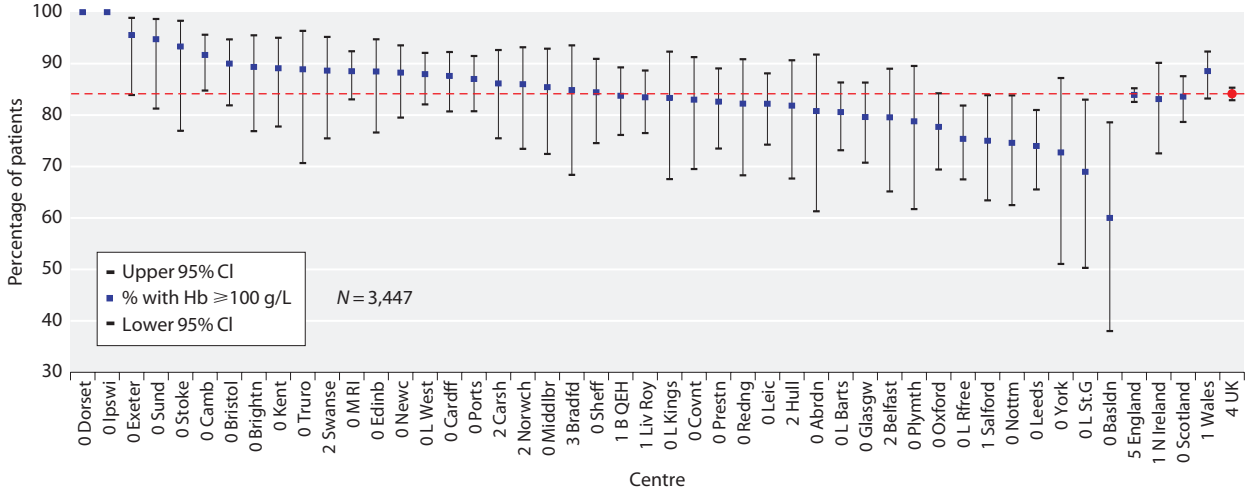

Fig. 3.8b. Percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 achieving haemoglobin ⩾100 g/L by centre on 31/12/2013

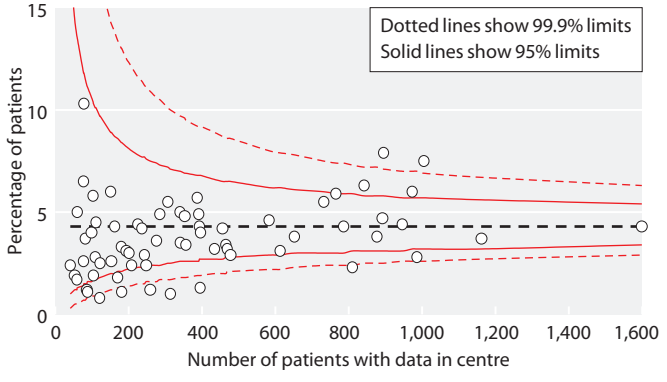

Fig. 3.9. Funnel plot of percentage of prevalent transplant patients with haemoglobin <100 g/L by centre size on 31/12/2013

<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

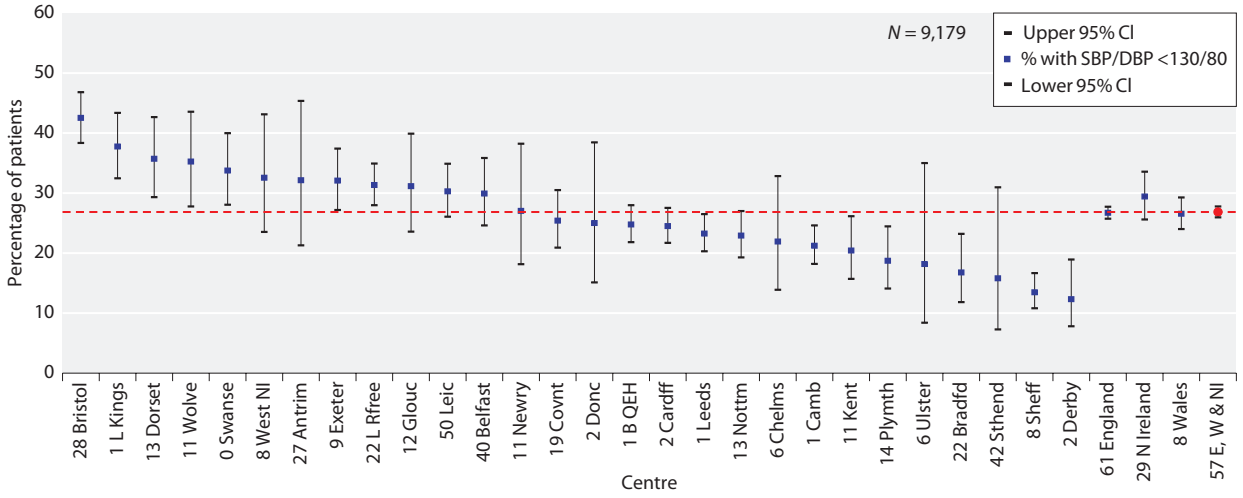

Fig. 3.10a. Percentage of prevalent transplant patients with eGFR ⩾30 ml/min/1.73 m^2 achieving blood pressure of <130/80 mmHg by centre on 31/12/2013

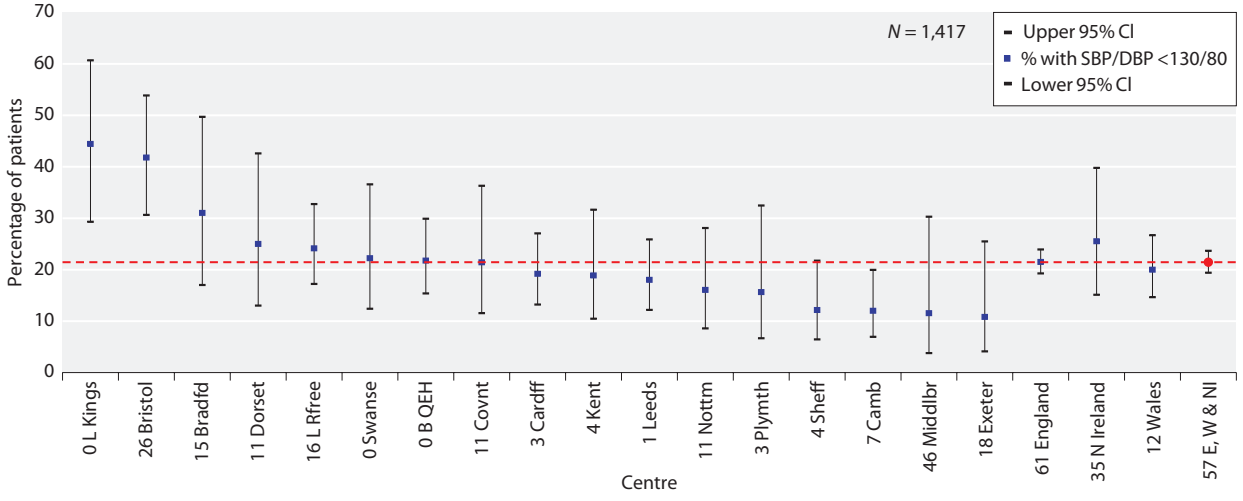

Fig. 3.10b. Percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 achieving blood pressure of <130/80 mmHg by centre on 31/12/2013

BP <130 **and** diastolic BP <80 mmHg) was higher (26.8% vs. 21.5%) in those with better renal function (eGFR ⩾30 ml/min/1.73 m^2).

Analysis of prevalent patients by CKD stage

Introduction

Approximately 2.4% of prevalent transplant patients returned to dialysis in 2013, 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 2013 ($N = 26,896$) and were classified

Table 3.12. Analysis by CKD stage for prevalent transplant patients compared with prevalent dialysis patients on 31/12/2013

	Stage 1–2T (⩾60)	Stage 3T (30–59)	Stage 4T (15–29)	Stage 5T (<15)	Stage 5D
Number of patients	9,536	13,757	3,154	449	21,278
% of patients	35.5	51.2	11.7	1.7	
eGFR ml/min/1.73 m^2 [a]					
mean ± SD	76.9 ± 15.0	45.7 ± 8.3	23.9 ± 4.1	11.9 ± 2.5	
median	72.9	45.9	24.4	12.4	
Systolic BP mmHg					
mean ± SD	134.2 ± 16.8	135.7 ± 17.4	139.9 ± 18.9	145.2 ± 21.5	132.1 ± 25.1
% ⩾130	59.6	63.4	70.3	77.0	51.4
Diastolic BP mmHg					
mean ± SD	78.4 ± 10.0	78.3 ± 10.4	78.8 ± 11.5	82.1 ± 13.1	68.4 ± 14.9
% ⩾80	48.6	47.7	48.4	60.3	21.6
Cholesterol mmol/L					
mean ± SD	4.4 ± 1.0	4.5 ± 1.1	4.6 ± 1.2	4.6 ± 1.2	4.0 ± 1.1
% ⩾4	67.7	70.4	71.2	68.5	45.1
Haemoglobin g/L					
mean ± SD	136.4 ± 16.1	127.8 ± 16.3	115.7 ± 15.2	106.0 ± 15.1	111.8 ± 13.6
% <100.0	1.5	3.2	13.6	32.4	16.6
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	28.4	34.3
Corrected calcium mmol/L					
mean ± SD	2.4 ± 0.1	2.4 ± 0.2	2.4 ± 0.2	2.4 ± 0.2	2.4 ± 0.2
% >2.5	28.5	28.7	22.2	16.8	17.7
% <2.2	4.2	5.2	9.1	17.8	15.7
PTH pmol/L					
median	8.5	9.5	15.9	28.4	31.1
% >72	0.3	0.7	4.0	13.7	17.5

[a]Prevalent transplant patients with no ethnicity data were classed as White
[b]Only PD patients included in stage 5D, $n = 2{,}330$

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 2013, comprised the comparison dialysis cohort ($N = 21{,}278$) including 2,330 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 2013 laboratory data. Scottish centres were excluded from blood pressure, calcium, cholesterol and PTH analyses as corresponding data were not provided.

Results and conclusions

Table 3.12 shows that 13.4% of the prevalent transplant population (3,603 patients), had moderate to advanced renal impairment of eGFR <30 ml/min/1.73 m^2. The table also demonstrates that patients with failing grafts achieved UK Renal Association standards for some key biochemical and clinical outcome variables less often than dialysis patients. This substantial group of patients represents a considerable challenge, as resources need to be channelled to improve key outcome variables and achieve a safe and timely modality switch to another form of renal replacement therapy.

eGFR slope analysis

Introduction

The gradient of deterioration in eGFR (slope) may predict patients likely to have early graft failure. The

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

Patient characteristic		*N*	Median slope	Lower quartile	Upper quartile	*p*-value
Age at transplant	<40	4,438	−1.08	−4.15	11.1	<0.0001
	40–55	5,556	−0.36	−2.74	16.0	
	>55	4,499	−0.39	−2.74	15.8	
Ethnicity	Asian	1,313	−0.93	−3.88	16.6	<0.0001
	Black	856	−1.29	−4.27	13.2	
	Other	295	−1.03	−4.57	13.3	
	White	11,204	−0.52	−2.95	13.8	
Gender	Male	8,860	−0.36	−2.78	15.7	<0.0001
	Female	5,633	−0.91	−3.80	12.5	
Diabetes	Non-diabetic	12,210	−0.47	−2.95	15.1	<0.0001
	Diabetic	2,008	−1.23	−4.01	10.6	
Donor	Cadaveric	9,464	−0.58	−3.14	14.3	0.8
	Live	5,029	−0.57	−3.17	14.8	
Year of transplant	2002	787	−0.61	−2.32	05.8	<0.001
	2003	972	−0.55	−2.34	08.6	
	2004	1,138	−0.32	−2.11	10.6	
	2005	1,134	−0.17	−2.07	13.0	
	2006	1,434	−0.59	−2.66	11.2	
	2007	1,572	−0.66	−2.71	11.3	
	2008	1,804	−0.58	−2.96	14.3	
	2009	1,876	−0.93	−3.78	13.6	
	2010	1,943	−0.80	−4.53	24.9	
	2011	1,833	−0.40	−5.93	44.2	
Status of transplant at end of follow-up	Died	1,006	−0.88	−3.98	19.4	<0.001
	Failed	1,029	−6.23	−11.96	−2.90	
	Re-transplanted	54	−3.83	−6.80	−1.47	
	Functioning	12,404	−0.29	−2.51	16.0	
All		**14,493**	**−0.58**	**−3.15**	**1.45**	

eGFR slope and its relationship to specific patient characteristics are presented here.

Methods

All UK patients aged ⩾18 years receiving a renal transplant between 1st January 2002 and 31st December 2011, 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 14,493 patients. The median GFR slope was −0.58 ml/min/1.73 m^2/year (table 3.13). The gradient was steeper for Black recipients (−1.3 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 (−0.58 ml/min/1.73 m^2/year) compared to patients who received organs from live donors (−0.57 ml/min/1.73 m^2/year). Female patients had a steeper slope (−0.91 ml/min/

1.73 m^2/year) than males (−0.36 ml/min/1.73 m^2/year), as did diabetic patients (−1.23 ml/min/1.73 m^2/year) compared to non-diabetic patients (−0.47 ml/min/1.73 m^2/year). The slope was steeper in younger recipients, possibly reflecting increased risk of immunological damage. As might be expected, the steepest slope was in patients where the transplant subsequently failed. This analysis has assumed linearity of progression of fall in GFR and further work is underway to characterise the patterns of progression more precisely.

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

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 2013.

Results and conclusions

Table 3.14 and figure 3.11 show the differences in the cause of death between prevalent dialysis and transplant patients. Table 3.15 shows the cause of death for prevalent

Table 3.14. Cause of death by modality in prevalent RRT patients on 1/1/2013, who died in 2013

	All modalities		Dialysis		Transplant	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	734	23	647	24	87	17
Cerebrovascular disease	136	4	111	4	25	5
Infection	664	21	531	20	133	26
Malignancy	311	10	186	7	125	24
Treatment withdrawal	525	16	517	19	8	2
Other	660	21	543	20	117	23
Uncertain	186	6	161	6	25	5
Total	**3,216**		**2,696**		**520**	
No cause of death data	1,353	30	1,130	30	223	30

Table 3.15. Cause of death in prevalent transplant patients on 1/1/2013 by age, who died in 2013

	All age groups		<65 years		⩾65 years	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	87	17	47	18	40	16
Cerebrovascular disease	25	5	11	4	14	5
Infection	133	26	65	25	68	27
Malignancy	125	24	73	28	52	20
Treatment withdrawal	8	2	5	2	3	1
Other	117	23	54	20	63	25
Uncertain	25	5	9	3	16	6
Total	**520**		**264**		**256**	
No cause of death data	223	30	110	29	113	31

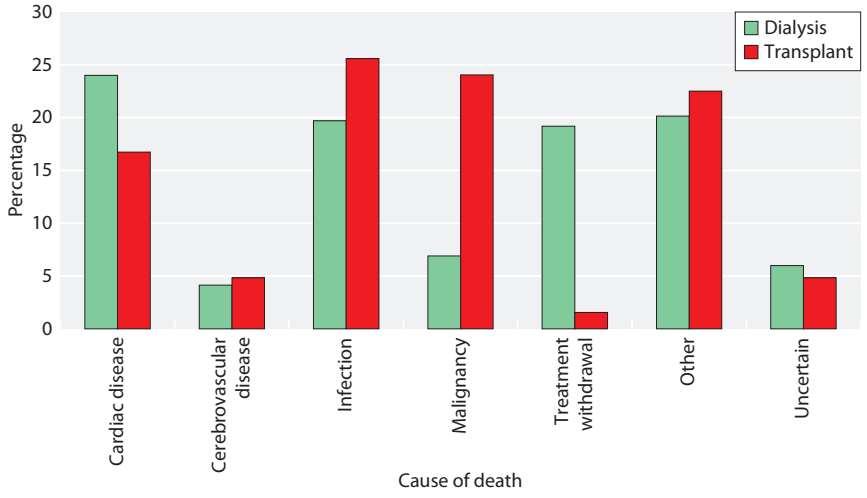

Fig. 3.11. Cause of death by modality for prevalent patients on 1/1/2013, who died in 2013

transplant patients by age. Death due to cardiovascular disease was less common in transplanted patients than in dialysis patients, perhaps reflecting the cardiovascular screening undertaken during transplant work-up; transplant recipients are a pre-selected lower risk group of patients. The leading causes of death amongst transplant patients were infection (26%), malignancy (24%) and other (23%). 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 22% in 2013) with an increase in the proportion ascribed to infection or malignancy (30% in 2003 compared to 50% in 2013). This change has also been reported in other registries, e.g. ANZDATA (http://www.anzdata.org.au) and may reflect better management of cardiovascular risk (although table 3.12 shows blood pressure management remained suboptimal). Explanations for the rising death rate secondary to malignancy may include the increasing age of transplant recipients and the increased intensity of immunosuppressive regimens leading to complications of over-immunosuppression.

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

References

1 Ansell D, Tomson CRV: UK Renal Registry 11th Annual Report (December 2008) Chapter 15 The UK Renal Registry, UKRR database, validation and methodology. Nephron Clin Pract 2009;111(suppl 1): c277–c285

2 Pruthi R, Ravanan R, O'Neill J, Roderick P, Pankhurst L, Udayaraj U: 15th annual report: Chapter 9 centre variation in access to renal transplantation in the UK (2006–2008). Nephron Clin Pract. 2013; 123(suppl 1):183–93. doi: 10.1159/000353328

3 Pruthi R, Casula A, MacPhee I: UK Renal Registry 16th annual report: Chapter 3 demographic and biochemistry profile of kidney transplant recipients in the UK in 2012: national and centre-specific analyses. Nephron Clin Pract. 2013;125(1–4):55–80. doi: 10.1159/000360022

4 Bosma RJ, Doorenbos CRC, Stegeman CA, Homan van der Heide JJ, Navis G: Predictive Performance of Renal Function Equations in Renal Transplant Recipients: An analysis of Patient Factors in Bias. Am J Transplant 2005;5:2183–2203

5 Froissart M, Rossert J, Jacquot C, Paillard M, Houillier P: Predictive Performance of the Modification of Diet in Renal Disease and Cockcroft-Gault Equations for Estimating Renal Function. J Am Soc Nephrol. 2005;16:763–773

6 Hariharan, S, McBride MA, Cherikh WS, Tolleris CB, Bresnahan BA, Johnson CP: Post-transplant renal function in the first year predicts long-term kidney transplant survival. Kidney Int 2002;62:1:311–318

7 UK Renal Association Clinical Practice Guidelines Committee: Anaemia of CKD, 5th Edition. 2010. http://www.renal.org/clinical/GuidelinesSection/AnaemiaInCKD.aspx

8 UK Renal Association Clinical Practice Guidelines Committee: Guideline 3.7: Target haemoglobin. 2007 RA Guidelines – Complications of CKD, 4th Edition. 2007. http://www.renal.org/Clinical/GuidelinesSection/ComplicationsofCKD.aspx

9 UK Renal Association Clinical Practice Guidelines Committee: Guideline: Post-operative Care of the Kidney Transplant Recipient, 5th Edition. 2011. http://www.renal.org/Clinical/GuidelinesSection/Post-operative-Care-Kidney-Transplant-Recipient.aspx

10 UK Renal Association Clinical Practice Guidelines Committee: Guideline 2.1: Treatment of patients with CKD. 2007 RA Guidelines – CKD, 4th Edition. 2007. http://www.renal.org/Clinical/GuidelinesSection/CKD.aspx

11 White CA, Akbari A, Doucette S, Fergusson D, Knoll GA: Estimating Glomerular Filtration Rate in Kidney Transplantation: Is the New

Chronic Kidney Disease Epidemiology Collaboration Equation Any Better? Clin Chem 2010;56:3:474–477
12 Ng FL, Holt DW, Chang RWS, MacPhee IAM: Black renal transplant recipients have poorer long-term graft survival than CYP3A5 expressers from other ethnic groups. Nephrol Dial Transplant 2010;25:628–634
13 Isaacs RB, Nock SL, Spencer CE, Connors AF Jr, Wang XQ, Sawyer R, Lobo PI: Racial disparities in renal transplant outcomes. Am J Kidney Dis 1999;34:4:706–712
14 Udayaraj U, Casula A, Ansell D, Dudley CRK, Ravanan R: Chronic Kidney Disease in Transplant Recipients – Is It Different From Chronic Native Kidney Disease? Transplantation 2010;90:7:765–770

Appendix 1: Reporting status of audit measures

Table 3.16. Showing the reporting status of the recommended Renal Association Audit Measures for the Post-operative Care of Kidney Transplant Recipients in the 17th 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

Table 3.16. Continued

RA audit measure	Included in UKRR annual report?	Reason for non-inclusion
26. Proportion of patients receiving secondary prevention with a statin, anti-platelet agents and RAS blockers	No	UKRR does not currently collect these data
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

UK Renal Registry 17th Annual Report: Chapter 4 Demography of the UK Paediatric Renal Replacement Therapy Population in 2013

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Key Words

Aetiology · Children · Demography · End stage renal disease · Established renal failure · Incidence · Prevalence · Pre-emptive transplantation · Renal replacement therapy · Survival

Summary

- A total of 891 children and young people under 18 years with established renal failure (ERF) were receiving treatment at paediatric nephrology centres in 2013.
- At the census date (31st December 2013), 80.2% of prevalent paediatric patients aged <18 years had a functioning kidney transplant, 11.7% were receiving haemodialysis (HD) and 8.1% were receiving peritoneal dialysis (PD).
- In patients aged <16 years the prevalence of ERF was 58.2 per million age related population (pmarp) and the incidence 9.3 pmarp, in 2013.
- The most common diagnosis was renal dysplasia ± reflux, present in 34.2% of prevalent paediatric patients aged <16 years in 2013.
- About a third of patients had one or more reported comorbidities at onset of renal replacement therapy (RRT).
- The improvement in rates of pre-emptive transplantation for those referred early has remained consistent over the last 10 years at 36.3%, compared to 26.9% in 1999–2003.
- At transfer to adult services, 85.2% of patients had a functioning kidney transplant.
- Survival during childhood amongst children commencing RRT was the lowest in both those aged less than two years old with a hazard ratio of 5.0 (confidence interval 2.8–8.8), and in those receiving dialysis compared to having a functioning transplant with a hazard ratio of 7.1 (confidence interval 4.7–11.7).

Introduction

Established renal failure requiring renal replacement therapy is a significant cause of long term morbidity and mortality during childhood, with specialist care being provided in 13 paediatric nephrology centres in the UK. All centres are equipped to provide peritoneal dialysis and haemodialysis, with ten centres also undertaking kidney transplantation for children. In the UK in 2012, the prevalence rate of treated ERF in children aged under 16 years was 56.7 and the incidence rate was 9.0 per million age related population [1].

The objectives of this report are:

(i) To describe the UK prevalence, incidence, causes of ERF and modality of treatment of children on RRT on 31st December 2013
(ii) To describe trends in (i) over the past 15 years, and
(iii) To describe pre-emptive transplantation rates and survival of children on RRT aged <16 years old in the UK.

Methods

Data collection was performed by all 13 paediatric nephrology centres managing children on RRT in the UK in 2013. Data submission to the UK Renal Registry (UKRR) in previous years has been electronic in most cases with diminishing proportions of paper-based returns over the past few years. All data items are then checked, validated and manually entered into the current paediatric UKRR database.

In this report, patient groups are described as: (i) 'prevalent' group: patients who were receiving RRT on the 31st December 2013; (ii) 'incident' group: patients who started RRT between 1st January and 31st December 2013; and (iii) '5 year' groups: patients who started RRT in the periods of 1999–2003, 2004–2008 and 2009–2013.

The populations used to calculate the incidence and prevalence rates were obtained from the Office for National Statistics (ONS) [2]. The mid-2013 population estimate produced by the ONS, based on the 2011 Census, was used for calculating the 2013 incident and prevalent group rates; the 2001 Census data was used for the 1999–2003 '5 year' group, the 2006 data for the 2004–2008 '5 year' group and the 2011 data for the 2009–2013 '5 year' group.

Infants under the age of three months and 'late presenters' (defined as children commencing dialysis within three months following first review by a paediatric nephrologist) were excluded from analyses when calculating pre-emptive transplantation rates. For survival analysis, only patients starting RRT between 1st January 1999 and 31st December 2012 were included to ensure a minimum of one year follow up at the census date (31st December 2013), and were followed up to a maximum age of 16 years.

Statistical analyses

Statistical analyses were performed using SAS 9.3, with group analyses using the Chi-square test and median analyses using the Kruskal-Wallis test. A Cox regression model was used in calculating hazard ratios for patient survival, adjusting for gender, age at start of RRT, and RRT modality as a time dependent variable. Survival probabilities were calculated using univariate Kaplan Meier curves.

Results

Accuracy and completeness of data returns

All centres submitted data electronically to the UKRR in 2013. The data returns now show near 100% data completeness being achieved by all centres for a range of data items including gender, ethnicity, treatment modality and age at start of RRT. Data completeness for other core items was similar to previous reports [1] and is shown in table 4.1.

The UK paediatric prevalent ERF population in 2013

A total of 891 children and young people under 18 years with ERF were receiving treatment at paediatric nephrology centres in 2013 (table 4.1). At the census date, 80.2% had a functioning kidney transplant, 11.7% were receiving HD and 8.1% were receiving PD (table 4.4).

Patients aged 16–18 years may receive their medical care either in a paediatric or in an adult nephrology centre. Adult renal centres report RRT patients over the age of 18 years to the UKRR. As data were incomplete for the 16–18 year old patients, they have been excluded from the majority of subsequent analyses (particularly when describing incidence and prevalence rates).

There were 702 children under 16 years of age receiving RRT in the UK in 2013. Table 4.2 shows the number of patients receiving RRT and rate of RRT pmarp by age group and gender. The prevalence of RRT increased with age and was higher in males across all age groups with an overall male to female prevalence ratio of 1.5 : 1. The reported prevalence rate in under 16 year olds was 58.2 pmarp.

Table 4.3 shows the ethnic origin of current RRT patients and their prevalence rates. Children from ethnic minorities displayed higher prevalent rates of RRT when compared with White children, with South Asian children displaying the highest rates.

Table 4.1. Data completeness for paediatric prevalent ERF population in 2013

		Percentage completeness				
Centre	*N*	First seen date	Height at RRT start	Weight at RRT start	Creatinine at RRT start	Primary renal diagnosis
Blfst_P*	35	94.3	85.7	88.6	94.3	100.0
Bham_P*	96	97.9	94.8	95.8	94.8	86.5
Brstl_P*	54	100.0	98.2	100.0	100.0	100.0
Cardf_P	25	100.0	96.0	96.0	96.0	100.0
Glasg_P*	50	96.0	90.0	94.0	96.0	100.0
L Eve_P*	98	100.0	68.4	75.5	76.5	100.0
L GOSH_P*	189	97.4	86.8	94.7	93.1	100.0
Leeds_P*	85	98.8	87.1	97.7	97.7	98.8
Livpl_P	39	97.4	79.5	84.6	94.9	97.4
Manch_P*	76	94.7	90.8	96.1	96.1	100.0
Newc_P*	33	100.0	90.9	90.9	90.9	100.0
Nottm_P*	86	97.7	68.6	81.4	98.8	98.8
Soton_P	25	100.0	76.0	76.0	92.0	96.0
UK	**891**	**97.9**	**84.9**	**90.8**	**93.4**	**98.1**

*Denotes centre undertaking kidney transplantation for children

Table 4.2. The UK paediatric prevalent ERF population <16 years old in 2013, by age group and gender

	All patients		Males		Females		M:F
Age group	*N*	pmarp	*N*	pmarp	*N*	pmarp	rate ratio
0–<2 years	23	14.2	16	19.3	7	8.9	2.2
2–<4 years	48	29.8	37	44.9	11	14.0	3.2
4–<8 years	150	48.2	89	55.8	61	40.1	1.4
8–<12 years	201	71.5	125	86.8	76	55.4	1.6
12–<16 years	280	96.2	158	106.0	122	85.9	1.2
Under 16 years	**702**	**58.2**	**425**	**68.8**	**277**	**47.1**	**1.5**

pmarp – per million age related population

Table 4.3. The UK paediatric prevalent ERF population <16 years old by age and ethnic group in 2013[a]

	White		South Asian		Black		Other[b]
Age group	*N*	pmarp	*N*	pmarp	*N*	pmarp	*N*
0–<4 years	45	17.4	9	42.7	2	23.7	9
4–<8 years	94	39.3	30	153.8	4	51.3	17
8–<12 years	144	56.3	33	158.3	8	95.9	7
12–<16 years	201	74.6	41	186.7	9	102.5	18
Under 16 years	**484**	**47.3**	**113**	**135.5**	**23**	**68.9**	**51**

pmarp – per million age related population
[a]ethnicity data missing for 31 children not included in this table
[b]pmarp not expressed for group 'Other', as heterogeneous group

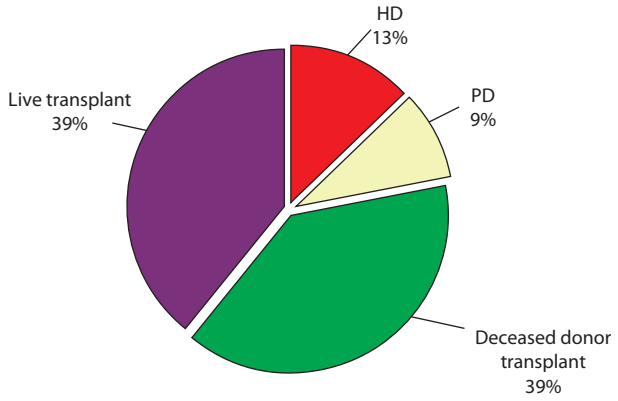

Fig. 4.1. RRT treatment used by prevalent paediatric patients <16 years old in 2013

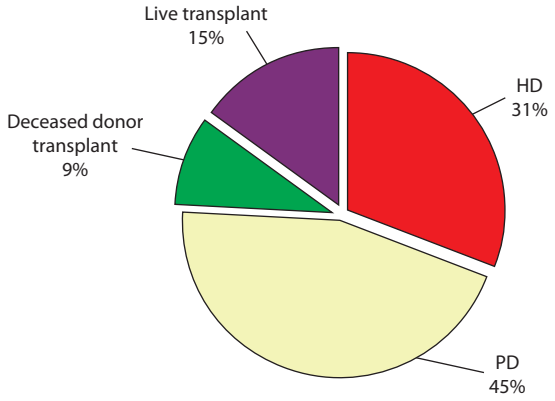

Fig. 4.2. Treatment modality at start of RRT in prevalent paediatric patients <16 years old in 2013

Modality of treatment

Current treatment modality in the prevalent paediatric population less than 16 years old in 2013 is displayed in figure 4.1. Of the 78% with a functioning transplant, 50% received a deceased donor transplant and 50% a living donor transplant.

The treatment modality in use at the start of RRT is displayed in figure 4.2. This shows that 45% of patients were treated with PD at the start of RRT whilst 31% of patients were treated with HD. Of children under 16, 24% were reported to have received a pre-emptive transplant.

Further treatment modality analysis by age is shown in table 4.4 which demonstrates that in the under two year old age group one child received a live transplant and that almost similar proportions of patients were being treated with PD (52.2%) and HD (43.5%). This contrasts with older children from the age of 8 to <16 years where approximately 85% had a functioning graft and twice the number of patients were on HD compared to PD. Subsequent analysis of RRT modality by gender and ethnicity showed no difference. However, as absolute sub-group numbers are small, caution is needed in conducting any comparative analyses.

Cause of ERF

Table 4.5 shows the diagnostic categories for the prevalent ERF population under 16 years in 2013 and figure 4.3 displays the percentage of patients in each diagnostic category for incident and prevalent cohorts. In comparison to previous years, (0.7% in 2012 [1] and 0.4% in 2011 [3]) 2.1% of children had a missing diagnosis in 2013.

Of the 702 patients, renal dysplasia ± reflux remained the commonest condition causing ERF (34%), whilst there were no documented patients with drug nephrotoxicity.

Table 4.4. Current treatment modality by age in the prevalent paediatric ERF population in 2013

		Current treatment							
		HD		PD		Live transplant		Deceased donor transplant	
Age group	Total	*N*	%	*N*	%	*N*	%	*N*	%
0–<2 years	23	10	43.5	12	52.2	1	4.3	0	0.0
2–<4 years	48	13	27.1	15	31.3	16	33.3	4	8.3
4–<8 years	150	15	10.0	12	8.0	79	52.7	44	29.3
8–<12 years	201	20	10.0	11	5.5	79	39.3	91	45.3
12–<16 years	280	31	11.1	13	4.6	102	36.4	134	47.9
16–<18 years	189	15	7.9	9	4.8	71	37.6	94	49.7
Under 16 years	**702**	**89**	**12.7**	**63**	**9.0**	**277**	**39.5**	**273**	**38.9**
Under 18 years	**891**	**104**	**11.7**	**72**	**8.1**	**348**	**39.1**	**367**	**41.2**

Table 4.5. Number, percentage and gender by primary renal disease as cause of ERF in the prevalent paediatric ERF population under 16 years in 2013*

Diagnostic group	*N*	%	Male	Female	M:F ratio
Renal dysplasia ± reflux	240	34.2	147	93	1.6
Obstructive uropathy	128	18.2	121	7	17.3
Glomerular disease	74	10.5	32	42	0.8
Congenital nephrotic syndrome	68	9.7	37	31	1.2
Tubulo-interstitial diseases	46	6.6	19	27	0.7
Renovascular disease	32	4.6	19	13	1.5
Polycystic kidney disease	31	4.4	11	20	0.6
Metabolic	27	3.8	14	13	1.1
Uncertain aetiology	25	3.6	11	14	0.8
Malignancy & associated disease	16	2.3	5	11	0.5
Missing	15	2.1	9	6	1.5
Total	**702**	**100**	**425**	**277**	**1.5**

*In 2013 there were no patients with ERF secondary to 'drug nephrotoxicity'

As for associated comorbidities at the onset of RRT, table 4.6 shows that congenital abnormalities were the commonest, reported in 9.0% of patients, followed by developmental delay at 8.3%. Overall 67.7% of patients had no registered comorbidities, with 21.8% having one comorbidity listed, and 10.5% having two or more comorbidities. Centre analysis showed significant variation in reporting of registered comorbidities with some centres, e.g. Cardiff (89%), Birmingham (83%), London GOSH (82%), Glasgow (80%) and London Evelina (80%) reporting no comorbidity in the majority of their patients, as compared to other centres which reported no comorbidity in a smaller proportion of patients, e.g. Bristol (36%), Manchester (43%) and Belfast (43%). Causes of the variation in reporting need to be understood as there may be genuine differences between centres in willingness to accept patients with comorbidity onto the RRT programme.

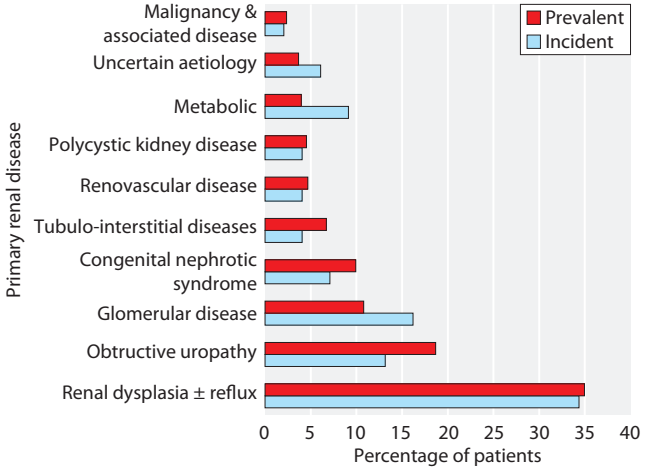

Fig. 4.3. Primary renal disease percentage in incident and prevalent paediatric ERF patients <16 years old in 2013 for whom a causative diagnosis was reported

The UK incident paediatric ERF population in 2013

There were 124 patients under 18 years of age who commenced RRT at paediatric renal centres in 2013. As previously, the following analyses are restricted to the 112 patients who were under 16 years of age.

Table 4.6. Frequency of registered comorbidities at onset of RRT in prevalent paediatric patients aged <16 years with ERF in 2013

Comorbidity	*N*	Percentage of all RRT patients
Congenital abnormality	63	9.0
Developmental delay	58	8.3
Syndromic diagnosis	55	7.8
Prematurity	48	6.8
Consanguinity	29	4.1
Chromosomal abnormality	14	2.0
Family member with ERF	14	2.0
Congenital heart disease	11	1.6
Liver disease	11	1.6
Cerebral palsy	8	1.1
Malignancy	6	0.9
Psychological disorder	5	0.7
Neural tube defect	4	0.6
Diabetes	1	0.1
No reported comorbidity	475	67.7
One reported comorbidity	153	21.8
Two or more comorbidities	74	10.5

Table 4.7. The incident paediatric ERF population <16 years old in the UK in 2013, by age group and gender

	All patients		Male		Female		
Age group	*N*	pmarp	*N*	pmarp	*N*	pmarp	M:F ratio
0–<2 years	19	11.8	13	15.7	6	7.6	2.1
2–<4 years	17	10.6	11	13.4	6	7.6	1.7
4–<8 years	14	4.5	4	2.5	10	6.6	0.4
8–<12 years	31	11.0	20	13.9	11	8.0	1.7
12–<16 years	31	10.7	12	8.1	19	13.4	0.6
Under 16 years	**112**	**9.3**	**60**	**9.7**	**52**	**8.8**	**1.1**

pmarp – per million age related population

The incidence rate of RRT was 9.3 pmarp in 2013. Patients commencing RRT in 2013 are displayed by age and gender in table 4.7.

Table 4.8 shows that the reported incidence of RRT has remained between 9.2 and 10.0 pmarp since 1999, with the highest incidence rates seen in both the youngest and oldest age groups.

Trends in ERF demographics

There were 1,681 children under 16 years of age who had received RRT in the UK over the 15 year period between 1999 and 2013. Analysis of ERF demographics for children less than 16 years of age over this period included 546 patients reported to the paediatric registry in 1999–2003, 575 in 2004–2008 and 560 in 2009–2013. In table 4.9, comparing the current 5-year period with the two previous 5-year periods has shown a sustained increase in the number of younger children aged 0–<8 years starting RRT. Conversely there has been a sustained reduction in numbers of older children aged 8–<16 years. The percentage of children on RRT who were from a South Asian ethnic background also increased during this period, although table 4.10 shows that the level of missing ethnicity data has recently increased considerably. Table 4.11 demonstrates that the reported patient population at most paediatric renal centres has fluctuated in size since 1999–2003.

Table 4.12 shows the number and percentage of children receiving RRT with each of the major reported comorbidities over the last 15 years. Syndromic diagnoses (8.2%), developmental delay (7.7%) and congenital abnormalities (7.3%) continued to be the most common reported comorbidities in 2009–2013. There has been a noticeable reported decrease in frequencies of consanguinity, family history of ERF and chromosomal

Table 4.8. Reported average incident rate by age group in 5-year time periods of children under 16 years of age commencing RRT

	Per million age related population		
Age group	1999–2003	2004–2008	2009–2013
0–<2 years	11.0	14.1	12.4
2–<4 years	6.2	6.5	8.4
4–<8 years	5.3	6.8	6.3
8–<12 years	9.1	8.3	9.0
12–<16 years	13.6	14.0	12.7
Under 16 years	**9.2**	**10.0**	**9.6**

Table 4.9. Number and percentage of children <16 years old who commenced RRT by age group and 5-year period at start of RRT

	1999–2003		2004–2008		2009–2013		1999–2013
Age group	*N*	%	*N*	%	*N*	%	% change
0–<2 years	74	13.6	102	17.7	98	17.5	3.9
2–<4 years	44	8.1	45	7.8	65	11.6	3.5
4–<8 years	78	14.3	92	16.0	90	16.1	1.8
8–<12 years	141	25.8	120	20.9	122	21.8	−4.0
12–<16 years	209	38.3	216	37.6	185	33.0	−5.2
Under 16 years	**546**		**575**		**560**		

Table 4.10. Number and percentage of children under 16 years who commenced RRT, by ethnicity and 5-year period of starting RRT*

	1999–2003		2004–2008		2009–2013		1999–2013
Ethnic group	*N*	%	*N*	%	*N*	%	% change
White	424	78.1	433	76.4	368	70.1	−8.0
South Asian	84	15.5	87	15.3	96	18.3	2.8
Black	14	2.6	23	4.1	17	3.2	0.7
Other	21	3.9	24	4.2	44	8.4	4.5
Under 16 years	**543**		**567**		**525**		

*Three children in 1999–2003, eight in 2004–2008 and thirty five in 2009–2013 with no ethnicity recorded are excluded from this table

Table 4.11. Number and percentage of children under 16 years by renal centre and 5-year period of starting RRT*

	1999–2003		2004–2008		2009–2013		1999–2013
Centre	*N*	%	*N*	%	*N*	%	% change
Blfst_P	18	3.3	14	2.4	25	4.5	1.2
Bham_P	52	9.5	63	11.0	63	11.3	1.7
Brstl_P	38	7.0	36	6.3	31	5.5	−1.4
Cardf_P	15	2.8	20	3.5	17	3.0	0.3
Glasg_P	36	6.6	46	8.0	36	6.4	−0.2
L Eve_P	56	10.3	55	9.6	59	10.5	0.3
L GOSH_P	91	16.7	114	19.8	118	21.1	4.4
Leeds_P	47	8.6	60	10.4	44	7.9	−0.8
Livpl_P	26	4.8	27	4.7	16	2.9	−1.9
Manch_P	60	11.0	44	7.7	61	10.9	−0.1
Newc_P	29	5.3	28	4.9	17	3.0	−2.3
Nottm_P	53	9.7	56	9.7	53	9.5	−0.3
Soton_P	24	4.4	12	2.1	20	3.6	−0.8
Total <16	**545**		**575**		**560**		

*One child in 1999–2003 with an unknown centre at start of RRT was excluded from this table

Table 4.12. Trends in comorbidity frequency at the start of RRT in the paediatric population under 16 years by 5-year period

	1999–2003		2004–2008		2009–2013		1999–2013
Comorbidity	*N*	%	*N*	%	*N*	%	% change
Syndromic diagnosis	37	6.8	50	8.7	46	8.2	1.4
Developmental delay	42	7.7	45	7.8	43	7.7	0.0
Congenital abnormality	42	7.7	51	8.9	41	7.3	−0.4
Prematurity	27	4.9	30	5.2	31	5.5	0.6
Consanguinity	28	5.1	17	3.0	19	3.4	−1.7
Family member with ERF	23	4.2	15	2.6	11	2.0	−2.2
Congenital heart disease	12	2.2	18	3.1	9	1.6	−0.6
Psychological disorder	12	2.2	4	0.7	9	1.6	−0.6
Liver disease	5	0.9	13	2.3	7	1.3	0.3
Cerebral palsy	7	1.3	13	2.3	6	1.1	−0.2
Neural tube defect	1	0.2	5	0.9	6	1.1	0.9
Chromosomal abnormality	19	3.5	17	3.0	4	0.7	−2.8
Malignancy	7	1.3	4	0.7	4	0.7	−0.6
Diabetes	4	0.7	4	0.7	1	0.2	−0.6
No reported comorbidity	360	65.9	383	66.6	399	71.3	5.3
One reported comorbidity	130	23.8	130	22.6	108	19.3	−4.5
Two or more comorbidities	56	10.3	62	10.8	53	9.5	−0.8

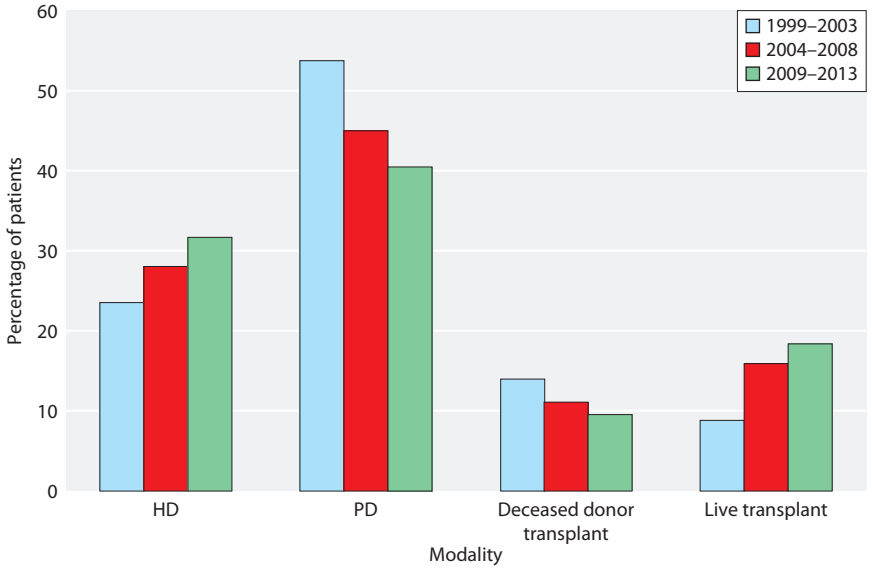

Fig. 4.4. Treatment modality at start of RRT for incident paediatric patients <16 years old by 5-year time period

abnormalities. Overall there is a trend towards the reporting of no comorbidities in children receiving RRT over the last 15 years and it should be clarified whether this is truly due to identifying fewer comorbidities or a result of underreporting.

As for changes in modality at the start of RRT, figure 4.4 shows that the percentage of children who were using PD at the start of RRT has fallen from 53.7% in 1999–2003 to 40.5% in 2009–2013, whilst the percentage commencing RRT on HD increased from 23.5% in 1999–2003 to 31.7% in 2009–2013. During this period the overall percentage receiving a transplant at the start of RRT rose from 22.8% to 27.9%, with an increase in living donation from 8.8% to 18.4%, and a corresponding fall in deceased donor transplantation from 14.0% to 9.5% for the same time period.

Table 4.13 shows the diagnostic categories for 540 of the 546 (98.9%) patients in 1999–2003, for 566 of the 575 (98.4%) patients in 2004–2008 and 540 of the 560 (96.4%) patients in 2009–2013 aged <16 years for whom a causative diagnosis was reported. Overall there has been an increase in the percentage of children receiving RRT with renal dysplasia ± reflux and obstructive uropathy whilst the frequency of glomerular disease has fallen markedly. In addition, numbers with uncertain aetiology have increased whilst those with malignancy

Table 4.13. Number and percentage of children under 16 years for whom a primary renal diagnosis had been reported as a cause of ERF, by 5-year time period and observed change in proportion of patients in each diagnostic group*

	1999–2003		2004–2008		2009–2013		1999–2013
Primary renal diagnosis	*N*	%	*N*	%	*N*	%	% change
Renal dysplasia ± reflux	157	29.1	191	33.7	182	33.7	4.6
Obstructive uropathy	80	14.8	75	13.3	97	18.0	3.1
Glomerular disease	130	24.1	112	19.8	83	15.4	−8.7
Tubulo-interstitial diseases	42	7.8	46	8.1	41	7.6	−0.2
Congenital nephrotic syndrome	27	5.0	33	5.8	35	6.5	1.5
Metabolic	29	5.4	25	4.4	31	5.7	0.4
Uncertain aetiology	12	2.2	32	5.7	29	5.4	3.1
Renovascular disease	23	4.3	19	3.4	19	3.5	−0.7
Polycystic kidney disease	16	3.0	19	3.4	19	3.5	0.6
Malignancy & associated disease	10	1.9	9	1.6	4	0.7	−1.1
Drug nephrotoxicity	14	2.6	5	0.9	0	0.0	−2.6

*Six children in 1999–2003, nine in 2004–2008 and twenty in 2009–2013 with no primary renal diagnosis recorded are excluded from this table

Table 4.14. Demographic characteristics of pre-emptive transplantation in children aged three months to 16 years in the UK between 1999–2013, analysed by 5-year time period, gender, ethnicity, age at start of RRT and primary renal diagnosis

	N	*N* (%) pre-emptively transplanted
Total cohort analysed (1999–2013)	1,212	402 (33.2)
Time period		
1999–2003	405	109 (26.9)
2004–2008	402	146 (36.3)
2009–2013	405	147 (36.3)
Gender		
Male	749	268 (35.8)
Female	463	134 (28.9)
Ethnicity		
Black	35	5 (14.3)
Other	59	19 (32.2)
South Asian	196	41 (20.9)
White	885	323 (36.5)
Age at start of RRT		
3 months–<2 years	122	6 (4.9)
2–<4 years	130	36 (27.7)
4–<8 years	206	79 (38.4)
8–<12 years	297	106 (35.7)
12–<16 years	457	175 (38.3)
Primary renal diagnosis		
Renal dysplasia ± reflux	398	168 (42.2)
Glomerular disease	217	27 (12.4)
Obstructive uropathy	215	96 (44.7)
Congenital nephrotic syndrome	81	5 (6.2)
Metabolic	73	34 (46.6)
Tubulo-interstitial diseases	71	17 (23.9)
Polycystic kidney disease	43	20 (46.5)
Renovascular disease	37	15 (40.5)
Uncertain aetiology	28	9 (32.1)
Malignancy & associated disease	14	0 (0)
Drug nephrotoxicity	10	1 (10)

and drug nephrotoxicity have fallen between 1999–2003 and 2009–2013 although in these categories absolute numbers are very small.

Pre-emptive transplantation

Of a total of 1,681 patients aged 0–16 years who started RRT between 1999 and 2013, 469 patients were excluded from this analysis (94 patients were excluded due to being aged <3 months, and a further 375 patients were excluded due to being late presenters). Of 1,212 patients identified as being aged three months to <16 years and having started RRT between 1999–2013, table 4.14 shows pre-emptive transplantation was seen to occur in 33.2% of patients and was significantly higher in males (35.8%) than females (28.9%) ($p = 0.01$). This difference is not significant however when adjusted for other factors in a logistic regression. Ethnicity was also seen to be a key factor, with children from Black (14.3%) and South Asian (20.9%) ethnicity having significantly lower rates of transplantation than their White counterparts (35.8%) ($p < 0.0001$). Analysis by age at start of RRT showed that as expected, the lowest rate of pre-emptive transplantation was in the three months to two year group (4.9%), whilst children aged four to sixteen years all had similar rates of pre-emptive transplantation. As for primary renal diagnosis, children with metabolic causes (46.6%), polycystic kidney disease (46.5%), obstructive uropathy (44.7%), renal dysplasia ± reflux (42.2%) and renovascular disease (40.5%) had the highest rates of pre-emptive transplantation, whilst those with malignancy (0.0%) had the lowest rate. Table 4.14 demonstrates the initial rise in pre-emptive transplantation rates from 26.9% in 1999–2003 to 36.3% in 2004–2008 was maintained in 2009–2013 ($p = 0.005$).

Transfer of patients to adult renal services in 2013

A total of 101 patients were reported by paediatric nephrology centres to have transferred to adult renal services in 2013. The median age of patients transferred out was 18.1 years with an inter-quartile range of 17.8 years to 18.5 years. Table 4.15 shows that of the transferred patients 60.4% were male, with ethnic minorities constituting 19.8% of patients. The vast majority (85.2%) had a functioning renal transplant at the time of transfer to an adult renal centre. Renal dysplasia ± reflux, glomerular disease and obstructive uropathy accounted for the primary renal diagnosis in over 70% of patients.

Survival of children on RRT during childhood

Of patients under 16 years of age, 1,569 were identified as starting RRT between 1999 and 2012 at paediatric centres in the UK and were included in the survival analyses. At the census date (31st December 2013) there were a total of 99 deaths reported in children on RRT under 16 years of age at paediatric centres. The median follow up time was 3.5 years (range of one day to 15 years). Table 4.16 shows the survival hazard ratios (following adjustment for age at start of RRT, gender and RRT modality) and highlights that children starting RRT under two years of age had the worst survival outcomes with a hazard ratio of 5.0 (confidence interval (CI) 2.8–8.8, $p < 0.0001$) when compared to 12–16 year olds. Outcomes in both the 2–<4 age group and the

Table 4.15. Modality, gender, ethnicity and primary renal diagnosis of patients transferred out from paediatric nephrology centres to adult renal services in 2013

	N	% distribution
Modality		
Transplant	86	85.2
HD	11	10.9
PD	4	4.0
Gender		
Male	61	60.4
Female	40	39.6
Ethnicity		
White	81	80.2
South Asian	17	16.8
Other	2	2.0
Black	1	1.0
Primary renal diagnosis		
Renal dysplasia ± reflux	30	29.7
Glomerular disease	24	23.8
Obstructive uropathy	19	18.8
Congenital nephrotic syndrome	7	6.9
Tubulo-interstitial diseases	5	5.0
Metabolic	4	4.0
Uncertain aetiology	4	4.0
Polycystic kidney disease	3	3.0
Renovascular disease	3	3.0
Drug nephrotoxicity	1	1.0
Malignancy & associated disease	1	1.0

Table 4.16. Survival hazard ratio during childhood for paediatric RRT patients aged <16 years in the UK adjusted for age at start of RRT, gender and RRT modality

	Hazard ratio	Confidence interval	*p*-value
Age			
0–<2 years	5.0	2.8–8.8	<0.0001
2–<4 years	2.9	1.4–5.7	0.003
4–<8 years	2.2	1.3–4.0	0.006
8–<12 years	1.4	0.7–2.9	0.4
12–16 years	1.0	–	–
Gender			
Female	1.2	0.7–1.9	0.5
Male	1.0	–	
RRT modality			
Dialysis	7.1	4.7–10.7	<0.0001
Transplant	1.0	–	

4–<8 age group were also significantly worse with a hazard ratios of 2.9 (CI 1.4–5.7, $p = 0.003$) and 2.2 (CI 1.3–4.0, $p = 0.006$) respectively. Being on dialysis, as expected, was seen to lower survival significantly compared to having a functioning transplant with a hazard ratio of 7.1 (CI 4.7–10.7, $p < 0.0001$). Figure 4.5 shows unadjusted Kaplan Meier (KM) survival probabilities. As the maximum age of follow up was restricted to 16 years, it was not possible to calculate 10 year survival probabilities for patients starting RRT aged >8 years, or 5 year survival probability for children starting RRT aged >12 years. This figure again highlights worse outcomes for those aged less than two years, particularly during the first year.

Mortality data in 2013

Eight deaths occurred in paediatric renal centres in 2013; of these, seven were under 16 years of age and one was aged 18 years at the time of death. In children

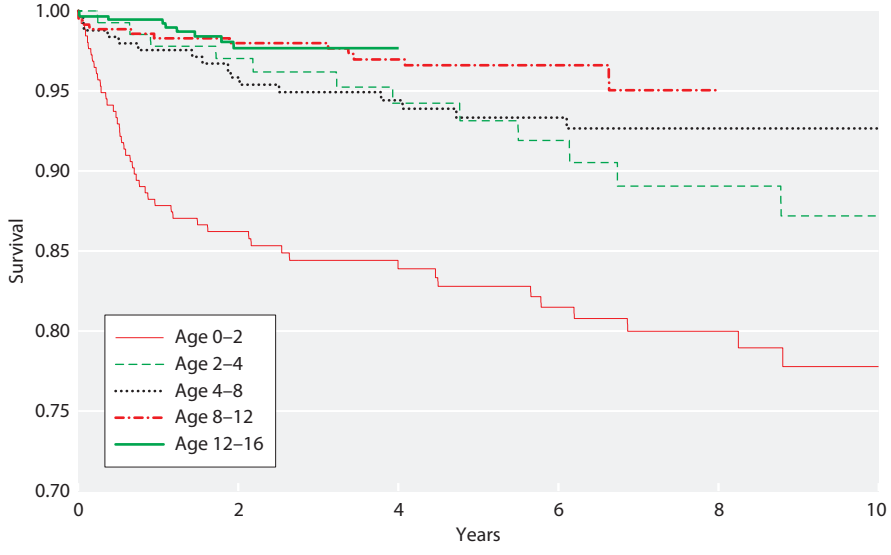

Fig. 4.5. Unadjusted KM survival in paediatric patients <16 years old starting RRT between 1999 and 2012, by age at start

aged <16 years with treated ERF, the total reported mortality in 2013 in the UK at paediatric centres was 1.0% (7/702), and 3.3% (5/152) for those on dialysis. The median age at death was 7.4 years with a range of 1.3 years to 18.0 years.

Transplant deaths

At the time of death, two children had received a kidney transplant. Infection was the cause of death in one, and the other patient died from drug related toxic epidermal necrolysis during treatment for post-transplant lymphoproliferative disorder.

Dialysis deaths

At the time of death, three children were on dialysis (two HD and one PD). Three further children died whilst receiving active palliative care (two HD and one PD). Infections were the cause of death in two patients, one of which was associated with HD and the other with PD. One patient died as a result of complications from treatment of malignancy.

Discussion

This report has focused on the current demography and the demographic trends over the past 15 years in the UK paediatric ERF population. It includes 702 children and adolescents under 16 years of age, who were receiving RRT in 2013. The sub-section on the trends in demographics includes children and adolescents under 16 years of age on RRT; 546 from 1999–2003, 575 from 2004–2008 and 560 from 2009–2013.

Data completeness

The ongoing sustained effort by clinical teams, data managers and statisticians to improve the accuracy, quality and consistency of data, analyses and conclusions continues with our aim to maintain full electronic annual returns from all centres. A revised data set (The NEW Paediatric Dataset) is in the process of being implemented and when complete will further improve registry reports.

For 2013, 100% of data were submitted electronically from the 13 paediatric nephrology centres in the UK. Data returns were complete for key data items and this together with improved checking and validation procedures within the registry contributed to continuing quality improvement. Ongoing work to merge the paediatric and adult registries will enable better identification and reporting of the 16–18 year old age group ($n = 189$ in 2013) who are not well represented in this report.

Incidence, prevalence and trends

The incidence rate of RRT in the less than 16 year age group was 9.3 pmarp in 2013; this rate has been stable since 1999. The overall prevalence rate of RRT in the less than 16 year age group was 58.2 pmarp. The prevalence of RRT increased with age and was higher in males across all age groups. Children from ethnic minorities displayed higher prevalent rates of RRT when compared with White children, with South Asian children displaying the highest rates. Overall, there was a continuing trend of increased prevalence of children on RRT with increased age, in keeping with improved survival with increasing age. Over time, the prevalent paediatric population is younger, with more children aged less than 8, and fewer aged 8–16.

Treatment modality of ERF

PD was the initial treatment modality for 45% of patients in prevalent paediatric <16 years old in 2013, 31% commenced HD and 24% received a pre-emptive transplant. Age influenced the modality of RRT with the majority of those under two (52%) receiving PD, although absolute numbers are small in this group. Overall the majority of prevalent children on RRT had a functioning transplant (78%), about half of which were deceased donors and the other half living donor transplants. Over the last 15 years, the proportion of incident paediatric patients <16 years old receiving PD as initial modality is reducing whilst proportions of those receiving HD and living kidney donation are increasing, with more younger and fewer older patients in the cohort over time.

Causes of ERF and observed trends 1999–2013

As previously, renal dysplasia ± reflux (34.2%), obstructive uropathy (18.2%), and glomerular disease (10.5%) were the commonest listed aetiologies for prevalent paediatric patients <16 years old with ERF. These accounted for 62.9% of all patients for whom a primary diagnosis had been reported. Observation of trends over the 15-year period showed an increase in the percentage of incident paediatric patients <16 years old receiving RRT with renal dysplasia ± reflux and obstructive uropathy with a fall in the percentage with glomerular disease. Further analyses are needed to understand if the proportional reduction in glomerular disease was a result of improved outcomes or a result of very young children with structural renal disease being offered

treatment. No cases of ERF secondary to 'drug nephrotoxicity' were reported this year or in the most recent 5-year period.

Comorbidities

At the onset of RRT in prevalent paediatric patients <16 years old, 32.3% of patients had one or more associated comorbidities. This overall proportion of children with reported comorbidities has fallen from 34.1% to 28.5% over the past 15 years. There continues to be significant variation in registered comorbidity rates between centres (from 89% to 36% with no registered comorbidities); it is likely that this is influenced by different reporting practices between centres, however, importantly it may reflect differing approaches to acceptance of patients with comorbidity for RRT between centres. Consequently understanding this variation remains an area for further work for the registry and individual centres.

Pre-emptive transplantation

Over the past 15 years, pre-emptive transplantation was seen to occur in 33.2% of children under 16 years of age. The improvement in rates of pre-emptive transplantation for those referred early has remained consistent over the last 10 years at 36.3%, compared to 26.9% in 1999–2003. There were significantly lower rates of pre-emptive transplantation in girls, however this difference was not present once corrected for other factors. There were significantly lower rates of pre-emptive transplantation in ethnic minorities and this would be of interest for further research. Detailed analyses of late presenters may identify other barriers to pre-emptive transplantation.

Transfer out and survival data

Although practice varied regarding transfer age between individual centres, the median age of transfer to adult services was 18.1 years in 2013. Of patients receiving RRT, 85.2% transferred with a functioning renal transplant. There were differing practices between centres regarding transition and transfer out arrangements; it is also likely that variability exists in reporting of 'transfer out' timelines to the registry for patients being transitioned to adult renal centres. Consensus regarding terminology and process will facilitate future comparative interpretation.

Survival data of children on ERF during childhood who commenced RRT between 1999 and 2012 highlights the less favourable outcome for children less than two years of age. These data also highlight the significantly better survival of children with functioning transplants when compared to those on dialysis. Further work in this area will aim to identify the reasons why patients are receiving dialysis and their barriers to transplantation. Longer term survival data up to four years was available for those aged 12 to 16 years and 10 year survival data for those aged $\leqslant$6 years of age.

Current and future work

A research project forming a collaboration between the UKRR and the University of Bristol has begun and aims to identify broad outcomes for young adults on RRT and examine the process of transition. Due to variation in the age at transfer to adult centres and the fact the adult renal centres begin reporting RRT patients once they have reached the age of 18, young adults presenting in renal centres before the age of 18 are not reported to the UKRR. The creation of datasets for young adults on RRT will be able to report much more comprehensively on the 16–18 year old age group, solve issues with patient timelines by linking those moving between paediatric and adult databases as well as establishing longer term graft outcomes for those transplanted in childhood.

Conflicts of interest: none

References

1 Pruthi R, O'Brien C, Casula A, Braddon F, Lewis M, Maxwell H, Stojanovic J, Tse Y, Inward C, Sinha MD. UK Renal Registry 16th Annual Report: Chapter 7 Demography of the UK Paediatric Renal Replacement Therapy Population in 2012. Nephron Clin Pract 2013; 125(1–4):127–38. doi: 10.1159/000360026

2 http://www.Ons.Gov.Uk/census

3 Pruthi R, O'Brien C, Casula A, Braddon F, Lewis M, Maxwell H, Tse Y, Inward C, Sinha MD. UK Renal Registry 15th Annual Report (December 2011): Chapter 4 Demography of the UK Paediatric Renal Replacement Therapy Population in 2011. Nephron Clin Pract 2013;123(suppl 1): 81–92. doi: 10.1159/000353323

UK Renal Registry 17th Annual Report: Chapter 5 Survival and Cause of Death in UK Adult Patients on Renal Replacement Therapy in 2013: National and Centre-specific Analyses

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Key Words
Cause of death · Comorbidity · Dialysis · End stage renal disease · Established renal failure · Haemodialysis · Median life expectancy · Outcome · Peritoneal dialysis · Renal replacement therapy · Survival · Transplant · Vintage

Summary

- Survival of incident patients on renal replacement therapy (RRT) continued to improve over the last 14 years for both short and long term survival up to 10 years post RRT start.
- One year after 90 day age adjusted survival for incident patients in 2012 was 91.0%, similar to the 2011 cohort (90.9%). There was a difference in one year after 90 day incident patient survival by age group and diabetic status: diabetic patients aged <65 years had worse survival than non-diabetic patients, but survival for older diabetic patients ($\geqslant 65$ years) was better than for non-diabetic patients.
- There was a declining trend in the overall incident patient death rate with a steeper rate of decline in the older age group ($\geqslant 65$ years), where the death rate fell from 395 per 1,000 patient years in 2003 to 261 in 2012.
- The median life years remaining for an incident patient aged 25–29 years was 18.5 years and approximately 2.4 years for a 75+ year old.
- One year age adjusted survival for prevalent dialysis patients was 89.3% in the 2012 cohort, similar to the 2011 cohort (89.7%).
- Some centre and UK country variability was evident in incident and prevalent patient survival after adjusting to age 60 and this would need further investigation.
- The relative risk of death on RRT in the one year follow up period in 2013 decreased with age from 16.2 times that of the general population at age 35–39 years to 2.6 times at age 85 and over.
- In the prevalent dialysis population, cardiovascular disease was the most common cause of death, accounting for 27% of deaths. Infection and other causes of death accounted for 21% of deaths each and treatment withdrawal for 16% of deaths.

Introduction

The analyses presented in this chapter examine a) survival from the start of RRT of adult patients; b) projected life years remaining for adult patients starting RRT; c) survival amongst prevalent adult dialysis patients alive on 31st December 2012; d) the death rate in the UK compared to the general population; e) the cause of death for incident and prevalent adult patients. They encompass the outcomes from the total incident adult UK dialysis population (2012) reported to the UK Renal Registry (UKRR), including the 19.6% who started on peritoneal dialysis and the 7.5% who received a pre-emptive renal transplant. These results are therefore a true reflection of the outcomes in the whole UK adult incident RRT population. Analyses of survival within the first year of starting RRT include patients who were recorded as having started RRT for established renal failure (as opposed to acute kidney injury) but who had died within the first 90 days of starting RRT, a group excluded from most other countries' registry data. As is common in other countries, survival analyses are also presented for the first year after 90 days.

The term established renal failure (ERF) used throughout this chapter is synonymous with the terms end stage renal failure (ESRF) and end stage renal disease (ESRD) which are in more widespread international usage. Within the UK, patients have disliked the term 'end stage'; the term ERF was endorsed by the English National Service Framework for Renal Services, published in 2004.

Since 2006, the UKRR has openly reported and published centre attributable RRT survival data. It is again stressed that these are raw data which continue to require very cautious interpretation. The UKRR can adjust for the effects of the different age distributions of patients in different centres, but lacks sufficient data from many participating centres to enable adjustment for primary renal diagnosis, other comorbidities at start of RRT (age and comorbidity, especially diabetes, are major factors associated with survival [1–3]) and ethnic origin, which have been shown to have an impact on outcome (for instance, better survival is expected in centres with a higher proportion of Black and South Asian patients) [4]. This lack of information on case-mix makes interpretation of any apparent difference in survival between centres and UK countries difficult. Despite the uncertainty about any apparent differences in outcome, for centres which appear to be outliers the UKRR will follow the clinical governance procedures as set out in chapter 2 of the 2009 UKRR Report [5].

Methods

The unadjusted survival probabilities (with 95% confidence intervals) were calculated using the Kaplan–Meier method, in which the probability of surviving more than a given time can be estimated for all members of a cohort of patients overall or by subgroup such as age group, but without any adjustment for confounding factors such as age that affect the chances of survival. Where centres are small, or the survival probabilities are greater than 90%, the confidence intervals are only approximate.

In order to estimate the difference in survival of different subgroups of patients within the cohort, a stratified proportional hazards model (Cox) was used where appropriate. The results from the Cox model were interpreted using a hazard ratio. When comparing two groups, the hazard ratio is the ratio of the estimated hazard for group A relative to group B, where the hazard is the risk of dying at time t given that the individual has survived until this time. The underlying assumption of a proportional hazards model is that the hazard ratio remains constant throughout the period under consideration. Whenever used, the assumptions of the proportional hazards model were tested.

To allow comparisons between centres with differing age distributions, survival analyses were statistically adjusted for age and reported as survival adjusted to age 60. This gives an estimate of what the survival would have been if all patients in that centre had been aged 60 at the start of RRT. This age was chosen because it was approximately the average age of patients starting RRT 15 years ago at the start of the UKRR's data collection. The average age of patients commencing RRT in the UK has recently stabilised around an age of 62 years, but the UKRR has maintained age adjustment to 60 years for comparability with all previous years' analyses. Diabetic patients were included in all analyses unless stated otherwise and for some analyses, diabetic and non-diabetic patients were analysed separately and compared. Non-diabetic patients were defined as all patients excluding those patients with diabetes as the primary renal disease. All analyses were undertaken using SAS 9.3.

Centre variability for incident and prevalent patient survival was analysed using a funnel plot. For any number of patients in the incident cohort (x-axis), one can identify whether any given survival probability (y-axis) falls within, plus or minus 2 standard deviations (SDs) from the national mean (solid lines, 95% limits) or 3SDs (dotted lines, 99.9% limits).

Definition of RRT start date

The incident survival figures quoted in this chapter are from the first day of RRT whether with dialysis or a pre-emptive transplant. In the UKRR all patients starting RRT for ERF are included from the date of the first RRT treatment wherever it took place (a date currently defined by the clinician) if the clinician considered the renal failure irreversible. Should a patient recover renal function within 90 days they were then excluded. These UK data therefore may include some patients who died within 90 days who had developed acute potentially reversible renal failure but were recorded by the clinician as being in irreversible established renal failure.

Previously, the UKRR asked clinicians to re-enter a code for established renal failure in patients initially coded as having acute renal failure once it had become clear that there was no

recovery of kidney function. However, adherence to this requirement was very variable, with some clinicians entering a code for established renal failure only once a decision had been made to plan for long-term RRT [6]. All UK nephrologists have now been asked to record the date of the first haemodialysis session and to record whether the patient was considered to have acute kidney injury (acute renal failure) or to be in ERF at the time. For patients initially categorised as 'acute', but who were subsequently categorised as ERF, the UKRR assigns the date of this first 'acute' session as the date of start of RRT.

UKRR analyses of electronic data extracted for the immediate month prior to the start date of RRT provided by clinicians highlighted additional inconsistencies in the definition of this first date when patients started on peritoneal dialysis, with the date of start reported to the UKRR being later than the actual date of start. These findings are described in detail in chapter 13 of the 2009 Report [6]. This concern is unlikely to be unique to the UK, but will be common to analyses from all renal centres and registries.

In addition to these problems of defining day 0 within one country, there is international variability on when patient data are collected by national registries with some countries (often for financial re-imbursement or administrative reasons) defining the 90th day after starting RRT as day 0, whilst others collect data only on those who have survived 90 days and report as zero the number of patients dying within the first 90 days.

Thus as many other national registries do not include reports on patients who do not survive the first 90 days, survival from 90 days onwards is also reported to allow international comparisons. This distinction is important, as there is a much higher death rate in the first 90 days, which would distort comparisons.

Methodology for incident patient survival

The incident population is defined as all patients over 18 years old who started RRT at UK renal centres and did not have a recovery lasting more than 90 days within 90 days of starting RRT. Patients were considered 'incident' at the time of their first RRT, thus patients re-starting dialysis after a failed transplant were not included in the incident cohort (see appendix B:1 for a detailed definition of the incident (take-on) population).

For incident survival analyses, patients newly transferred into a centre who were already on RRT were excluded from the incident population for that centre and were counted at the centre at which they started RRT. Some patients recover renal function after more than 90 days but subsequently returned to RRT. If recovery was for less than 90 days, the start of RRT was calculated from the date of the first episode and the recovery period ignored. If recovery was for 90 days or more, the length of time on RRT was calculated from the day on which the patient restarted RRT.

The incident survival cohort was **NOT** censored at the time of transplantation and therefore included the survival of the 7.5% who received a pre-emptive transplant. An additional reason for not censoring was to facilitate comparison between centres. Centres with a high proportion of patients of South Asian and Black origin are likely to have a healthier dialysis population, because South Asian and Black patients are less likely to undergo early transplantation [7], and centres with a high pre-emptive transplant rate are likely to have a less healthy dialysis population as transplantation selectively removes fit patients only. However censoring at transplantation was performed in the 1997–2012 cohort to establish the effect on long term survival by age group and also in the 2009–2012 cohort to investigate the effect on the outlying status of centres.

The one year incident survival is for patients who started RRT from 1st October 2011 until the 30th September 2012 and followed up for one full year (e.g. patients starting RRT on 1st December 2011 were followed through to 30th November 2012). The 2013 incident patients could not be analysed as they had not yet been followed for a sufficient length of time. For analysis of one year after 90 day survival, patients who started RRT from 1st October 2011 until 30th September 2012 were included in the cohort and they were followed up for a full one year after the first 90 days of RRT.

Two year's incident data (2011–2012) were combined to increase the size of the patient cohort, so that any differences between the four UK countries can likely be more reliably identified. To help identify any centre differences in survival from the small centres (where confidence intervals are large), an analysis of one year after 90 day survival using a rolling four year combined incident cohort from 2009 to 2012 was also undertaken. For those centres which had joined the UKRR after 2009, data were not available for all the years but the available data were included. A 10 year rolling cohort was used when analysing trends over time and for long term survival, a cohort from 1997 to 2012 was analysed.

The death rate per 1,000 patient years was calculated by dividing the number of deaths by the person years exposed. Person years exposed are the total years at risk for each patient (until death, recovery or lost to follow up). The death rate is presented by age group and UK nation.

Adjustment of one year after 90 day survival for the effect of comorbidity was undertaken using a rolling four year combined incident cohort from 2009 to 2012. Twenty-four centres returned $\geqslant$85% of comorbidity data for patients in the combined cohort. Adjustment was first performed to a mean age of 60 years, then to the average distribution of primary renal diagnoses for the 24 centres. The individual centre data were then further adjusted for average distribution of comorbidity present at these centres.

Methodology of median life expectancy

Kaplan Meier survival analyses were used to calculate the median survival after the first 90 days by age group (18–34, 35–44, 45–54, 55–64, 65–74, 75+) for incident patients starting RRT from 2001–2010, with at least three years follow up from 2011 to 2013. The patient inclusion criteria are the same as those of the incident patient cohort described above. Patients were followed until death, censoring (recovery or lost to follow up) or the end of the study period. Median life years remaining is the difference between the age when reaching the 50% probability of survival and the age of starting RRT. Median life years remaining were calculated for all incident and diabetic incident patients

Methodology for prevalent dialysis patient survival

The prevalent dialysis patient group was defined as all patients over 18 years old, alive and receiving dialysis on 31st December 2012 who had been on dialysis for at least 90 days at one of the UK adult renal centres. Prevalent dialysis patients on 31st December 2012 were followed-up in 2013 and were censored at transplantation. When a patient is censored at transplantation, this means that the patient is considered as alive up to the point of

transplantation, but the patient's status post-transplant is not considered.

As discussed in previous reports, comparison of survival of prevalent dialysis patients between centres is complex. Survival of prevalent dialysis patients can be studied with or without censoring at transplantation and it is common practice in some registries to censor at transplantation. Censoring could cause apparent differences in survival between those renal centres with a high transplant rate and those with a low transplant rate, especially in younger patients where the transplant rate is highest. Censoring at transplantation systematically removes younger fitter patients from the survival data. The differences are likely to be small due to the relatively small proportion of patients being transplanted in a given year compared to the whole dialysis population (about 14% of the dialysis population aged under 65 and 2% of the population aged 65 years and over). To allow comparisons with other registries the survival results for prevalent dialysis patients **CENSORED** for transplantation have been quoted. To understand survival of patients, including survival following transplantation, the incident patient analyses should be viewed. The effect of not censoring at transplantation was performed in the 2012 cohort to investigate the effect on the outlying status of centres.

Methodology for comparing mortality in prevalent RRT patients with the mortality in the general population

Data on the UK population in mid-2013 and the number of deaths in each age group in 2013 were obtained from the Office of National Statistics. The age specific UK death rate was calculated as the number of deaths in the UK per thousand people in the population. The age specific expected number of deaths in the RRT population was calculated by applying the UK age specific death rate to the total of years exposed for RRT patients in that age group. This is expressed as deaths per 1,000 patient years. The age specific number of RRT deaths is the actual number of deaths observed in 2013 in RRT patients. The RRT observed death rate was calculated as number of deaths observed in 2013 per 1,000 patient years exposed. Relative risk of death was calculated as the ratio of the observed and expected death rates for RRT patients. The death rate was calculated for the UK general population by age group and compared with the same age group for prevalent patients on RRT on 31st December 2012.

Methodology of cause of death

The EDTA-ERA Registry codes for cause of death were used. These have been grouped into the following categories:

- Cardiac disease
- Cerebrovascular disease
- Infection
- Malignancy
- Treatment withdrawal
- Other
- Uncertain

Completeness of cause of death data was calculated for all prevalent patients on RRT that died in a specific year with cause of death data completed for that year. Patients that were lost to follow up or that recovered were not included in the cause of death completeness calculation.

Adult patients aged 18 years and over from England, Wales, Scotland and Northern Ireland were included in the analyses of cause of death. The incident patient analysis included all patients starting RRT in the years 2000–2012. Analysis of prevalent patients included all those aged over 18 years and receiving RRT on 31st December 2012 and followed-up for one year in 2013.

Results

Incident (new RRT) patient survival

Overall survival

The 2012 incident cohort included 6,881 patients who started RRT, without any period of renal function recovery lasting more than 90 days. The age adjusted (adjusted to age 60) one year after 90 day survival for incident patients starting RRT in 2012 (table 5.1), was similar to last year: 91.0% compared to 90.9% in the 2011 cohort. Survival at 90 days was also similar to the 2011 cohort at 96.2% (table 5.1).

Survival by UK country

There was no evidence of a difference in the 90 day survival between the UK countries (table 5.2). One year after 90 day survival in Wales decreased to 86.6% from 88.2% in the previous cohort (2010–2011) and although there was evidence that survival was lower compared to England, Northern Ireland and Scotland (table 5.2), this data have not been adjusted for differences in primary renal diagnosis, ethnicity, socio-economic status or comorbidity, nor for differences in life expectancy in the general populations of the four UK countries. There are known regional differences in the life expectancy of

Table 5.1. Survival of incident patients, 2012 cohort

Interval	Unadjusted survival (%)	Adjusted survival (%)	*95% CI*	*N*
Survival at 90 day	94.5	96.2	95.6–96.7	6,881
Survival one year after 90 days	88.0	91.0	90.2–91.8	6,484

Table 5.2. Incident patient survival across the UK countries, combined 2 year cohort (2011–2012), adjusted to age 60

Interval	England	N Ireland	Scotland	Wales	UK
Survival at 90 day (%)	96.2	96.4	95.9	96.5	96.2
95% CI	*95.8–96.6*	*94.9–97.9*	*94.9–97.0*	*95.5–97.6*	*95.8–96.6*
Survival 1 year after 90 days (%)	91.2	91.6	90.8	86.6	90.9
95% CI	*90.6–91.8*	*89.2–94.0*	*89.2–92.5*	*84.4–88.8*	*90.3–91.5*

the general population within the UK. Table 5.3 shows differences in life expectancy between the UK countries for the period 2010–2012. These differences in life expectancy are not accounted for in these analyses and are likely to be one of the reasons contributing to the variation in survival between renal centres and UK countries.

Survival by modality

It is impossible to obtain truly valid comparisons of survival of patients starting RRT on different treatment modalities, as modality selection is not random. In the UK, patients starting peritoneal dialysis as a group were younger and fitter than those starting haemodialysis and were transplanted more quickly. The age adjusted one year survival estimates for incident patients starting RRT on HD and PD were 89.2% and 93.7% respectively, with PD patient survival increasing by 0.8% from the previous year (figure 5.1). Over the last 10 years the one year after 90 days survival has progressively improved in HD patients, but remained static in PD patients (figure 5.1).

Survival by age

Tables 5.4 and 5.5 show survival of all incident patients, those aged ⩾65 years and those aged <65

Table 5.3. Life expectancy in years in UK countries, 2010–2012 (source ONS [8])

	At birth		At age 65	
Country	Male	Female	Male	Female
England	79.2	83.0	18.6	21.1
Northern Ireland	77.8	82.3	17.9	20.6
Scotland	76.6	80.8	17.2	19.5
Wales	78.2	82.8	18.0	20.6
UK	**78.9**	**82.7**	**18.4**	**20.9**

Table 5.4. Unadjusted 90 day survival of incident patients, 2012 cohort, by age

Age group	Survival (%)	*95% CI*	*N*
18–64	97.5	*96.9–98.0*	3,541
⩾65	91.3	*90.3–92.2*	3,340
All ages	94.5	*93.9–95.0*	6,881

Table 5.5. Unadjusted one year after day 90 survival of incident patients, 2012 cohort, by age

Age group	Survival (%)	*95% CI*	*N*
18–64	93.8	*93.0–94.6*	3,444
⩾65	81.3	*79.8–82.6*	3,040
All ages	88.0	*87.1–88.7*	6,484

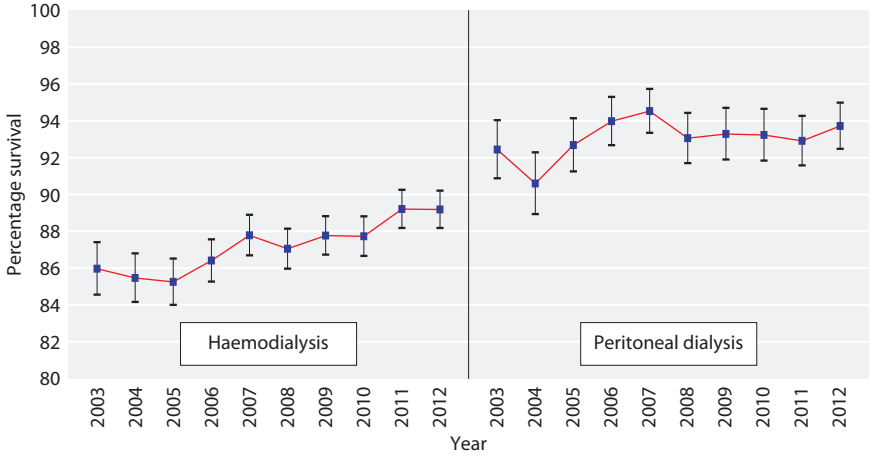

Fig. 5.1. Trend in one year after 90 day incident patient survival by first modality, 2003–2012 cohorts (adjusted to age 60) (excluding patients whose first modality was transplantation)

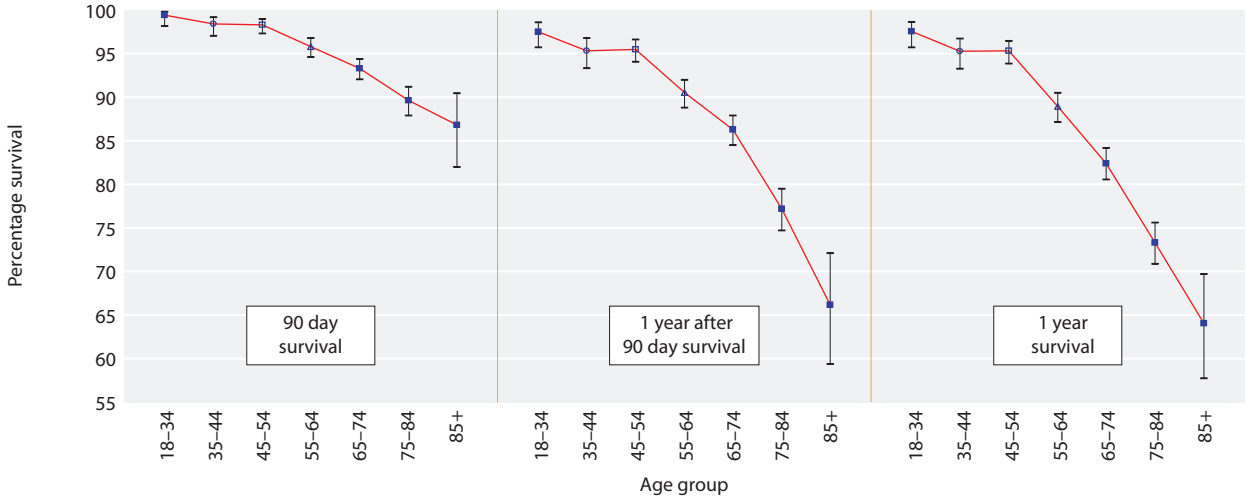

Fig. 5.2. Unadjusted survival of incident patients by age group, 2012 cohort

years. In the UK, short term survival (survival at 90 days) remains static at 94.5% (table 5.4). Survival one year after 90 days increased marginally compared to last year (87.5%) and this was mainly due to an increase in survival for patients aged ⩾65 years (table 5.5). There was a steep decline in survival with advancing age (figures 5.2 and 5.3).

There was a curvilinear increase in death rate per 1,000 patient years with age for the period one year after 90 days (figure 5.3). There was evidence that the overall death rate in Wales was higher than in the other UK countries, mostly due to a higher death rate in Wales for older patients (⩾65 years old) (figure 5.3). There was also evidence that the one year prevalent dialysis patient death rate in the 2012 cohort was higher in Wales compared to England.

From figure 5.4 it can be seen that 50% of patients starting RRT aged between 45–54 survived for over 10 years, 50% of patients starting RRT aged between 55–64 survived for about 5.8 years and 50% of patients starting RRT aged between 65–74 survived for about 3.4 years (also see also median life expectancy on RRT).

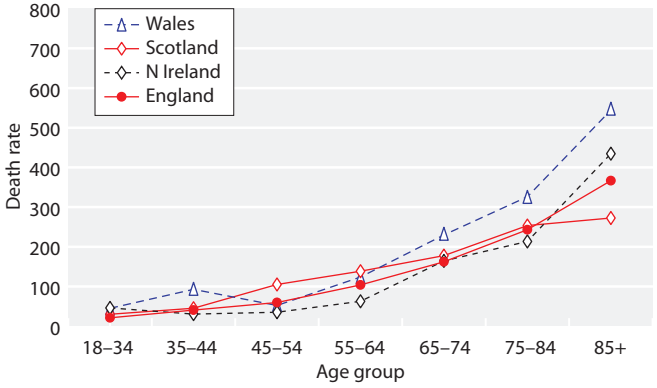

Fig. 5.3. One year after 90 days death rate per 1,000 patient years by UK country and age group for incident patients, 2009–2012 cohort

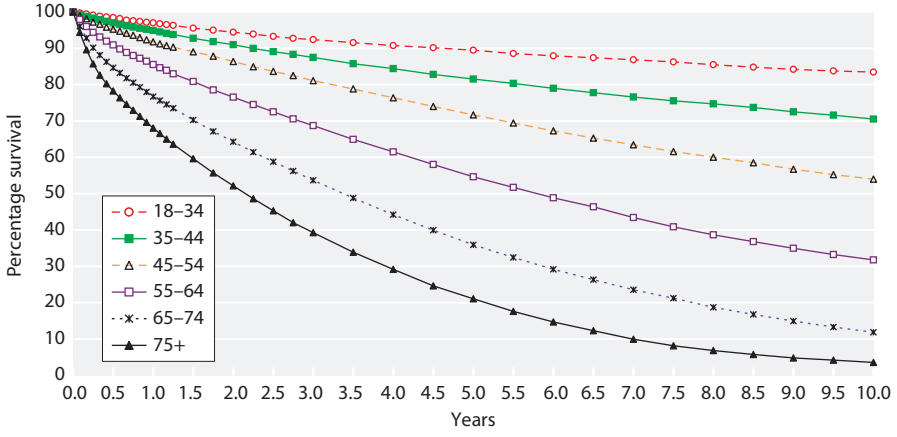

Fig. 5.4. Survival of incident patients (unadjusted), 1997–2012 cohort (from day 0), without censoring at transplantation

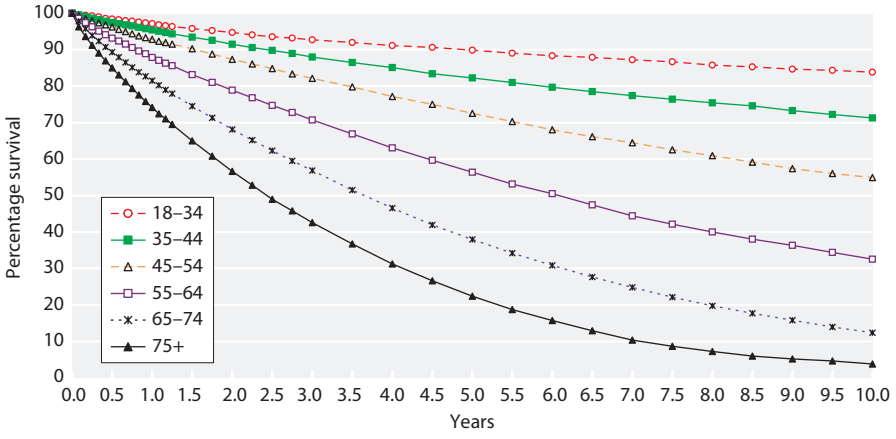

Fig. 5.5. Survival of incident patients (unadjusted), 1997–2012 cohort (from day 90), without censoring at transplantation

Figure 5.5 illustrates the survival of incident patients, without censoring at transplantation and shows that 50% of patients aged between 55–64 years survived for 6 years and 50% of patients aged between 65–74 years survived for about 3.6 years.

Censoring at transplantation would make the longer term outcomes of younger patients (who were more likely to have undergone transplantation) appear worse than they actually were. Without censoring, the 10 year survival for patients aged 18–34 years was 83.4% (figure 5.4), which contrasts with a 56.9% survival if censoring at the time of transplantation (data not shown). For more detailed information on this effect, refer to the 2008 Report [9].

Age and the hazard of death

Figure 5.6 shows the monthly hazard of death from the first day of starting RRT by age group, which falls sharply during the first 4–5 months, particularly for older patients (⩾65 years).

A 10 year increase in patient age was associated with a 1.68 times increased risk of death within 90 days and a 1.65 times increased risk of death within one year after 90 days (table 5.6).

Survival by gender

There were no survival differences between genders in an incident cohort of patients starting RRT from 2001 to 2010 and followed up for a minimum of three years until 2013 (figure 5.7). Gender differences were investigated in the first 90 days and one year after the first 90 days and

Table 5.6. Increase in proportional hazard of death for each 10 year increase in age, 2012 incident cohort

Interval	Hazard of death for 10 year age increase	*95% CI*
First 90 days	1.68	*1.54–1.82*
1 year after first 90 days	1.65	*1.56–1.75*

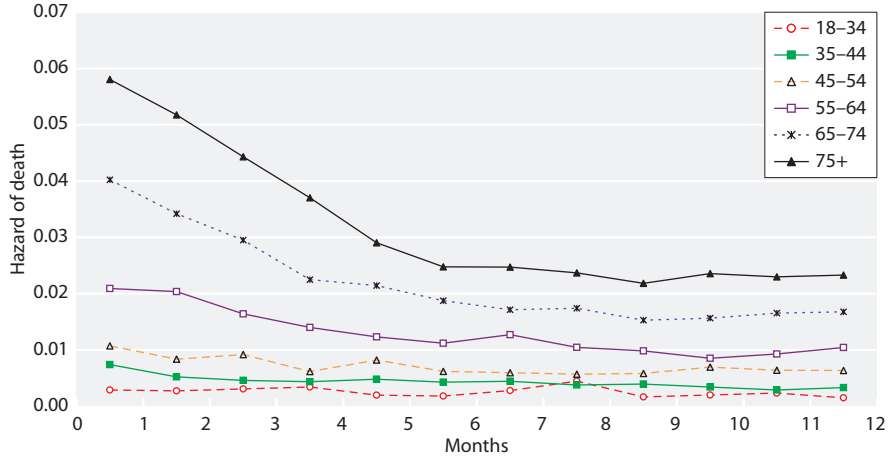

Fig. 5.6. First year monthly hazard of death, by age group 1997–2012 combined incident cohort

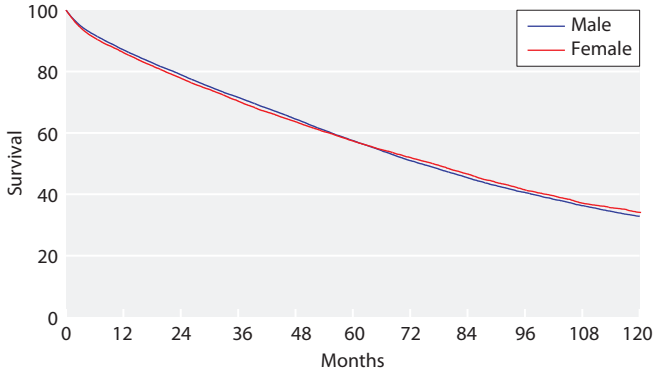

Fig. 5.7. Long term survival of incident patients by gender, 2001–2010 combined cohort, adjusted to age 60

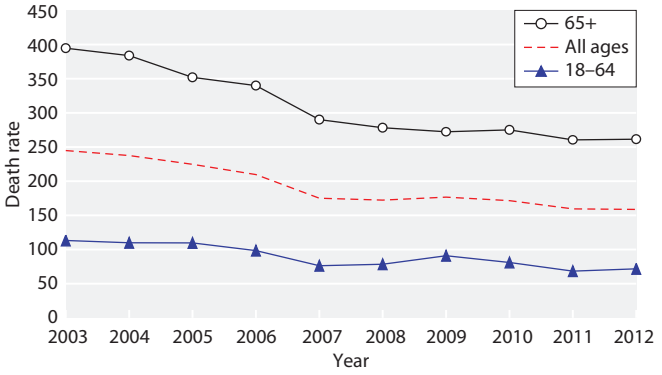

Fig. 5.8. One year incident death rate per 1,000 patient years by age group, 2003–2012 cohort

there was also no evidence of a survival difference (data not shown).

Survival in the 2003–2012 cohort

The death rate per 1,000 patient years in the first year of starting RRT from 2003 to 2012 is shown in figure 5.8. There was a declining trend in the overall death rate with a steeper rate of decline in the older age group (⩾65 years). It is important to note that these death rates are not directly comparable with those produced by the United States Renal Data System (USRDS) Registry, as the UK data include the first 90 day period when death rates are higher than subsequent time periods.

The time trend changes are shown in figure 5.9. The left hand plot, which includes only those centres that have been sending data continuously since 2003, shows a similar improvement in survival to the plot in which data from all renal centres are analysed.

One year after 90 days incident patient survival in the 2003–2012 cohort by centre, UK country and overall, can be found in appendix 1, table 5.24.

Long term survival: trends up to 10 years post RRT start

Longer term survival of patients on RRT continued to improve (tables 5.7 and 5.8). There is a steep decline in survival with advancing age. The unadjusted survival analyses (figures 5.10, 5.11) show a large improvement in one to 10 year survival across the years for both those aged under and those 65 years and over. One year survival amongst patients aged <65 years at start of RRT has improved from 87.6% in the 1998 cohort to 93.1% in the 2012 cohort.

Similarly, for patients aged ⩾65 years there has been a 14.8% absolute improvement in one year survival from the 1998 to 2012 cohorts (table 5.8). As these are observational data it remains difficult to attribute this reduction in risk of death to any specific improvements in care.

Change in survival on RRT by vintage

Figure 5.12 shows the instantaneous hazard of death by age group. There is little evidence of a worsening prognosis with time on RRT (vintage) for the majority

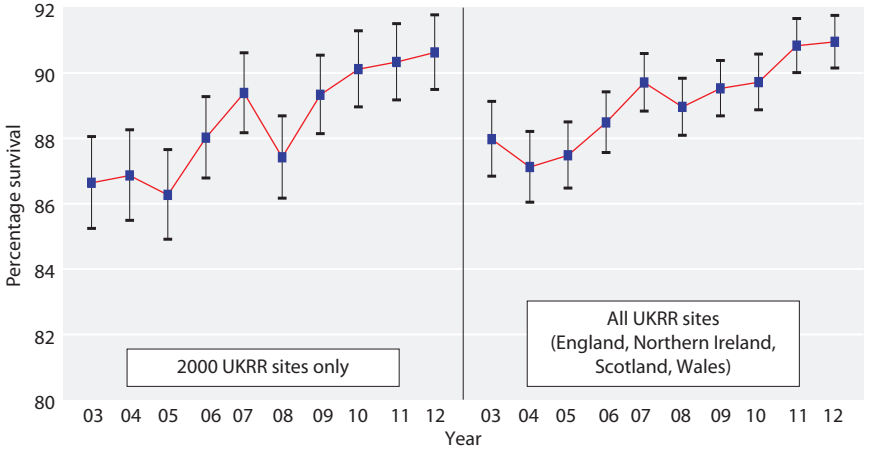

Fig. 5.9. Change in one year after 90 day survival, 2003–2012 incident cohort (adjusted to age 60)
Showing 95% confidence intervals

Table 5.7. Unadjusted survival of incident patients, 1998–2012 cohort for patients aged 18–64 years

Cohort	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10 year	*95% CI for latest year*	*N*
2012	**93.1**										***92.2–93.9***	**3,541**
2011	93.4	88.7									*87.6–89.7*	3,361
2010	92.2	86.7	81.7								*80.3–83.0*	3,370
2009	91.3	85.1	80.5	76.5							*75.0–77.9*	3,402
2008	91.6	86.1	81.2	77.1	73.3						*71.8–74.8*	3,455
2007	92.7	87.2	81.9	77.0	73.2	69.5					*67.9–71.1*	3,335
2006	90.7	85.0	80.2	75.8	72.2	68.2	64.3				*62.5–65.9*	3,166
2005	89.7	83.7	78.7	73.9	69.4	65.8	62.7	59.7			*57.8–61.5*	2,831
2004	89.6	83.5	78.1	72.7	68.0	64.3	61.2	57.4	54.9		*52.9–56.8*	2,563
2003	89.4	82.7	77.3	72.4	67.3	63.3	59.5	56.8	54.2	51.6	*49.5–53.7*	2,266
2002	88.6	80.7	74.7	69.1	65.1	61.2	57.8	54.9	51.7	49.7	*47.4–51.8*	2,030
2001	88.0	81.0	75.4	70.2	65.2	60.5	56.5	53.1	50.2	48.0	*45.6–50.3*	1,740
2000	89.2	81.4	74.5	69.2	63.7	59.1	55.6	52.5	50.1	47.3	*44.8–49.8*	1,529
1999	87.0	81.1	73.3	67.5	62.1	58.1	53.9	51.0	48.6	47.0	*44.3–49.7*	1,346
1998	87.6	80.3	74.4	69.5	64.1	59.0	55.2	53.2	50.0	47.8	*44.9–50.6*	1,170

Table 5.8. Unadjusted survival of incident patients, 1998–2012 cohort for patients aged ⩾65 years

Cohort	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10 year	*95% CI for latest year*	*N*
2012	**77.4**										***75.9–78.8***	**3,340**
2011	77.4	62.9									*61.2–64.5*	3,367
2010	76.4	63.5	51.3								*49.6–53.0*	3,280
2009	76.6	63.4	52.6	41.7							*40.0–43.4*	3,375
2008	74.7	61.4	50.2	40.7	32.6						*30.9–34.2*	3,185
2007	75.2	61.3	50.1	40.8	32.3	25.7					*24.2–27.3*	3,215
2006	72.0	58.4	47.1	37.5	29.4	23.5	18.1				*16.8–19.5*	3,131
2005	71.1	57.3	45.4	36.3	28.0	21.3	16.8	12.7			*11.5–14.0*	2,939
2004	69.2	54.3	42.8	34.3	27.1	21.4	16.7	13.3	10.3		*9.2–11.5*	2,626
2003	68.4	53.8	42.0	32.2	24.7	18.5	14.6	11.4	8.9	7.2	*6.2–8.3*	2,315
2002	66.0	50.7	40.3	31.8	23.9	18.3	13.7	10.9	8.3	6.5	*5.5–7.7*	2,086
2001	66.5	51.8	38.4	28.9	21.9	16.2	12.2	9.3	7.4	5.7	*4.6–6.9*	1,710
2000	66.0	52.4	39.6	28.6	22.3	17.3	13.3	9.9	7.7	5.9	*4.7–7.1*	1,497
1999	68.4	51.6	39.2	30.0	22.3	16.5	11.8	8.9	6.7	5.3	*4.1–6.7*	1,217
1998	62.6	45.5	36.1	26.5	20.1	14.1	10.6	7.6	5.8	4.7	*3.5–6.2*	1,020

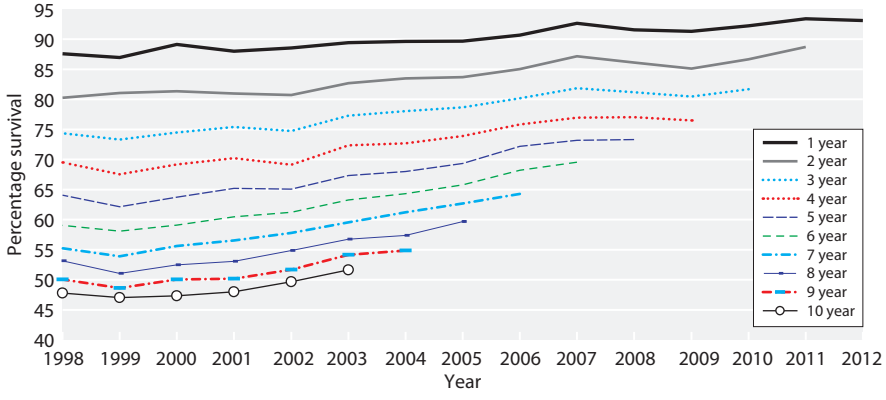

Fig. 5.10. Change in long term survival by year of starting RRT, for incident patients aged 18–64 years

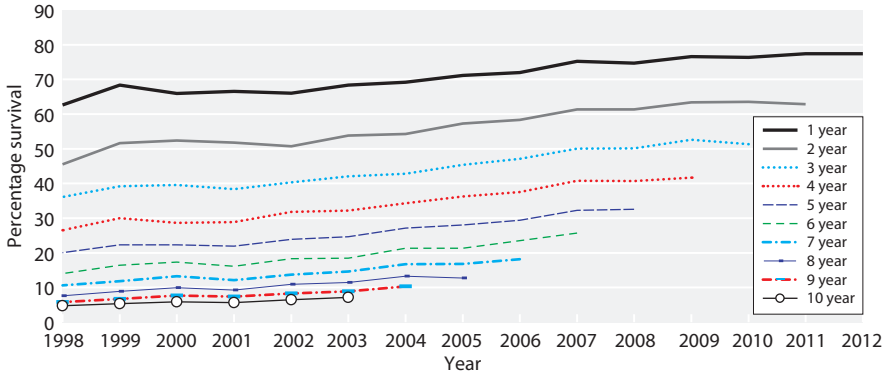

Fig. 5.11. Change in long term survival by year of starting RRT, for incident patients aged ⩾65 years

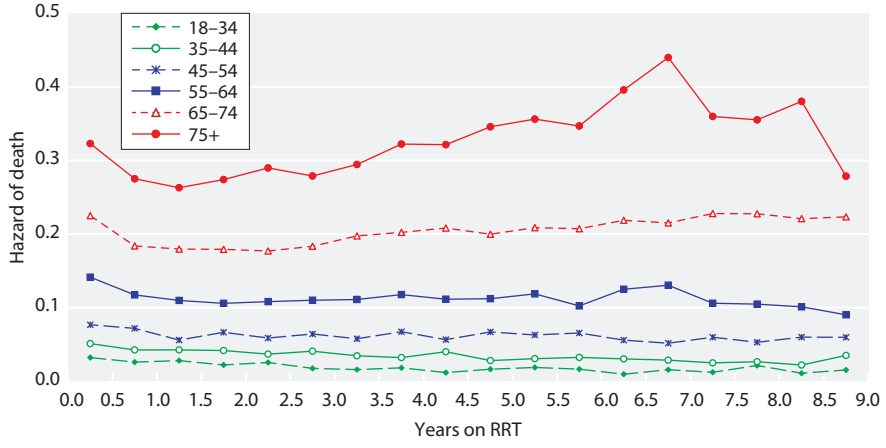

Fig. 5.12. Six monthly hazard of death, by vintage and age group, 1997–2012 incident cohort after day 90 (not censored at transplantation)

of incident RRT patients in the UK (not censored for transplantation), although an increased hazard over time is evident for incident patients aged 75 years and older. The apparent vintage effect when censoring for transplantation (data not shown) is at least in part because these younger and healthier patients are only included in the survival calculation up to the date of transplantation. In the older age groups there were decreasing numbers remaining alive beyond seven years accounting for the increased variability seen. Figures 5.13 and 5.14 show these data for the non-diabetic and diabetic patients respectively.

Centre variability in one year after 90 days survival

In the analysis of the 2012 incident cohort survival data, some of the smaller centres had wide confidence

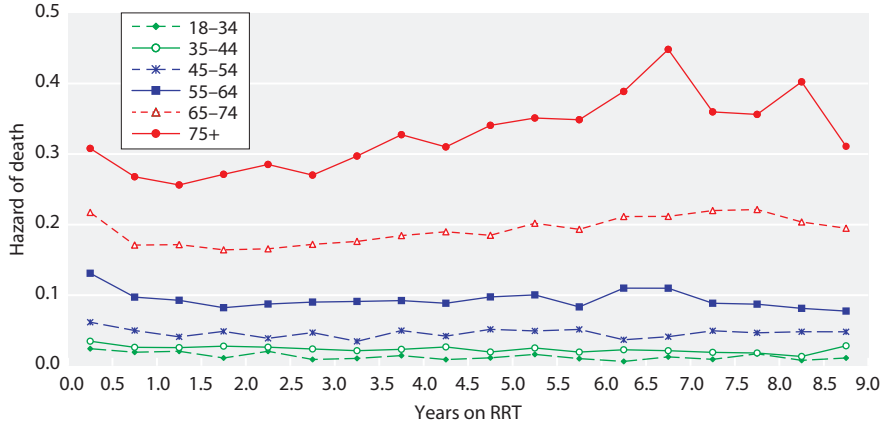

Fig. 5.13. Six monthly hazard of death, by vintage and age group, 1997–2012 non-diabetic incident cohort after day 90 (not censored at transplantation)

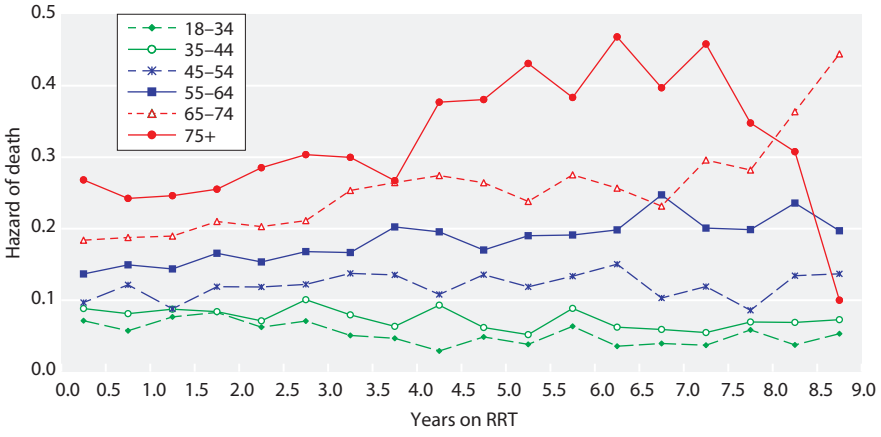

Fig. 5.14. Six monthly hazard of death, by vintage and age group, 1997–2012 diabetic incident cohort after day 90 (not censored at transplantation)

intervals (appendix 1, table 5.22) due to small numbers of patients. This was addressed by including a larger cohort across several years, which will also assess sustained performance. Similar to previous years, this is shown as a rolling four year cohort from 2009 to 2012. These data are presented as a funnel plot in figure 5.15. Table 5.9 allows centres to be identified on this graph by finding the number of patients treated by the centre and then looking up this number on the x-axis. One centre (Swansea) had survival below the 95% lower limit whilst four centres (London St. George's, London Guy's, Stevenage, Western Trust Northern Ireland) had survival above the 95% upper limit.

With 71 centres it would be expected that only three centres would be outside these limits by chance. It is important to acknowledge that these data have not been adjusted for any patient related factor except age (i.e. not comorbidity, primary renal disease or ethnicity) and have not been censored at transplantation, so the effect of differing centre rates of transplantation was not taken into account. Figure 5.16 illustrates the effect of adjusting for comorbidity on survival in centres with good comorbidity returns (⩾85%), with the biggest improvement in survival seen in Swansea. Adjustment for comorbidity could have an important effect on survival results for in some renal centres like Swansea that appear to have a higher comorbid burden in their RRT population. This could affect the outlier status of centres as illustrated in figure 5.15, but due to poor comorbidity returns for many renal centres, comorbidity adjustment for the entire incident RRT population is not yet possible. Case mix adjustment performed in a cohort of incident patients starting RRT in England from 2002 to 2006 and linked to the Hospital Episodes Statistics (HES) data, found that three of the four survival outliers were

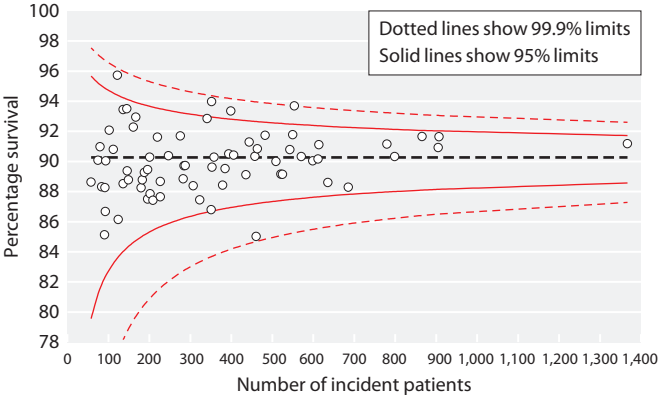

Fig. 5.15. Funnel plot for age adjusted one year after 90 days survival, 2009–2012 incident cohort

no longer outliers after adjustment for HES-derived case mix [10]. Swansea could not be evaluated in this analysis as this was only for England, but the study results highlight that variability in survival between centres is affected by case mix.

Also see appendix 1, table 5.22 and 5.23 for unadjusted and adjusted survival together with 95% confidence intervals for incident patient survival one year after 90 days and at 90 days. The one year after 90 days survival for the 2003 to 2012 cohort can be found in appendix 1, table 5.24.

Centre variability in one year after 90 day survival: impact of adjustment for comorbidity

Although comorbidity returns to the UKRR have remained poor, there was an increase in the number of centres returning ⩾85% of comorbidity data to the UKRR for patients starting RRT in 2012. Using the combined incident cohort from 2009–2012, 24 centres had returned comorbidity data for ⩾85% of patients and

Table 5.9. Age adjusted (to age 60) one year after 90 day survival, 2009–2012 incident cohort

	1 year after 90 days			
		Age adjusted survival	Limits for funnel plot	
Centre	*N*	%	Lower 95% limit	Upper 95% limit
D & Gall	58	88.6	79.5	95.7
Inverns	75	90.1	81.2	95.2
Clwyd	80	91.0	81.6	95.1
Ulster	84	88.3	81.8	95.0
Carlis	91	85.1	82.2	94.9
Newry	92	88.3	82.3	94.9
Wrexm	93	86.7	82.4	94.8
Bangor	94	90.0	82.4	94.8
Sthend	102	92.1	82.8	94.7
Antrim	112	90.8	83.2	94.5
West NI	122	95.7	83.6	94.4
Colchr	124	86.1	83.6	94.4
Klmarnk	136	88.5	84.0	94.2
Krkcldy	136	93.4	84.0	94.2
Ipswi	145	93.5	84.2	94.1
Donc	146	89.4	84.3	94.1
Basldn	149	88.8	84.3	94.1
York	161	92.3	84.6	94.0
Truro	167	92.9	84.7	93.9
Chelms	180	88.2	85.0	93.8
Dudley	183	88.8	85.0	93.8
Liv Ain	188	89.3	85.1	93.7
Airdrie	196	87.5	85.2	93.7
Abrdn	196	89.4	85.2	93.7
Dundee	201	90.3	85.3	93.7
Wirral	202	87.8	85.3	93.6
Shrew	209	87.4	85.4	93.6
Plymth	220	91.6	85.6	93.5
Bradfd	227	88.7	85.7	93.5
Sund	227	87.6	85.7	93.5
Glouc	247	90.4	85.9	93.4
Belfast	276	91.7	86.2	93.2
Derby	283	88.8	86.2	93.2
Norwch	285	89.7	86.2	93.2
Dorset	288	89.7	86.3	93.2
Edinb	307	88.4	86.4	93.1
Wolve	323	87.4	86.5	93.0
Redng	341	92.8	86.6	93.0
Newc	351	86.8	86.7	92.9
L St.G	352	94.0	86.7	92.9
Stoke	353	89.6	86.7	92.9
Hull	358	90.3	86.7	92.9
Middlbr	379	88.4	86.8	92.9
B Heart	385	89.5	86.9	92.8
Liv Roy	394	90.5	86.9	92.8
Stevng	399	93.4	86.9	92.8
Covnt	406	90.4	87.0	92.8
Brightn	436	89.1	87.1	92.7
Nottm	444	91.3	87.1	92.7
Swanse	455	84.3	87.2	92.7
Camb	458	90.3	87.2	92.7
Kent	464	90.8	87.2	92.6
Exeter	483	91.7	87.3	92.6
Prestn	509	90.0	87.4	92.5
Salford	521	89.2	87.4	92.5
L Kings	525	89.1	87.4	92.5
Leeds	543	90.8	87.5	92.5
Sheff	550	91.8	87.5	92.5
L Guys	554	93.7	87.5	92.5
Bristol	571	90.3	87.5	92.4
M RI	599	90.0	87.6	92.4
Ports	612	90.2	87.6	92.4
Oxford	614	91.1	87.6	92.4
Glasgw	636	88.6	87.7	92.3
Cardff	691	88.3	87.8	92.3
L Rfree	780	91.1	88.0	92.1
Carsh	799	90.3	88.0	92.1
B QEH	866	91.7	88.1	92.1
Leic	905	90.9	88.1	92.0
L Barts	907	91.6	88.1	92.0
L West	1,367	91.2	88.6	91.7

these centres were included in this analysis. Adjustment was first performed to age 60, then to the average distribution of primary renal diagnoses for the 24 centres. Further adjustment was then made to the average distribution of comorbidities present at those centres (table 5.10).

It can be seen that adjustment for age has the largest effect, most notably in those centres with the lower unadjusted survival figures. Survival improved for all centres after adjustment for age, as the average age for incident patients was higher than the adjustment to the average age of 60 years. There were only minor differences for most centres after adjustment for primary renal diagnosis (PRD), but survival increased by $\geqslant$1% for four centres (Swansea, Wrexham, Newry, Derby). In six centres (Swansea, Newry, Basildon, Middlesbrough, Bradford, Leeds) adjustment for comorbidity had a noticeable effect on adjusted survival (table 5.10, figure 5.16) helping explain the lower survival noted in figure 5.15. After adjustment for age, PRD and comorbidity, Swansea and Ulster had a noticeable improvement in survival of 10.3% and 7.5% respectively.

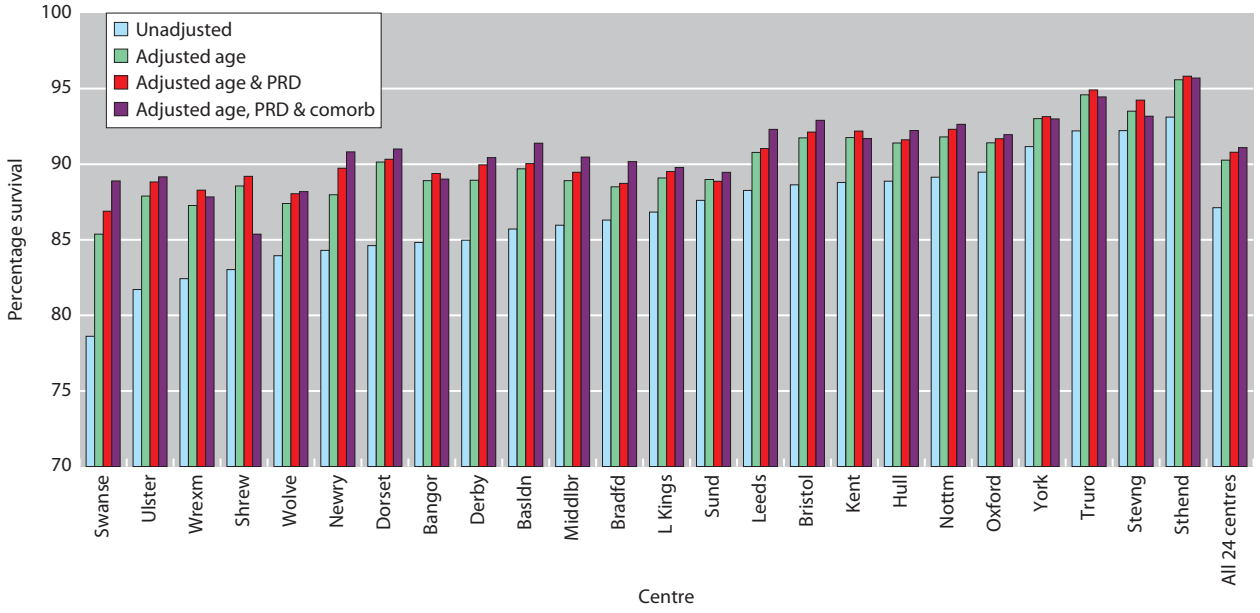

Fig. 5.16. The effect on survival after sequential adjustment for age, PRD and comorbidity, 2009–2012 incident cohort

Table 5.10. The effect of adjustment for age, PRD and comorbidity on survival, 2009–2012 incident cohort, % survival one year after 90 days

Centre*	Unadjusted	Age adjusted	Age, PRD adjusted	Age, PRD and comorbidity adjusted
Swanse	78.6	85.4	86.9	88.9
Ulster	81.7	87.9	88.8	89.2
Wrexm	82.4	87.3	88.3	87.8
Shrew	83.0	88.6	89.2	85.4
Wolve	83.9	87.4	88.1	88.2
Newry	84.3	88.0	89.7	90.8
Dorset	84.6	90.1	90.3	91.0
Bangor	84.8	88.9	89.4	89.0
Derby	85.0	88.9	90.0	90.4
Basldn	85.7	89.7	90.0	91.4
Middlbr	86.0	88.9	89.5	90.5
Bradfd	86.3	88.5	88.7	90.2
L Kings	86.8	89.1	89.5	89.8
Sund	87.6	89.0	88.9	89.5
Leeds	88.3	90.8	91.0	92.3
Bristol	88.6	91.7	92.1	92.9
Kent	88.8	91.8	92.2	91.7
Hull	88.9	91.4	91.6	92.2
Nottm	89.1	91.8	92.3	92.6
Oxford	89.5	91.4	91.7	92.0
York	91.2	93.0	93.1	93.0
Truro	92.2	94.6	94.9	94.5
Stevng	92.2	93.5	94.2	93.2
Sthend	93.1	95.6	95.8	95.7
All 24 centres	87.1	90.3	90.8	91.1

*Centre included if ⩾85% comorbidity data available

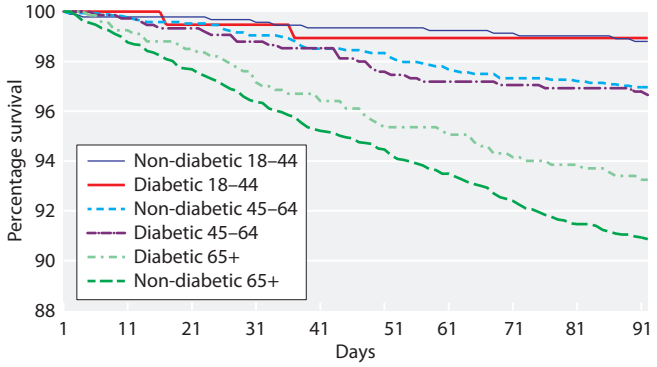

Fig. 5.17. Survival at 90 days for incident diabetic and non-diabetic patients by age group for patients starting RRT, 2012 cohort

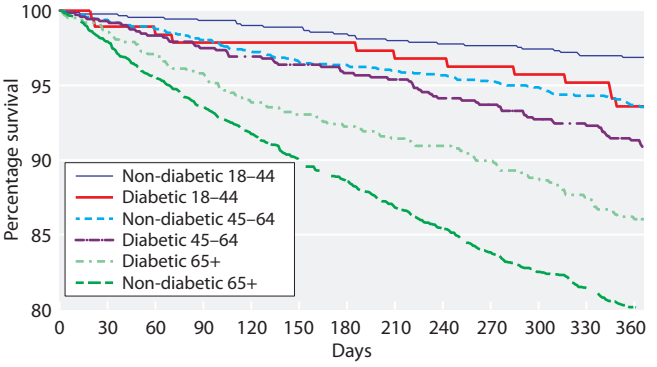

Fig. 5.18. Survival at one year after 90 days for incident diabetic and non-diabetic patients by age group for patients starting RRT, 2012 cohort

Survival in patients with diabetes

Although it has previously been shown that diabetic patients have worse long term survival compared to non-diabetic patients [3], non-diabetic patient survival in the older age group (⩾65 years) was worse compared to diabetic patients in the same age group during the first 90 days of starting RRT (2012 cohort) (figure 5.17) and in the subsequent year (figure 5.18); this might be due to patient selection.

Long term survival for diabetic and non-diabetic patients was evaluated in a cohort of patients starting RRT from 2001 to 2010 with a minimum of three years follow up until 2013. These data show large differences between diabetic and non-diabetic patient survival in the age groups 18–44 and 45–64 years, but there was very little difference in five year survival between diabetic and non-diabetic patients in the older age group (⩾65 years). In age group 18–44, 89% of non-diabetic patients were alive five years after start of RRT compared to 71% for diabetic patients. In the age group 45–64, 67% of non-diabetic patients were alive five years after start of RRT compared to 50% for diabetic patients (figure 5.19).

Median life expectancy on RRT

Figure 5.20 shows median life expectancy for incident RRT and diabetic patients after 90 days by age group. Incident patients starting RRT from 2001 to 2010 have been included in this analysis and patients were followed up for a minimum of three years. The estimated median survival will be different for low risk patients (e.g. polycystic kidney disease with a transplant) vs. high risk patients (diabetes with previous myocardial infarction on dialysis) even within the same age group. Median life years remaining for non-diabetic patients were also

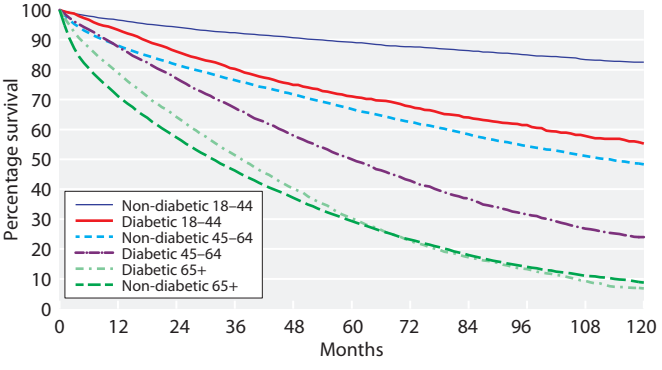

Fig. 5.19. Long term survival for incident diabetic and non-diabetic patients by age group, 2001–2010 cohort, followed up for a minimum of three years

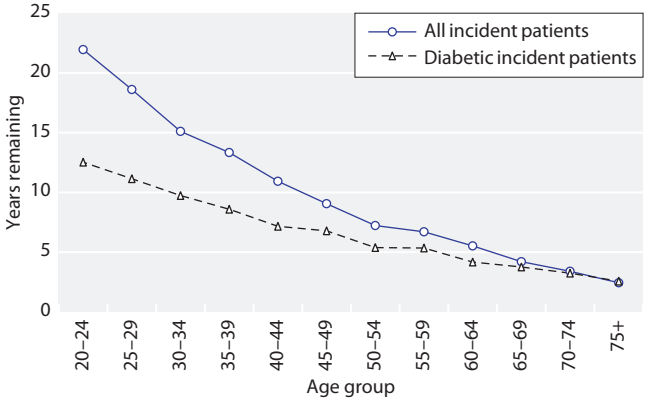

Fig. 5.20. Median life expectancy on RRT after 90 days, by age group, incident and incident diabetic patients starting RRT from 2001–2010

Table 5.11. One year survival of prevalent RRT patients in the UK (unadjusted unless indicated otherwise)

Patient group	Patients	Deaths	Survival	*95% CI*
Dialysis patients 2012 cohort				
All	26,285	3,640	85.5	*85.1–85.9*
All–adjusted to age 60	26,285	3,640	89.3	*88.8–89.7*
2 year survival – dialysis patients				
All patients alive on 31/12/2011	25,925	6,540	72.6	*72.0–73.2*

Cohorts of patients alive on 31/12/2012 unless indicated otherwise

calculated and show that median life expectancy for patients younger than 45 was on average nine years more for non-diabetic patients (data not shown) compared with age matched diabetic patients. In the older age group (⩾65 years), the median life years remaining were similar between diabetic and non-diabetic patients.

Survival in prevalent dialysis patients

Overall survival

Table 5.11 shows the one year survival for prevalent patients on dialysis. One year age adjusted survival for prevalent dialysis patients remained relatively unchanged at 89.3% in the 2012 cohort compared to 89.7% in the 2011 cohort.

Survival by UK country

The one year death rate for prevalent dialysis patients in each UK country is shown in table 5.12 for the 2012 cohort. There was evidence that the one year death rate in Wales was higher than in England and Northern Ireland; the higher median age in Wales compared to England and socio-economic reasons like life expectancy of the population and area deprivation, would affect the death rate in Wales. These results are unadjusted for age, PRD or comorbidity.

Table 5.12. One year death rate per 1,000 prevalent dialysis patient years in the 2012 cohort and median age of prevalent patients by country

	England	N Ireland	Scotland	Wales
Death rate	154	145	168	198
95% CI	149–160	119–160	150–188	172–226
Median age	66.2	68.4	66.2	68.2

One year survival of prevalent dialysis patients by centre

The age adjusted (adjusted to age 60) one year survival of dialysis patients by centre is illustrated in a funnel plot (figure 5.21). With over 70 centres included, it would be expected by chance that three centres would fall outside the 95% (1 in 20) confidence limits. The survival for four centres (Doncaster, Shrewsbury, Newcastle, Manchester RI) was below the 95% confidence limits, and for three centres (Cambridge, Birmingham QEH, Sheffield) above the 95% confidence limits.

Case mix adjustment performed in a cohort of incident patients starting RRT in England from 2002 to 2006 and linked to the HES data, showed that the lower than expected survival in Newcastle may be explained by case mix [10]. This study found that three of the four survival outliers were no longer outliers after adjustment for HES-derived case mix. It is not yet possible to routinely perform this adjustment using HES-linked data, but looking back at the 2002–2006 HES-linked data, Newcastle's survival did increase more than other centres after case mix adjustment and so their current

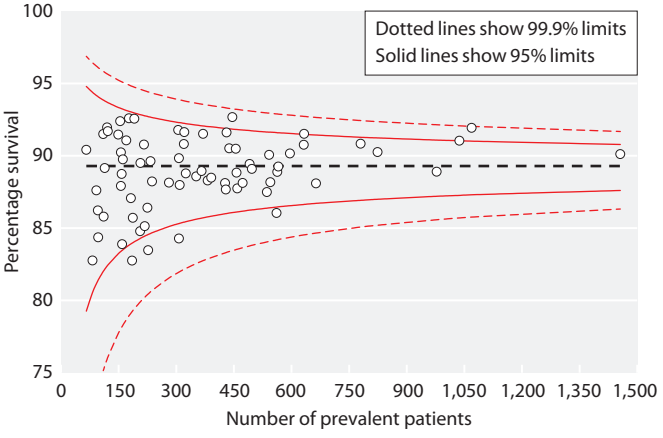

Fig. 5.21. One year survival funnel plot of prevalent dialysis patients by centre adjusted to age 60, 2012 cohort

Table 5.13. One year survival of prevalent dialysis patients in each centre (adjusted to age 60), 2012 cohort

Centre	*N*	Adjusted one year survical	Limits for funnel plot	
			Lower 95% limit	Upper 95% limit
D & Gall	66	90.4	79.3	94.8
Carlis	82	82.8	80.6	94.4
Inverns	92	87.6	81.2	94.2
Clwyd	96	86.2	81.4	94.1
Bangor	97	84.4	81.4	94.1
Newry	110	91.5	82.0	93.9
Colchr	111	85.8	82.1	93.8
Wrexm	114	89.2	82.2	93.8
Ulster	120	92.0	82.4	93.7
Sthend	122	91.7	82.5	93.7
York	149	91.5	83.2	93.3
Antrim	154	92.4	83.4	93.3
Ipswi	156	87.9	83.4	93.3
Chelms	156	90.2	83.4	93.3
Truro	158	88.7	83.4	93.3
Liv Ain	159	83.9	83.5	93.2
Plymth	161	89.8	83.5	93.2
Krkcldy	170	91.1	83.7	93.1
West NI	177	92.6	83.8	93.1
Klmarnk	182	87.1	83.9	93.0
Donc	185	82.8	84.0	93.0
Airdrie	187	85.7	84.0	93.0
Basldn	191	92.6	84.1	93.0
Sund	206	84.8	84.3	92.8
Dundee	207	89.5	84.3	92.8
Wirral	216	90.8	84.4	92.8
Bradfd	218	85.1	84.5	92.8
Dudley	225	86.4	84.5	92.7
Shrew	227	83.5	84.6	92.7
Glouc	233	89.6	84.6	92.7
Abrdn	237	88.2	84.7	92.6
Belfast	281	88.1	85.1	92.4
Dorset	305	91.8	85.3	92.3
Newc	307	84.3	85.3	92.3
Edinb	307	89.8	85.3	92.3
Derby	309	88.0	85.3	92.3
Redng	320	90.8	85.4	92.2
L St.G	321	91.6	85.4	92.2
Middlbr	325	88.8	85.4	92.2
Norwch	352	88.6	85.6	92.1
Wolve	366	88.9	85.7	92.1
Stoke	370	91.5	85.7	92.1
Swanse	382	88.3	85.8	92.0
Hull	391	88.5	85.8	92.0
Brightn	427	88.1	86.0	91.9
Kent	429	87.7	86.0	91.9
Exeter	431	91.6	86.0	91.9
Covnt	438	90.5	86.0	91.9
Camb	446	92.7	86.1	91.8
Nottm	455	90.5	86.1	91.8
B Heart	457	88.8	86.1	91.8
Liv Roy	459	87.7	86.1	91.8
Salford	473	88.1	86.2	91.8
Oxford	491	89.4	86.2	91.7
Stevng	497	89.1	86.3	91.7
Cardff	536	87.5	86.4	91.6
Bristol	542	90.1	86.4	91.6
Leeds	545	88.2	86.4	91.6
M RI	561	86.0	86.5	91.6
Prestn	563	88.9	86.5	91.6
L Kings	566	89.3	86.5	91.6
Ports	596	90.2	86.6	91.5
L Guys	632	90.8	86.6	91.5
Sheff	633	91.5	86.6	91.5
Glasgw	664	88.1	86.7	91.4
L Rfree	780	90.8	86.9	91.3
Carsh	824	90.3	87.0	91.2
Leic	978	88.9	87.2	91.1
L Barts	1,037	91.0	87.3	91.0
B QEH	1,069	91.9	87.3	91.0
L West	1,456	90.1	87.6	90.8

outlier status may reflect a higher comorbid burden in their dialysis population. Considering other outliers this year, Shrewsbury's survival did not increase more than the average after the HES-derived case mix adjustment and the impact from case mix cannot be commented on for Doncaster and Manchester RI as they were not part of the 2002–2006 HES-linked cohort analysis due to joining the UKRR only in 2007.

The funnel plot analysis shows an increase in the number of centres that are outliers below the below the 95% lower limits compared to the 2011 cohort when there were two outlying centres. The number of centres that were outliers above the 95% upper limit increased from two in the 2011 cohort to three in this most recent analysis.

Table 5.13 allows centres in figure 5.21 to be identified by finding the number of patients treated by the centre and the corresponding survival and then looking this up on the axes of the funnel plot.

One year survival of dialysis patients by centre is illustrated in figures 5.22 and 5.23 for patients aged <65 years and those aged $\geqslant 65$ years.

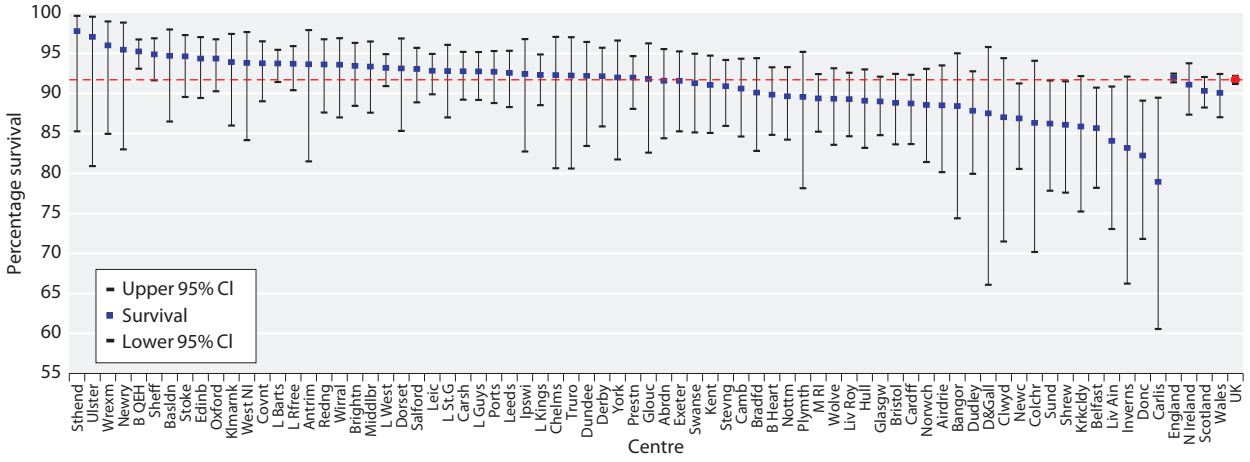

Fig. 5.22. One year survival of prevalent dialysis patients aged under 65 by centre, 2012 cohort

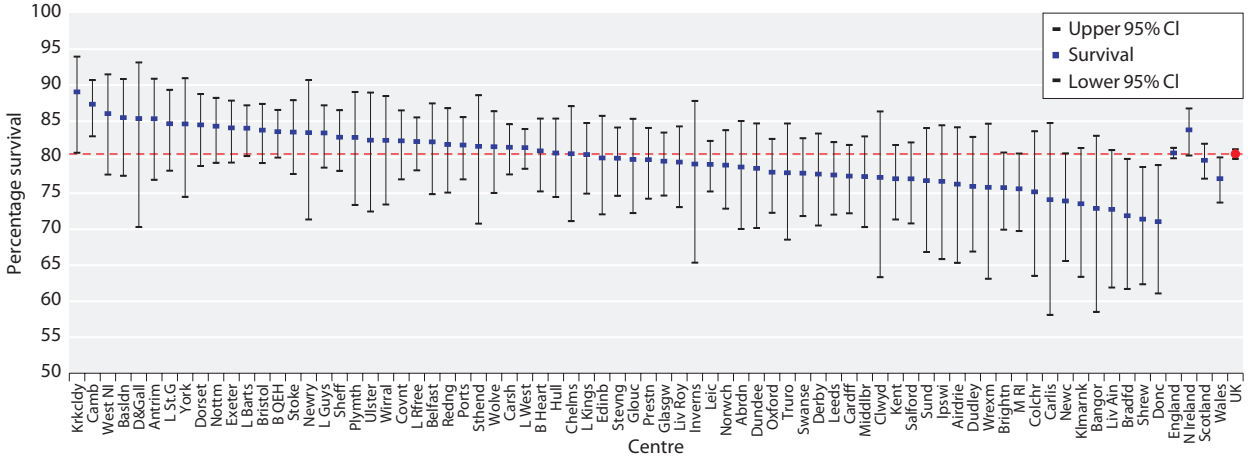

Fig. 5.23. One year survival of prevalent dialysis patients aged 65 years and over by centre, 2012 cohort

Survival by age group

Figure 5.24 shows the one year survival of prevalent dialysis patients who were alive and receiving dialysis on 31st December 2012, stratified by age group. There was a curvilinear decrease in survival with increasing age, especially so for patients aged ⩾75 years (figure 5.24).

One year death rate in prevalent dialysis patients in the 2012 cohort by age group

The death rates for prevalent patients on dialysis by age group are shown in figure 5.25. The younger patients included in this analysis are a selected higher risk group, as the similar aged transplanted patients have been excluded. The increase in the death rate was not linear with age; with a 10 year increase in age in the younger

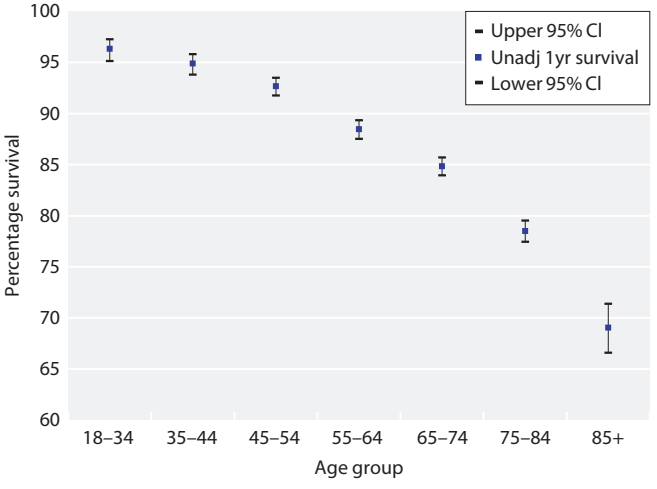

Fig. 5.24. One year survival of prevalent dialysis patients by age group, 2012 cohort

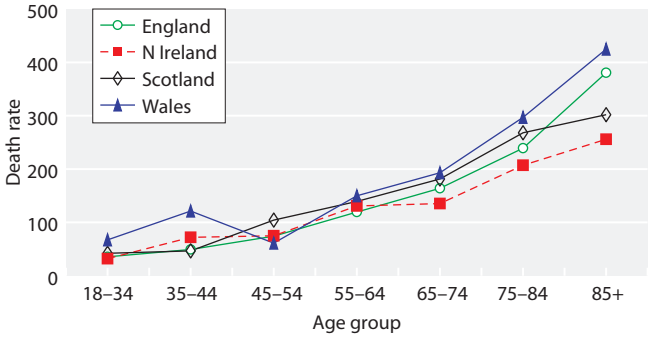

Fig. 5.25. One year death rate per 1,000 patient years by UK country and age group for prevalent dialysis patients, 2012 cohort

Table 5.14. One year survival of prevalent RRT patients in the UK by age group and diabetic status

Patient group	Patients	Deaths	Survival	*95% CI*
Dialysis patients 2012 cohort				
All, age <65	12,273	940	91.7	*91.2–92.2*
All, age 65+	14,012	2,700	80.4	*79.8–81.1*
Non-diabetic <65	9,611	592	93.3	*92.7–93.8*
Non-diabetic 65+	11,033	2,081	80.8	*80.1–81.5*
Diabetic <65	2,662	348	86.1	*84.7–87.4*
Diabetic 65+	2,979	619	79.0	*77.5–80.5*

Cohorts of patients alive on 31/12/2012

patients, the death rate increased by about 15 deaths per 1,000 patient years compared with an increase of about 130 deaths per 1,000 patient years in the older age groups. There was no evidence that the apparent differences between the countries were significant except for Wales where there was evidence that the death rate was higher compared to England.

Time trends in survival, 2003 to 2012

Figure 5.26 illustrates that one year survival for prevalent dialysis patients has gradually improved since 2003. In Northern Ireland and Wales the numbers of patients were much smaller than in England and survival was therefore more variable with very wide confidence intervals, making it difficult to draw conclusions on trends. The change in prevalent survival by centre over the cohort years 2003 to 2012 is shown in this chapter, appendix 1, table 5.25.

Survival in patients with diabetes

There was a large difference in one year survival between diabetic and non-diabetic prevalent dialysis patients in the younger age group (aged <65 years), whereas survival was very similar for older diabetic and non-diabetic patients (⩾65 years) (table 5.14). Similar findings were reported for incident patients (see section on survival in patients with diabetes).

Time trends in patient with a primary diagnosis of diabetes

The age adjusted one year survival for dialysis patients with diabetic primary renal disease in the UK are shown in table 5.15.

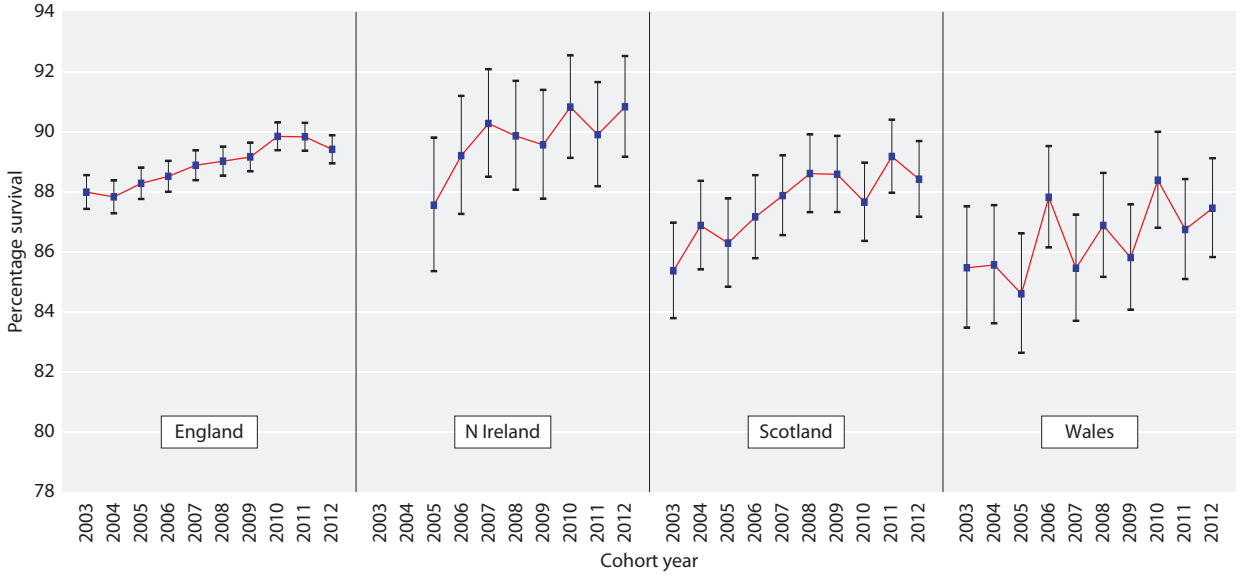

Fig. 5.26. Serial one year survival for prevalent dialysis patients by UK country, 2003 to 2012 cohort years, adjusted to age 60

Table 5.15. Serial one year survival of prevalent dialysis patients with a primary diagnosis of diabetes, 2003–2012 cohort years

	Year									
Survival	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1 year survival %	81.8	82.8	82.4	84.8	83.6	84.0	83.5	85.1	85.2	84.6

Death rate on RRT compared with the UK general population

The death rate compared to the general population is shown in table 5.16. The relative risk of death on RRT decreased with age from 16.2 times that of the general population at age 35–39 years to 2.6 times the general population at age 85 and over. Figure 5.27 shows that the relative risk of death has decreased substantially for the younger age groups (<50 years) compared to the relative risk of death in the 1998–2001 cohort. The overall relative risk of death at 6.2 in the 2012 cohort is similar to that in the 2011 and 2010 cohort. With the reduction in rates of death on RRT over the last 10 years, the relative risk of death is falling (7.7 in 1998–2001 cohort).

Table 5.16. Death rate by age group for all prevalent RRT patients, 2012 cohort, compared with the general population and with previous analyses in the 1998–2001 cohort

Age group	UK population mid 2013 (thousands)	UK deaths in 2013	Death rate per 1,000 population	Expected number of deaths in UKRR population	UKRR deaths in 2013	UKRR death rate per 1,000 prevalent RRT patients	Relative risk of death in 2013	Relative risk of death 1998–2001 cohort
20–24	4,313	1,496	0.3	0	15	15	44.4	41.1
25–29	4,350	1,996	0.5	1	13	9	18.5	41.8
30–34	4,327	2,782	0.6	1	32	15	22.7	31.2
35–39	3,967	3,807	1.0	3	43	16	16.2	26.0
40–44	4,496	6,413	1.4	6	109	26	18.1	22.6
45–49	4,687	9,728	2.1	11	165	31	14.8	19.0
50–54	4,344	13,759	3.2	18	223	38	12.1	12.8
55–59	3,757	19,026	5.1	29	335	59	11.6	10.1
60–64	3,541	28,361	8.0	45	442	79	9.9	10.4
65–69	3,491	42,380	12.1	69	596	105	8.6	7.9
70–74	2,539	52,165	20.5	97	690	147	7.1	7.2
75–79	2,092	72,499	34.7	135	787	203	5.9	5.3
80–84	1,550	96,885	62.5	155	675	272	4.3	4.0
85+	1,459	219,977	150.8	172	444	389	2.6	3.0
Total	**48,913**	**571,274**	**11.7**	**742**	**4,569**	**88**	**6.2**	**7.7**

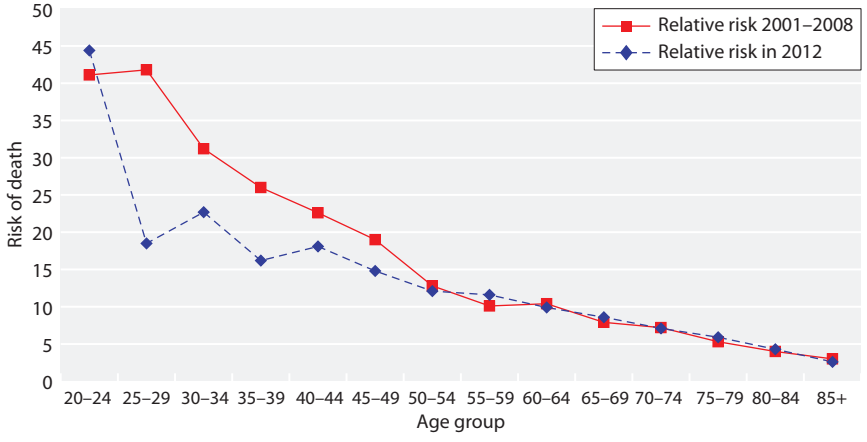

Fig. 5.27. Relative risk of death in prevalent RRT patients in the 2012 cohort compared to the UK general population

Cause of death

Data completeness

Completeness of cause of death data was 70.0% in 2013 (see appendix 1, table 5.26). A large improvement of 35% in the completeness of cause of death data for Wales, contributed to the overall UK improvement of 2.2% in 2013 (appendix 1, table 5.26). Some centres consistently achieve a very high rate of data return for cause of death because a process is in place to ensure that these data were entered. Several centres have shown substantial improvement in data returns (appendix 1, table 5.26), but there was still much variability between the centres regarding the completeness of cause of death with some centres returning no data and other centres having 100%.

Cause of death in incident RRT patients

Cause of death within the first 90 days

See table 5.17.

Cause of death within one year after 90 days

Treatment withdrawal as a cause of death (tables 5.17, 5.18) in incident patients in the first 90 days and one year after 90 days was more common in older patients (aged 65+) and malignancy more common in younger patients (<65 years old). Infection as cause of death within the first 90 days was more common in older patients. Cardiac disease remained the leading cause of death both in the first 90 days and one year after 90 days. Treatment withdrawal as cause of death at 90 days has increased in older patients (aged 65+) during the last three years (data not shown).

Cause of death in prevalent RRT patients in the 2012 cohort

Table 5.19 shows the cause of death for both prevalent dialysis and transplant patients in the 2012 cohort. These data are neither age adjusted nor adjusted for differences in the comorbidity between the two groups. Cardiac

Table 5.17. Cause of death in the first 90 days for incident patients by age group, 2000–2012 cohort

	All age groups		<65 years		⩾65 years	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	717	26	171	29	546	26
Cerebrovascular disease	132	5	30	5	102	5
Infection	480	18	88	15	392	18
Malignancy	253	9	75	13	178	8
Treatment withdrawal	414	15	56	9	358	17
Other	625	23	155	26	470	22
Uncertain	115	4	23	4	92	4
Total	**2,736**		**598**		**2,138**	
No cause of death data	2,582	49	570	49	2,012	48

Table 5.18. Cause of death at one year after 90 days for incident patients by age group, 2000–2012 cohort

	All age groups		<65 years		⩾65 years	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	1,133	23	368	26	765	21
Cerebrovascular disease	251	5	69	5	182	5
Infection	921	18	258	18	663	18
Malignancy	543	11	181	13	362	10
Treatment withdrawal	833	17	119	8	714	20
Other	1,071	21	335	24	736	20
Uncertain	274	5	83	6	191	5
Total	**5,026**		**1,413**		**3,613**	
No cause of death data	4,563	47.6	1,285	47.6	3,278	47.6

Table 5.19. Cause of death in prevalent RRT patients by modality, 2012 cohort

	All modalities		Dialysis		Transplant	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	734	23	647	24	87	17
Cerebrovascular disease	136	4	111	4	25	5
Infection	664	21	531	20	133	26
Malignancy	311	10	186	7	125	24
Treatment withdrawal	525	16	517	19	8	2
Other	660	21	543	20	117	23
Uncertain	186	6	161	6	25	5
Total	**3,216**		**2,696**		**520**	
No cause of death data	1,353	30	1,130	30	223	30

Table 5.20. Cause of death in prevalent transplanted patients by age group, 2012 cohort

	All age groups		<65 years		⩾65 years	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	87	17	47	18	40	16
Cerebrovascular disease	25	5	11	4	14	5
Infection	133	26	65	25	68	27
Malignancy	125	24	73	28	52	20
Treatment withdrawal	8	2	5	2	3	1
Other	117	23	54	20	63	25
Uncertain	25	5	9	3	16	6
Total	**520**		**264**		**256**	
No cause of death data	223	30	110	29	113	31

disease as a cause of death was less common in transplanted patients as these were a pre-selected low risk group of patients. Malignancy and infection were both responsible for a greater percentage of deaths in prevalent transplanted patients, with treatment withdrawal a common cause of death in the prevalent dialysis population.

Table 5.20 shows that malignancy and cardiac disease were slightly more common in younger (<65 years) prevalent transplanted patients as the cause of death than in older (⩾65 years old) transplanted patients.

Table 5.21 shows the cause of death for prevalent dialysis patients in the 2012 cohort. Prevalent dialysis patients aged ⩾65 years were substantially more likely to withdraw from treatment than younger patients and cardiac disease was much more common as a cause of death in younger (<65 years) dialysis patients. Figure 5.28

Table 5.21. Cause of death in prevalent dialysis patients by age group, 2012 cohort

	All age groups		<65 years		⩾65 years	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	647	24	223	32	424	21
Cerebrovascular disease	111	4	37	5	74	4
Infection	531	20	149	21	382	19
Malignancy	186	7	37	5	149	7
Treatment withdrawal	517	19	56	8	461	23
Other	543	20	162	23	381	19
Uncertain	161	6	43	6	118	6
Total	**2,696**		**707**		**1,989**	
No cause of death data	1,130	30	296	30	834	30

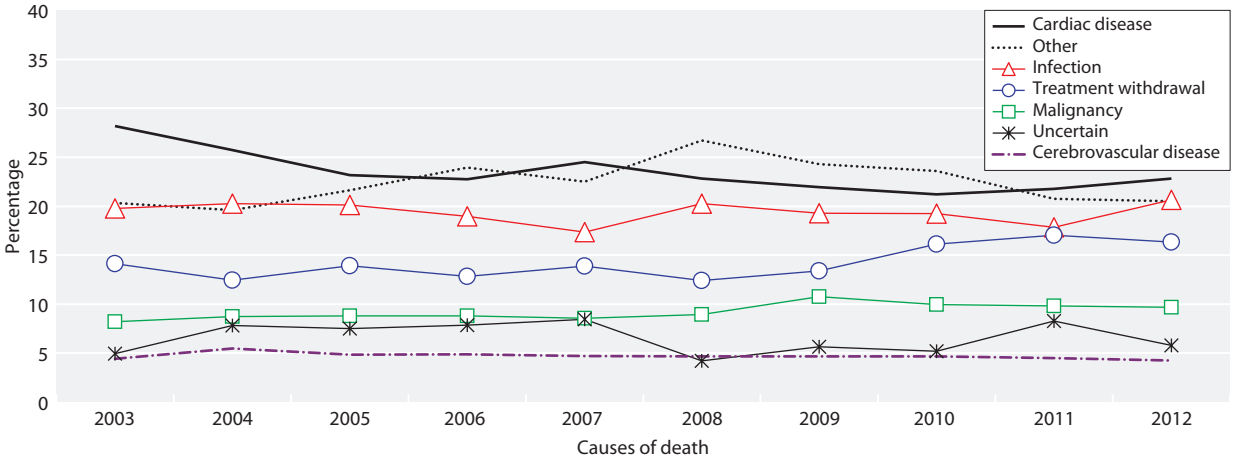

Fig. 5.28. Cause of death in prevalent RRT patients by cohort year

shows cause of death for prevalent patients in the 2003 to 2012 cohort. Over time, cardiovascular disease as cause of death has decreased markedly; treatment withdrawal has increased over time, while infection as cause of death remained at a high level over this period (figure 5.27).

Conclusions

One year after 90 days age adjusted (adjusted to age 60) survival for incident RRT patients improved over the last 10 years (2003 to 2012 cohorts), although survival in the 2012 cohort remained relatively unchanged at 91.0% compared to 90.9% for those patients starting RRT in 2011. Prevalent dialysis patient survival remained static over the last three years (2010 to 2012 cohort).

One year after 90 day survival in incident patients with diabetes aged $\geqslant$65 years, was better compared to non-diabetic patients, whereas in younger (aged $<$65 years) incident patients with diabetes, survival was worse compared to non-diabetic patients. The relative risk of death on RRT decreased with age from 16.2 times that of the general population at age 35–39 years to 2.6 times the general population at age 85 and over.

In the prevalent RRT population, cardiovascular disease accounted for 27% of deaths, infection and other causes of death accounted for 21% of deaths each and treatment withdrawal for 16% of deaths. Since 2003, infection as cause of death remained high and treatment withdrawal as cause of death increased.

There was much variability in survival between centres, with outlying centres below the lower 95% and 99% confidence limits for incident RRT and prevalent dialysis patient survival. The survival analyses in this chapter have not been adjusted for any case-mix factors except for age, and differences in primary renal diagnosis, ethnicity, comorbidity and life expectancy in the general population have not been considered.

Research has suggested that adjustment for comorbidity only explains a modest part of the variance in ERF patient outcomes [10]. At centre level however, the prevalence of comorbidities could vary substantially between patient populations of the different renal centres and it would be expected that adjustment for comorbidity may explain an increased amount of the variance in survival outcome. An incident patient analysis evaluating the effect of adjusting for PRD and comorbidity in addition to age in those centres returning $\geqslant$85% of comorbidities, showed that at centre level, there is clear benefit in some centres when adjusting for PRD and comorbidities. Research using comorbid conditions identified from the HES data, illustrated that adjusting for HES derived case-mix, including comorbid conditions, affected the position and outlying status of some renal centres on the funnel plot for incident patients and reduced outlying centres from four to one [11]. Variation in the proportion of patients with terminal illness receiving RRT between centres could also contribute to variations in survival and provide a possible explanation for lower survival than expected for some centres. Survival adjusted for case-mix (age, ethnicity, PRD and comorbidity) will be introduced in future UKRR reports and this will provide a fairer comparison of centres and a more accurate identification of outlying centres on the funnel plots.

Conflicts of interest: none

References

1 Plantinga LC, Fink NE, Levin NW, et al.: Early, Intermediate, and Long-Term Risk Factors for Mortality in Incident Dialysis Patients: The Choices for Healthy Outcomes in Caring for ESRD (CHOICE) Study. American journal of kidney diseases: the official journal of the National Kidney Foundation 2007;49(6):831–40

2 Miskulin DC, Meyer KB, Martin AA, et al.: Comorbidity and its change predict survival in incident dialysis patients. American journal of kidney diseases: the official journal of the National Kidney Foundation 2003;41(1):149–61

3 Nitsch D, Burden R, Steenkamp R, Ansell D, Byrne C, Caskey F, et al.: Patients with diabetic nephropathy on renal replacement therapy in England and Wales. Qjm-an International Journal of Medicine 2007 Sep;100(9):551–60

4 Roderick P, Byrne C, Casula A, Steenkamp R, Ansell D, Burden R, et al.: Survival of patients from South Asian and Black populations starting renal replacement therapy in England and Wales. Nephrology Dialysis Transplantation 2009 Dec;24(12):3774–82

5 Tomson C, Maggs C: UK Renal Registry 12th Annual Report (December 2009): Chapter 2: introduction. Nephron Clin Pract 2010;115(suppl 1): c3–8

6 Ford DJ, Fogarty DG, Steenkamp R, Tomson CRV, Ben-Shlomo Y, Ansell D: Chapter 13: The UK Renal Registry Advanced CKD Study: frequency of incorrect reporting of date of start of RRT. Nephron Clinical Practice 115(suppl 1):c271–c78

7 Malek SK, Keys BJ, Kumar S, Milford E, Tullius SG: Racial and ethnic disparities in kidney transplantation. Transplant International 2011; 24(5):419–24 doi: 10.1111/j.1432–2277.2010.01205.x[published Online First: Epub Date]

8 Office for National Statistics: www.ons.gov.uk, http://www.ons.gov.uk/ons/dcp171778_238743.pdf

9 Ansell D, Roderick P, Hodsman A, Ford D, Steenkamp R, Tomson C: UK Renal Registry 11th Annual Report (December 2008): Chapter 7 Survival and cause of death of UK adult patients on renal replacement therapy in 2007: national and centre-specific analyses. Nephron Clin Pract 2009;111(suppl 1):c113–39

11 Fotheringham J, et al.: Variation in centre-specific survival in patients starting renal replacement therapy in England is explained by enhanced comorbidity information from hospitalization data. Nephrology Dialysis Transplantation 29(2):422–430

10 van Manen JG, van Dijk PCW, Stel VS, Dekker FW, Cleries M, Conte F, et al.: Confounding effect of comorbidity in survival studies in patients on renal replacement therapy. Nephrology Dialysis Transplantation 2007;22(1):187–95

Appendix 1: Survival tables

Table 5.22. One year after 90 day incident survival percentage by centre, 2012 cohort, unadjusted and adjusted to age 60

Centre	Unadjusted one year after 90 days survival	Adjusted one year after 90 days survival	*Adjusted one year after 90 days 95% CI*
England			
B Heart	82.7	87.2	*81.6–93.1*
B QEH	90.3	92.4	*89.2–95.6*
Basldn	85.7	89.7	*82.9–97.1*
Bradfd	84.9	86.7	*79.5–94.7*
Brightn	86.1	91.1	*87.0–95.4*
Bristol	84.2	88.5	*84.0–93.3*
Camb	88.9	92.5	*88.7–96.5*
Carsh	84.1	89.1	*85.7–92.7*
Chelms	85.4	91.1	*84.6–98.1*
Colchr	73.5	82.6	*73.1–93.5*
Covnt	83.8	87.9	*82.5–93.7*
Derby	85.5	89.2	*83.4–95.4*
Donc	84.2	88.9	*81.0–97.5*
Dorset	83.8	90.2	*85.0–95.6*
Dudley	85.1	90.0	*83.2–97.2*
Exeter	87.8	93.0	*89.4–96.6*
Glouc	87.9	91.3	*85.4–97.6*
Hull	89.0	90.3	*84.6–96.5*
Ipswi	91.7	93.1	*86.0–100.0*
Kent	92.5	94.8	*91.3–98.4*
L Barts	89.9	90.8	*87.4–94.2*
L Guys	93.8	94.7	*91.1–98.3*
L Kings	88.0	89.8	*85.0–94.8*
L Rfree	91.8	93.6	*90.8–96.5*
L St.G	91.3	93.5	*89.1–98.3*
L West	90.5	92.5	*90.0–95.0*
Leeds	91.0	92.5	*88.7–96.5*
Leic	87.5	90.3	*86.9–93.8*
Liv Ain	91.9	95.1	*91.0–99.4*
Liv Roy	88.0	89.9	*84.5–95.7*
M RI	88.5	89.9	*85.6–94.3*
Middlbr	87.0	89.6	*84.8–94.7*
Newc	84.8	86.8	*80.6–93.5*
Norwch	81.3	87.9	*82.2–94.1*
Nottm	87.6	90.1	*84.8–95.8*
Oxford	92.5	93.9	*90.4–97.4*
Plymth	88.5	92.1	*86.2–98.3*
Ports	88.5	91.0	*87.2–94.9*
Prestn	91.2	92.8	*88.8–97.0*
Redng	93.6	96.0	*92.7–99.5*
Salford	85.8	89.0	*84.2–94.1*
Sheff	90.9	93.4	*90.1–97.0*
Shrew	78.2	85.0	*77.2–93.5*
Stevng	91.4	93.1	*88.6–97.8*
Stoke	90.8	94.0	*89.7–98.4*
Sund	91.4	93.0	*87.8–98.5*
Truro	91.5	94.6	*89.0–100.0*
Wirral	81.6	86.2	*77.3–96.0*
Wolve	80.5	84.1	*77.1–91.8*
York	92.0	94.0	*88.4–99.8*
N Ireland			
Antrim	83.9	89.4	*81.3–98.4*
Belfast	91.9	93.1	*88.4–98.1*
Newry	86.5	89.8	*79.7–100.0*
Ulster	90.0	93.9	*86.4–100.0*
West NI	96.3	97.5	*92.9–100.0*
Scotland			
Abrdn	86.4	89.9	*82.6–97.8*
Airdrie	90.0	92.0	*86.1–98.3*
Dundee	89.7	93.6	*87.7–99.8*
Edinb	91.8	92.8	*87.5–98.5*
Glasgw	87.6	90.2	*86.4–94.2*
Klmarnk	88.6	90.9	*82.8–99.7*
Krkcldy	96.6	97.3	*92.4–100.0*
Wales			
Cardff	82.5	86.9	*82.5–91.4*
Swanse	74.8	83.7	*78.3–89.5*
Wrexm	81.5	86.0	*75.6–97.9*
England	**88.3**	**91.2**	***90.4–92.0***
N Ireland	**90.3**	**92.8**	***89.7–96.1***
Scotland	**89.0**	**91.4**	***89.2–93.7***
Wales	**79.5**	**85.5**	***82.3–88.8***
UK	**88.0**	**91.0**	***90.2–91.8***

Excluded: centres with less than 20 patients (Bangor, Carlisle, Clwyd, D & Gall, Inverns, Sthend)

Table 5.23. Ninety day incident survival percentage by centre, 2012 cohort, unadjusted and adjusted to age 60

Centre	Unadjusted 90 day survival	Adjusted 90 day survival	*Adjusted 90 day 95% CI*
England			
B Heart	95.2	96.9	*94.2–99.6*
B QEH	98.2	98.7	*97.4–100.0*
Basldn	96.1	97.5	*94.1–100.0*
Bradfd	94.4	95.6	*91.5–99.9*
Brightn	91.5	94.9	*92.0–97.9*
Bristol	94.3	96.2	*93.6–98.8*
Camb	93.7	96.0	*93.4–98.8*
Carsh	94.7	96.7	*94.9–98.6*
Chelms	95.3	97.4	*94.0–100.0*
Colchr	94.4	96.9	*92.7–100.0*
Covnt	95.2	96.8	*94.1–99.6*
Derby	92.8	95.2	*91.6–99.0*
Dorset	97.4	98.5	*96.5–100.0*
Dudley	96.0	97.4	*94.0–100.0*
Exeter	95.9	97.8	*96.0–99.7*
Glouc	92.2	94.9	*90.7–99.3*
Hull	89.1	91.5	*86.5–96.7*
Ipswi	97.3	97.9	*94.0–100.0*
Kent	93.9	96.0	*93.2–99.0*
L Barts	95.3	96.0	*93.9–98.2*
L Guys	99.2	99.4	*98.2–100.0*
L Kings	98.5	98.8	*97.1–100.0*
L Rfree	96.2	97.2	*95.5–99.1*
L St.G	91.0	93.9	*89.8–98.1*
L West	96.4	97.4	*95.9–98.8*
Leeds	96.7	97.4	*95.2–99.7*
Leic	93.4	95.2	*92.9–97.6*
Liv Ain	94.1	96.6	*93.3–99.9*
Liv Roy	90.4	92.2	*87.7–97.0*
M RI	98.2	98.5	*96.8–100.0*
Middlbr	90.6	93.4	*89.8–97.1*
Newc	88.8	90.9	*86.1–95.9*
Norwch	93.8	96.2	*93.0–99.5*
Nottm	89.9	92.5	*88.2–97.1*
Oxford	90.4	92.7	*89.3–96.3*
Plymth	94.6	96.7	*93.1–100.0*
Ports	93.8	95.5	*92.9–98.1*
Prestn	94.0	95.3	*92.2–98.5*
Redng	97.6	98.6	*96.7–100.0*
Salford	99.2	99.4	*98.3–100.0*
Sheff	94.7	96.5	*94.1–98.9*
Shrew	91.1	94.4	*89.8–99.3*
Stevng	95.0	96.3	*93.1–99.5*
Stoke	90.6	94.2	*90.3–98.2*
Sund	95.9	96.9	*93.5–100.0*
Truro	87.8	92.7	*86.7–99.0*
Wirral	92.9	95.1	*90.0–100.0*
Wolve	90.7	93.4	*89.1–97.9*
York	94.5	96.1	*91.8–100.0*
N Ireland			
Belfast	92.5	94.0	*89.9–98.4*
Newry	95.8	97.1	*92.0–100.0*
Ulster	76.9	86.9	*77.8–97.1*
West NI	96.7	97.7	*93.5–100.0*
Scotland			
Dundee	95.1	97.1	*93.3–100.0*
Edinb	92.6	94.0	*89.5–98.8*
Glasgw	96.2	97.2	*95.2–99.3*
Klmarnk	89.7	92.1	*85.1–99.7*
Krkcldy	93.5	95.2	*89.1–100.0*
Wales			
Cardff	95.0	96.6	*94.5–98.8*
Clwyd	90.5	94.0	*86.4–100.0*
Swanse	92.9	96.1	*93.5–98.7*
Wrexm	87.5	91.6	*84.1–99.7*
England	**94.6**	**96.2**	***95.6–96.7***
N Ireland	**92.6**	**94.9**	***92.3–97.5***
Scotland	**95.5**	**96.7**	***95.4–98.1***
Wales	**93.1**	**95.7**	***94.0–97.4***
UK	**94.5**	**96.2**	***95.6–96.7***

Excluded: centres with less than 20 patients (Carlis, D & Gall, Inverns, Bangor) and centres with no deaths recorded in the first 90 days of RRT (Donc, Sthend, Antrim, Abrdn, Airdrie)

Table 5.24. One year after 90 day incident survival by centre for incident cohort years 2003–2012, adjusted to age 60

Centre	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
England										
B Heart	88.2	86.4	83.6	88.4	93.5	93.6	83.7	92.0	94.4	87.2
B QEH		88.0	90.4	86.8	92.9	89.7	92.4	88.3	93.3	92.4
Basldn	92.4	92.3	92.9	90.9	89.9	89.3	86.9	85.4	91.6	89.7
Bradfd	88.3	80.6	86.2	81.4	83.8	84.4	91.6	88.2	88.9	86.7
Brightn		90.6	84.4	87.1	94.2	89.3	85.7	88.4	91.0	91.1
Bristol	85.7	88.0	82.9	92.6	91.4	84.0	89.2	88.9	94.5	88.5
Camb	89.4	86.9	89.9	90.7	93.4	91.2	87.3	89.5	91.8	92.5
Carlis	82.5	86.9	79.6	89.9	96.5	87.8	71.8	86.3	91.5	
Carsh	89.9	85.7	90.3	88.4	87.1	86.6	88.0	89.9	94.3	89.1
Chelms		82.2	83.0	94.3	86.7	90.8	94.1	85.6	80.9	91.1
Colchr						86.6	86.3	96.8	84.1	82.6
Covnt	81.8	87.7	82.6	88.5	90.6	86.9	94.2	89.1	90.4	87.9
Derby	86.5	83.0	87.9	93.1	96.4	90.4	88.0	87.2	90.8	89.2
Donc						89.8	87.8	91.5	88.9	88.9
Dorset	85.9	91.3	82.6	86.3	90.4	93.5	92.4	87.5	88.2	90.2
Dudley	90.5	81.3	97.3	92.7	85.6	71.1	84.1	87.8	93.7	90.0
Exeter	82.2	88.5	86.2	88.8	86.4	87.0	89.1	95.3	88.5	93.0
Glouc	82.9	83.5	95.1	89.6	86.3	94.4	89.3	92.3	89.6	91.3
Hull	89.0	88.8	85.6	93.5	89.6	85.4	89.2	87.9	93.1	90.3
Ipswi	93.2	97.4	84.8	93.9	96.0	95.8	92.2	93.2	95.5	93.1
Kent					91.8	89.9	89.7	90.6	88.5	94.8
L Barts		87.1	91.1	93.9	86.5	92.5	90.8	91.8	93.7	90.8
L Guys	94.7	91.6	90.4	92.9	92.0	90.5	94.1	91.5	94.8	94.7
L Kings	88.0	86.9	91.9	85.2	87.8	89.7	85.9	89.7	90.9	89.8
L Rfree			93.3	89.7	94.4	95.2	89.1	90.3	90.9	93.6
L St.G					92.1	94.0	92.7	93.7	96.6	93.5
L West	95.9	92.4	94.1	92.5	92.8	94.2	93.1	88.8	90.7	92.5
Leeds	87.1	90.1	89.8	85.0	87.2	88.7	90.4	92.7	88.2	92.5
Leic	89.0	87.4	84.7	87.8	89.8	90.5	90.4	92.0	91.3	90.3
Liv Ain	N/A			86.9	82.9	78.5	82.8	89.1	86.3	95.1
Liv Roy	90.2	80.7	90.1	86.5	86.2	94.1	93.9	88.5	88.9	89.9
M RI					90.2	87.7	87.5	89.6	93.2	89.9
Middlbr	82.4	85.4	82.8	91.5	87.9	82.3	86.8	88.0	89.0	89.6
Newc	87.2	85.3	82.1	86.2	85.8	91.4	85.7	88.8	85.9	86.8
Norwch		84.6	90.7	86.5	91.0	89.0	89.7	92.2	89.5	87.9
Nottm	85.9	85.6	87.0	91.9	90.0	91.1	88.8	93.5	92.7	90.1
Oxford	89.0	87.8	87.9	90.2	89.3	87.1	91.6	90.6	88.8	93.9
Plymth	84.0	77.7	84.6	81.1	90.1	87.8	89.0	93.8	91.3	92.1
Ports	89.8	88.4	83.2	87.5	88.7	88.8	90.1	88.2	91.2	91.0
Prestn	85.2	87.2	88.5	83.6	91.4	82.1	87.5	87.6	91.8	92.8
Redng	92.1	90.7	90.7	91.1	90.7	95.2	89.0	92.9	93.0	96.0
Salford	88.4	85.1	88.3	90.6	89.2	86.0	88.7	86.7	91.9	89.0
Sheff	87.6	91.5	90.6	88.6	90.9	92.5	94.2	92.2	87.5	93.4
Shrew		87.4	86.2	87.7	91.8	92.9	84.7	86.9	91.9	85.0
Stevng	93.8	93.3	76.7	85.4	90.7	90.2	96.7	94.0	91.1	93.1
Sthend	91.7	90.4	91.1	94.8	91.8	86.2	91.5	81.9	94.3	
Stoke					87.4	89.7	85.8	87.0	93.0	94.0
Sund	80.6	86.7	80.6	83.6	88.8	85.3	83.0	84.1	88.7	93.0
Truro	86.9	92.7	90.6	89.5	90.2	89.2	94.2	90.9	93.0	94.6
Wirral	96.6	85.3	87.0	85.9	88.9	90.4	84.8	93.0	86.8	86.2
Wolve	83.6	88.0	84.2	89.3	89.5	89.4	88.6	87.5	89.5	84.1
York	76.1	91.3	84.0	82.6	95.1	86.2	94.1	86.2	93.4	94.0

Table 5.24. Continued

Centre	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
N Ireland										
Antrim			87.4	93.9	87.0	90.2	97.4	90.2	86.3	89.4
Belfast			87.0	93.1	91.0	88.4	91.4	89.3	92.5	93.1
Newry			90.2			90.0		92.0	87.9	89.8
Ulster								90.9	86.3	93.9
West NI				90.2	97.3	93.1	97.6	91.3	95.9	97.5
Scotland										
Abrdn	86.0	88.7	84.2	82.5	86.0	86.9	88.8	85.4	92.8	89.9
Airdrie	74.6	86.1	75.2	80.7	76.7	88.3	94.3	82.0	84.1	92.0
D & Gall	84.5						84.0			
Dundee	86.9	85.7	84.4	89.4	81.4	86.2	87.9	90.3	90.3	93.6
Edinb	86.7	79.4	83.3	88.8	90.1	84.5	85.1	86.4	90.2	92.8
Glasgw	87.4	81.0	86.3	83.4	88.1	84.2	88.7	86.9	88.6	90.2
Inverns	87.6	89.2	84.3	83.9	90.6	87.1		96.7		
Klmarnk	83.7	87.4	96.3	82.8	87.6	90.1	84.1	88.4	91.1	90.9
Krkcldy	88.2	89.8	78.3	80.2	87.4	87.0	90.1	93.6	92.4	97.3
Wales										
Bangor	91.1	80.8	82.3	81.4	92.3	87.8	87.3	89.1	94.3	
Cardff	87.2	85.4	87.2	87.1	84.3	83.2	89.3	89.5	88.2	86.9
Clwyd				96.9			92.3			
Swanse	84.6	77.7	82.7	84.2	89.0	85.1	81.7	86.8	85.0	83.7
Wrexm	93.5	77.2	97.7	85.5	90.0			82.1	88.8	86.0
England	**88.4**	**87.8**	**87.9**	**89.0**	**90.2**	**89.5**	**89.8**	**90.0**	**91.1**	**91.2**
N Ireland			**89.0**	**91.6**	**91.0**	**88.4**	**92.1**	**90.3**	**90.3**	**92.8**
Scotland	**86.0**	**84.7**	**84.5**	**84.5**	**86.5**	**86.0**	**87.4**	**87.8**	**90.2**	**91.4**
Wales	**87.0**	**82.4**	**86.0**	**86.2**	**86.8**	**84.4**	**87.3**	**88.6**	**87.6**	**85.5**
UK	**88.0**	**87.1**	**87.5**	**88.5**	**89.7**	**89.0**	**89.5**	**89.7**	**90.8**	**91.0**

Blank cells: centres with less than 20 patients for that year or centres with no data available for that year

Table 5.25. One year prevalent patient survival by centre for prevalent cohort years 2003–2012, adjusted to age 60

Centre	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
England										
B Heart	86.4	87.9	86.5	87.1	90.1	90.8	87.4	89.5	88.4	88.8
B QEH	89.1	89.1	88.4	88.5	88.4	90.2	89.5	91.2	91.7	91.9
Basldn	87.6	90.2	90.0	90.3	92.6	91.6	88.5	90.8	88.3	92.6
Bradfd	88.2	86.4	82.8	84.2	87.7	84.4	89.2	88.0	87.7	85.1
Brightn	87.1	84.3	87.6	87.1	88.7	87.3	89.9	88.1	89.2	88.1
Bristol	86.9	87.5	87.7	89.2	87.4	85.0	85.8	89.7	90.7	90.1
Camb	88.0	87.0	89.3	87.9	92.5	89.9	91.3	93.0	88.8	92.7
Carlis	82.9	83.7	83.9	85.8	86.9	80.2	80.4	93.2	88.8	82.8
Carsh	86.9	85.6	89.1	88.3	89.7	88.7	89.1	89.5	90.9	90.3
Chelms	86.4	82.9	85.6	87.5	85.0	86.0	89.5	84.1	91.2	90.2
Colchr						91.0	86.5	88.9	89.1	85.8
Covnt	89.1	89.3	85.0	87.1	87.2	90.9	90.1	91.0	91.8	90.5
Derby	88.5	87.6	88.5	86.8	90.2	90.4	89.9	89.7	89.5	88.0
Donc					88.7	83.8	88.8	91.7	91.1	82.7
Dorset	87.9	89.4	87.0	87.4	89.8	90.1	93.0	89.9	90.4	91.8
Dudley	86.0	85.9	87.3	87.2	88.8	88.8	90.7	87.6	91.5	86.4
Exeter	86.5	84.0	91.1	87.3	85.5	85.5	86.7	88.3	88.2	91.6
Glouc	88.9	88.1	91.1	88.2	86.2	91.7	92.2	89.5	90.6	89.6
Hull	86.1	84.5	85.8	89.9	86.7	87.7	87.5	89.7	90.9	88.5
Ipswi	90.0	85.7	84.3	86.3	93.1	84.6	87.6	91.9	90.4	87.9
Kent					86.2	87.9	90.3	89.7	89.1	87.7
L Barts	83.8	85.6	88.3	89.3	88.7	90.8	92.9	91.6	89.7	91.0
L Guys	88.4	89.3	87.2	90.5	90.3	91.3	90.9	93.9	91.1	90.8
L Kings	81.1	86.6	89.1	84.7	88.0	87.9	89.4	90.0	89.7	89.2
L Rfree		90.2	90.0	90.3	91.2	89.6	90.2	91.6	90.2	90.8
L St.G				95.8	94.3	89.2	90.7	91.8	88.3	91.6
L West	91.2	91.2	91.1	91.4	90.2	92.0	90.6	90.6	91.7	90.1
Leeds	85.8	89.1	88.6	88.1	87.2	88.7	90.8	88.8	86.5	88.2
Leic	85.1	86.6	84.4	89.7	89.5	88.5	90.3	89.7	90.3	88.9
Liv Ain		97.0	86.8	90.5	88.3	91.9	89.7	89.5	83.5	83.9
Liv Roy	85.3	83.6	87.6	84.4	86.4	89.0	88.9	90.5	88.5	87.7
M RI				86.4	86.3	87.5	86.9	88.4	90.7	86.0
Middlbr	83.6	86.1	85.1	87.2	86.9	86.4	83.5	93.0	88.6	88.8
Newc	80.9	85.9	83.7	85.9	86.2	87.0	86.1	85.0	89.1	84.3
Norwch	87.4	88.4	90.3	87.6	91.1	89.5	89.8	91.2	91.3	88.6
Nottm	86.7	84.7	83.2	89.5	88.3	88.0	89.5	89.8	89.0	90.5
Oxford	88.3	87.2	86.9	86.8	87.8	88.5	87.2	87.9	88.1	89.4
Plymth	85.9	87.7	83.7	82.7	88.0	85.8	85.2	89.8	84.6	89.8
Ports	89.2	85.9	85.2	89.8	88.4	89.2	88.4	88.2	89.9	90.2
Prestn	85.6	85.8	86.3	90.7	90.1	89.7	90.1	88.1	90.6	88.9
Redng	89.2	86.2	89.0	90.3	88.8	92.4	88.9	89.4	90.9	90.8
Salford	81.7	83.2	85.9	88.0	86.5	87.9	85.2	87.7	89.0	88.1
Sheff	87.8	86.9	89.2	88.8	88.7	89.7	89.5	88.7	88.9	91.5
Shrew	84.7	86.3	86.6	89.1	88.9	87.8	85.6	87.4	89.9	83.5
Stevng	89.6	88.8	89.4	89.7	92.4	90.5	90.0	92.8	92.0	89.1
Sthend	88.5	86.9	83.4	86.3	90.2	91.0	92.4	90.2	87.7	91.7
Stoke				84.5	87.3	88.4	86.8	90.5	90.5	91.5
Sund	81.9	86.4	79.4	83.7	87.5	85.2	84.7	83.7	86.5	84.8
Truro	89.9	84.8	91.8	89.3	89.4	88.9	90.7	89.0	89.6	88.7
Wirral	87.4	89.4	88.4	88.1	89.2	90.2	88.5	90.7	90.2	90.8
Wolve	87.6	86.5	89.3	87.8	92.8	89.4	87.3	89.2	88.7	88.9
York	82.9	89.4	84.0	88.5	87.8	88.8	90.0	84.1	88.6	91.5

Table 5.25. Continued

Centre	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
N Ireland										
Antrim			92.1	85.9	89.0	90.5	89.2	92.7	91.4	92.4
Belfast			86.3	90.9	88.8	88.7	88.8	89.3	89.3	88.1
Newry			87.5	87.4	90.9	94.3	88.0	92.0	83.8	91.5
Ulster			91.6	89.4	92.7	88.2	90.5	90.4	91.6	92.0
West NI			83.7	91.0	92.9	89.7	91.8	91.0	92.2	92.6
Scotland										
Abrdn	85.4	87.6	86.1	87.2	89.5	89.3	89.7	89.0	90.9	88.2
Airdrie	84.1	82.8	79.7	79.4	85.9	85.4	89.3	88.4	86.2	85.7
D & Gall	83.1	92.1	82.1	90.6	84.6	88.4	87.3	91.3	87.4	90.4
Dundee	85.8	87.3	87.4	83.8	83.8	93.6	87.6	88.0	91.8	89.5
Edinb	83.9	85.5	86.6	87.8	88.3	86.1	89.1	82.4	90.2	89.8
Glasgw	85.5	87.5	86.4	88.1	88.3	88.6	88.7	88.2	88.6	88.1
Inverns	86.8	87.0	86.4	93.8	89.2	92.2	89.0	86.8	87.9	87.6
Klmarnk	87.3	84.8	92.0	87.0	89.1	88.2	88.3	88.9	89.7	87.1
Krkcldy	86.3	89.6	88.0	88.2	90.4	86.6	87.3	89.7	87.7	91.1
Wales										
Bangor	89.8	86.6	88.5	81.4	88.7	85.0	85.4	86.8	89.9	84.4
Cardff	85.0	84.3	84.1	88.7	82.4	86.4	85.8	88.2	86.2	87.5
Clwyd	74.6	82.0	77.3	90.5	87.0	88.8	78.1	93.0	89.9	86.2
Swanse	87.0	89.0	85.4	87.9	89.4	87.2	87.4	88.9	86.1	88.3
Wrexm	85.4	82.1	85.1	87.6	85.1	88.9	86.7	85.7	87.2	89.2
England	**88.0**	**87.8**	**88.3**	**88.5**	**88.9**	**89.0**	**89.2**	**89.9**	**89.8**	**89.4**
N Ireland			**87.6**	**89.2**	**90.3**	**89.9**	**89.6**	**90.8**	**89.9**	**90.8**
Scotland	**85.4**	**86.9**	**86.3**	**87.2**	**87.9**	**88.6**	**88.6**	**87.7**	**89.2**	**88.4**
Wales	**85.5**	**85.6**	**84.6**	**87.8**	**85.5**	**86.9**	**85.8**	**88.4**	**86.7**	**87.5**
UK	**87.9**	**87.6**	**87.9**	**88.4**	**88.7**	**88.9**	**89.0**	**89.6**	**89.6**	**89.3**

Blank cells: data not reported for that year or less than 20 patients in the year

Table 5.26. Percentage completeness of EDTA cause of death for prevalent patients by centre and year of death, 2004 to 2013

Centre	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
England										
B Heart	77.5	68.1	85.7	84.3	95.2	100.0	96.5	95.9	98.8	98.7
B QEH		60.6	4.1	7.1	5.8	0.7	1.2	2.0	2.1	63.6
Basldn	84.0	42.1	21.7	45.5	47.6	76.2	65.6	84.6	91.2	90.5
Bradfd	83.3	87.8	94.0	88.2	94.7	83.7	100.0	97.5	97.7	97.9
Brightn				12.2	0.0	1.1	2.4	1.1	1.1	0.0
Bristol	90.8	77.3	61.0	61.3	66.4	71.9	91.5	98.0	82.2	82.5
Camb	1.6	1.5	1.3	1.1	1.6	3.9	10.5	61.4	96.0	81.0
Carlis	77.3	91.3	91.3	73.9	50.0	80.6	100.0	92.9	94.7	92.3
Carsh				0.8	1.6	0.8	6.7	25.5	40.7	17.4
Chelms	35.0	68.6	66.7	83.9	71.4	86.7	86.2	87.0	100.0	92.3
Colchr					33.3	66.7	85.2	90.5	100.0	91.7
Covnt	1.9	0.0	0.0	0.0	1.2	0.0	0.0	1.4	34.3	71.4
Derby	69.0	79.2	77.5	85.1	97.8	73.5	91.2	90.0	91.4	93.1
Donc					100.0	94.3	90.9	91.7	92.6	100.0
Dorset	29.7	64.9	65.1	87.2	88.9	85.2	95.7	95.0	89.1	98.3
Dudley	33.3	14.8	6.5	6.5	5.4	0.0	100.0	94.7	93.9	95.8
Exeter	42.3	36.7	19.3	4.8	3.1	3.0	90.4	86.5	97.0	100.0
Glouc	51.4	64.5	61.8	77.8	70.2	69.4	100.0	95.7	91.5	100.0
Hull	84.8	81.3	78.1	76.5	53.3	18.7	92.0	95.1	98.4	85.3
Ipswi	31.8	11.4	23.3	45.8	16.7	18.8	73.3	77.8	80.0	83.9
Kent					61.7	92.8	89.0	97.4	96.1	82.3
L Barts	86.5	84.0	88.2	75.2	78.7	70.1	73.9	83.1	80.9	82.8
L Guys				3.8	0.0	0.0	70.2	87.5	58.8	1.1
L Kings	66.7	85.5	91.9	76.1	91.4	67.9	96.0	97.6	100.0	98.9
L Rfree						0.9	1.8	0.0	7.1	6.0
L St.G				16.7	17.9	21.4	77.6	47.9	42.4	64.8
L West	67.8	81.8	31.5	19.4	6.4	2.2	2.3	95.8	98.6	97.1
Leeds	79.1	69.9	66.7	29.7	30.4	34.5	100.0	100.0	99.2	100.0
Leic	89.6	72.5	77.3	66.7	70.0	70.5	76.6	63.2	94.1	80.4
Liv Ain	66.7	50.0	81.3	76.9	70.0	100.0	94.4	95.7	0.0	0.0
Liv Roy	69.9	42.2	67.4	80.4	75.8	82.7	72.0	77.5	2.9	34.8
M RI				4.0	0.9	1.0	4.9	2.1	10.2	0.8
Middlbr	47.1	79.4	63.5	57.5	26.0	52.0	90.2	97.5	94.9	82.4
Newc	27.4	19.4	30.1	49.4	36.2	40.0	14.0	45.6	17.1	23.9
Norwch	31.6	22.4	23.1	18.7	21.9	45.2	77.0	71.4	76.5	92.2
Nottm	94.4	98.0	88.9	91.9	98.8	97.1	98.8	100.0	100.0	100.0
Oxford	1.9	2.9	0.0	0.0	1.0	0.0	84.6	98.2	95.8	98.2
Plymth	60.4	50.0	45.8	55.9	70.7	48.7	80.9	43.6	42.0	100.0
Ports	57.0	21.9	13.0	21.6	7.1	45.8	69.3	23.7	20.2	41.4
Prestn	77.2	50.0	56.7	50.0	39.5	17.9	95.6	98.9	97.6	98.0
Redng	84.4	81.5	78.7	97.8	89.6	86.4	100.0	96.7	98.1	93.4
Salford				1.3	0.0	1.3	0.0	0.0	0.0	0.0
Sheff	26.7	4.8	9.3	13.9	0.9	1.9	2.1	0.8	0.8	2.0
Shrew	25.0	66.7	53.1	89.3	64.5	20.5	46.0	0.0	7.9	17.7
Stevng	82.1	88.5	61.6	55.1	68.4	73.9	86.3	86.8	67.7	71.3
Sthend	26.1	39.4	9.4	3.3	57.7	75.0	91.7	90.0	100.0	100.0
Stoke				16.1	21.0	28.6	54.7	57.9	89.6	56.7
Sund	54.8	56.3	61.2	60.5	50.0	78.9	93.5	95.1	97.3	82.6
Truro	57.1	2.3	6.9	0.0	18.4	29.7	93.3	97.3	78.8	97.4
Wirral	66.7	32.3	97.0	84.6	100.0	90.3	86.5	0.0	2.6	26.7
Wolve	98.3	92.3	50.0	51.6	67.6	77.8	98.4	94.0	95.8	89.1
York	67.6	41.4	83.3	38.5	62.1	67.9	96.7	97.3	100.0	100.0

Table 5.26. Continued

Centre	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
N Ireland										
Antrim			10.0	8.8	3.7	28.0	96.8	95.2	100.0	100.0
Belfast			34.3	38.3	20.0	26.2	81.7	78.2	76.7	46.3
Newry			42.9	15.0	13.3	81.3	95.2	100.0	96.7	100.0
Ulster			85.7	92.9	90.0	75.0	95.0	95.2	100.0	100.0
West NI			57.7	36.8	23.5	45.8	96.0	83.3	100.0	95.8
Scotland										
Abrdn	35.0	0.0	0.0	2.1	100.0	100.0	100.0	100.0	100.0	100.0
Airdrie	34.5	42.4	26.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0
D & Gall	100.0	80.0	76.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Dundee	92.1	86.1	2.8	9.1	100.0	100.0	100.0	100.0	100.0	100.0
Edinb	51.7	50.8	29.3	47.5	100.0	100.0	100.0	100.0	100.0	100.0
Glasgw	49.6	43.8	55.1	59.2	100.0	100.0	100.0	100.0	100.0	100.0
Inverns					100.0	100.0	100.0	100.0	100.0	100.0
Klmarnk	15.0	0.0	11.1	15.6	100.0	100.0	100.0	100.0	100.0	100.0
Krkcldy	77.8	87.5	65.0	61.5	100.0	100.0	100.0	100.0	100.0	100.0
Wales										
Bangor	44.4	66.7	35.0	86.2	57.9	80.0	73.9	90.0	100.0	100.0
Cardff	2.6	4.3	2.9	4.1	0.0	2.4	6.8	8.1	0.6	74.0
Clwyd		5.9	11.1	45.5	84.2	83.3	100.0	85.7	89.5	83.3
Swanse	92.9	87.9	92.4	97.3	96.0	89.8	98.0	88.6	98.1	97.8
Wrexm	3.7	3.6	4.0	25.0	69.2	100.0	95.7	96.2	100.0	95.7
England	**53.8**	**48.4**	**42.2**	**38.6**	**37.3**	**39.2**	**59.3**	**64.1**	**65.2**	**65.6**
N Ireland			**39.0**	**32.8**	**21.7**	**42.5**	**90.4**	**87.0**	**91.1**	**79.5**
Scotland	**50.7**	**42.0**	**33.7**	**44.4**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Wales	**31.0**	**28.9**	**31.2**	**43.9**	**36.4**	**47.8**	**53.7**	**49.5**	**50.8**	**86.0**
UK	**51.7**	**45.5**	**40.5**	**39.3**	**42.7**	**45.3**	**63.4**	**67.3**	**67.8**	**70.0**

Blank cells: data not available for that year

UK Renal Registry 17th Annual Report: Chapter 6 Adequacy of Haemodialysis in UK Adult Patients in 2013: National and Centre-specific Analyses

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Key Words
Adequacy · Haemodialysis · Urea reduction ratio

Summary

- Data suitable for urea reduction ratio (URR) analyses were available in 15,223 (75.3%) of the 20,214 patients receiving haemodialysis (HD) in the UK on the 30/9/2013.
- In 2013, 88.6% of prevalent HD patients achieved a URR >65%. The between centre range of prevalent patients achieving this target was wide (77.1–97.6%).
- The median URR in 2013 was 75.0%.
- URR was greater in those with longer dialysis vintage. Ninety one percent of patients who had survived on renal replacement therapy (RRT) for more than two years achieved a URR >65% compared with only 74.2% of those on RRT for only six months.
- Large variation between centres in the percentage of patients achieving the UK Renal Association's (RA) URR guideline persists.

Introduction

Amongst patients with established renal failure (ERF), the delivered dose of HD [1] has been reported in observational studies to potentially influence survival [2–4]. The delivered dose of HD depends on treatment (duration and frequency of dialysis, dialyser size, dialysate and blood flow rate) and patient characteristics (size, weight, haematocrit and vascular access) [5]. The two widely accepted measures of urea clearance are Kt/V, the ratio between the product of urea clearance (K, in ml/min) and dialysis session duration (t, in minutes) divided by the volume of distribution of urea in the body (V, in ml) and URR which is derived solely from the percentage fall in serum urea (URR) during a dialysis treatment. Whilst Kt/V is a more accurate descriptor of urea clearance, its calculation is more complex and requires additional data items not commonly reported by most UK renal centres [6, 7]. The UKRR has historically presented analyses based on URR rather than Kt/V for comparative audit of haemodialysis adequacy as these data are more widely available. However, URR does not take into account the rebound in serum urea concentration at the end of dialysis, and so may over estimate delivered dialysis dose, particularly when higher blood pump speeds are used.

Based on published evidence, clinical practice guidelines have been developed by various national and regional organisations [8–11]. There is considerable uniformity between them with regard to the recommendations for minimum dose of dialysis although there are differences in the methodology advised. Table 6.1 lists the recommended RA audit measures which are relevant to the haemodialysis population and whether the audit measure is currently reported on in the UK Renal Registry (UKRR) annual report [9].

The main objective of this chapter is to determine the extent to which patients undergoing HD treatment for established renal failure in the UK received the dose of HD, as measured by URR, recommended in the UK RA current clinical practice guidelines [9].

Methods

Seventy-one renal centres in the UK submitted data electronically to the UKRR on a quarterly basis . The majority of these centres have satellite units but for the purposes of this study the data from the renal centres and their associated satellite units were amalgamated. Data from two groups of patients were analysed. Firstly, analysis was undertaken using data from the prevalent adult HD patient population as of the 30th September 2013. For this analysis, data for URR were taken from the 3rd quarter of 2013 unless that data point was missing in which case data from the 2nd quarter were taken. The prevalent population only included patients receiving HD who were alive on 30th September 2013. Data from those patients who had died before that date have not been included in the analysis. The second analysis involved adult incident patients who had commenced treatment with HD during 2012. For these patients, analysis was undertaken using the last recorded URR in the quarter in which the patient had started dialysis. The incident HD patient cohort was followed up

Table 6.1 Summary of recommended Renal Association Audit Measures relevant to haemodialysis adequacy [9]

RA Audit Measure	Included in UKRR annual report?	Reason for non-inclusion
Haemodialysis Adequacy Audit Measures		
Audit measure: The proportion of patients in the main renal unit and its satellite units who are on twice weekly haemodialysis	No	Varying levels of reporting between centres
Audit measure: Cumulative frequency curves of urea reduction ratio measured using a standard method of post-dialysis sampling	Yes, but data not presented in the cumulative frequency format	
Audit measure: The proportion of patient non-attendances for haemodialysis sessions and the proportion of dialysis sessions shortened at the patient's request	No	Data not available
Audit measure: The proportion of thrice weekly haemodialysis sessions which have prescribed treatment times less than 4 hours	No	Varying levels of reporting between centres
Audit measure: The proportion of hospital (main and satellite unit) and home haemodialysis patients who are prescribed more frequent than thrice weekly haemodialysis	Yes	Not for home haemodialysis patients

for one year and the last recorded URR in the quarter after one year follow-up was used for this analysis.

Data from patients known to be receiving more or less than thrice weekly HD were omitted from analysis for both the incident and prevalent population. Patients for whom data recording the number of dialysis sessions per week were missing, were assumed to be dialysing thrice weekly. However, because not all centres report frequency of HD, it is possible that data from a small number of patients receiving HD at a different frequency were included in the analyses. Home HD patients were excluded from the analysis.

Analyses of the data from both groups of patients included calculation of the median URR and of the proportion of patients who had achieved the RA guideline (as outlined below) in each of the renal centres as well as for the country as a whole. The median URR and proportion of patients who achieved the RA guideline were also calculated separately for males and females. The number of dialysis sessions per week and the time per dialysis session is shown by renal centre.

All patients with data were included in the statistical analyses at a national level, although centres with fewer than 20 patients, or providing less than 50% data completeness were excluded from the comparison between centres. The number preceding the centre name in each figure indicates the percentage of missing data for that centre.

The UK RA clinical practice guidelines in operation at the time these data were collected were as follows:

HD should take place at least three times per week in nearly all patients. Reduction of dialysis frequency to twice per week because of insufficient dialysis facilities is unacceptable.

Every patient receiving thrice weekly HD should have consistently:

- ***either URR >65%***
- ***or equilibrated Kt/V (eKt/V) of >1.2 (or single pool Kt/V of >1.3) calculated from pre- and post-dialysis urea values, duration of dialysis and weight loss during dialysis).***

To achieve a URR above 65% or eKt/V above 1.2 consistently in the vast majority of the HD population clinicians should aim for a minimum target URR of 70% or minimum eKt/V of 1.4 in individual patients.

The duration of thrice weekly HD in adult patients with minimal residual renal function should not be reduced below 4 hours without careful consideration.

Patients receiving HD twice weekly for reasons of geography should receive a higher sessional dose of HD. If this cannot be achieved, then it should be recognised that there is a compromise between the practicalities of HD and the patient's long-term health.

Measurement of the 'dose' or 'adequacy' of HD should be performed monthly in all hospital HD patients and may be performed less frequently in home HD patients. All dialysis units should collect and report this data to their regional network and the UKRR.

Post-dialysis blood samples should be collected either by the slow-flow method, the simplified stop-flow method, or the stop dialysate flow method. The method used should remain consistent within renal units and should be reported to the Registry.

The RA clinical practice guidelines for HD dose apply specifically to patients undergoing thrice weekly HD. In these patients it is recommended that blood for biochemical measurement (including pre-dialysis urea for URR) should be taken before the mid-week dialysis session [9].

Results

Data completeness

Sixty four of the 71 renal centres submitted HD dose (URR) data to the UKRR (table 6.2). Data were available

Table 6.2. Percentage completeness of URR data returns for prevalent patients on HD by centre, on 30/9/2013

Centre	% completeness	Centre	% completeness
B Heart	99.7	Sheff	96.0
B QEH	94.8	Shrew	91.6
Basldn	98.6	Stevng	98.1
Bradfd	98.9	Sthend	100.0
Brightn	2.9	Stoke	73.4
Bristol	100.0	Sund	2.5
Camb	98.0	Truro	78.3
Carlis	100.0	Wirral	0.0
Carsh	91.9	Wolve	94.2
Chelms	97.8	York	99.1
Colchr	82.9		
Covnt	98.5	**N Ireland**	
Derby	91.2	Antrim	99.1
Donc	100.0	Belfast	98.9
Dorset	99.6	Newry	78.1
Dudley	95.3	Ulster	98.9
Exeter	99.7	West NI	91.0
Glouc	100.0		
Hull	99.7	**Scotland**	
Ipswi	100.0	Abrdn	99.0
Kent	90.3	Airdrie	97.7
L Barts	0.0	D & Gall	91.9
L Guys	69.5	Dundee	95.5
L Kings	0.0	Edinb	99.6
L Rfree	0.0	Glasgw	97.0
L St.G	0.0	Inverns	94.1
L West	94.1	Klmarnk	91.3
Leeds	100.0	Krkcldy	95.7
Leic	99.6		
Liv Ain	0.0	**Wales**	
Liv Roy	0.0	Bangor	100.0
M RI	22.6	Cardff	95.0
Middlbr	99.0	Clwyd	96.9
Newc	10.7	Swanse	71.9
Norwch	98.2	Wrexm	90.3
Nottm	93.5		
Oxford	94.8	**England**	71.9
Plymth	95.6	**N Ireland**	94.6
Ports	97.9	**Scotland**	96.8
Prestn	85.4	**Wales**	87.7
Redng	6.7	**UK**	75.3
Salford	80.6		

for 75.3% ($n = 15,223$) of the total prevalent population ($n = 20,214$) treated with HD who met the inclusion criteria for these analyses.

Fifty-one centres reported URR data on more than 90% of patients. Five centres reported URR data on less than 50% of prevalent patients (Manchester RI, Newcastle, Reading, Brighton and Sunderland). URR data were not received from seven centres (London Barts, London Kings, London Royal Free, London St Georges, Liverpool Aintree, Liverpool Royal Infirmary and Wirral).

Several centres had a reduction in the completeness of URR data submitted to the UKRR in 2013 compared with 2012 (data not shown). These changes may represent changes in data extraction, or a move by centres to utilising Kt/V rather than URR as the preferred measure of dialysis dose.

Of the total incident patient population ($n = 4,348$) who started HD during 2012 and meeting the inclusion criteria for URR analyses, 48.9% ($n = 2,125$) had URR data available during the first quarter of treatment (data not shown).

Percentage completeness of data returns on the number of HD sessions varied across centres (table 6.3). Ten centres in England and two centres in Wales returned no data on this variable. All centres in Northern Ireland returned data in over 95% of their HD population. All centres in Scotland returned data in over 90% of their HD population.

For those centres that did return data, three dialysis sessions a week was most prevalent, although a few centres reported >10% of the HD population undergoing a frequency of HD more or less than three sessions a week (table 6.3). For example, Salford reported 16.5% of their prevalent haemodialysis population having more than three sessions a week whereas Southend reported that 15.0% of their population in 2013 had fewer than three sessions per week.

Wide between centre variation in completeness of data on dialysis session time was also evident (table 6.4). In

Table 6.3. Number of dialysis sessions for prevalent patients on HD by centre, on 30/9/2013

Centre	Percentage completeness	Frequency of dialysis/week %		
		<3 sessions	3 sessions	>3 sessions
England				
B Heart	91.7	5.7	93.5	0.8
B QEH	0.0			
Basldn	99.3	1.4	94.6	4.1
Bradfd	96.8	3.9	95.6	0.6
Brightn	100.0	0.0	99.1	0.9
Bristol	100.0	4.8	94.8	0.5
Camb	100.0	8.8	89.4	1.8
Carlis	85.2	7.7	92.3	0.0
Carsh	0.0			
Chelms	100.0	9.0	91.0	0.0
Colchr	97.1	0.0	100.0	0.0
Covnt	1.8	0.0	100.0	0.0
Derby	76.4	0.0	100.0	0.0
Donc	99.3	0.7	99.3	0.0
Dorset	99.6	2.5	97.1	0.4
Dudley	100.0	0.7	98.7	0.7
Exeter	100.0	3.3	95.6	1.1
Glouc	0.0			
Hull	1.4	0.0	100.0	0.0
Ipswi	87.8	3.0	97.0	0.0
Kent	98.3	3.3	95.3	1.5
L Barts	0.0			
L Guys	0.0			
L Kings	100.0	0.0	100.0	0.0
L Rfree	0.0			
L St.G	82.3	0.5	99.5	0.0
L West	45.1	0.7	98.5	0.8
Leeds	99.1	5.2	94.3	0.5
Leic	99.4	0.9	99.1	0.0
Liv Ain	99.3	0.7	97.4	2.0

Table 6.3. Continued

Centre	Percentage completeness	Frequency of dialysis/week %		
		<3 sessions	3 sessions	>3 sessions
Liv Roy	98.3	0.7	88.7	10.6
M RI	38.1	1.9	98.1	0.0
Middlbr	15.4	0.0	97.9	2.1
Newc	100.0	1.7	97.4	0.9
Norwch	98.6	0.7	97.8	1.4
Nottm	99.7	0.9	99.1	0.0
Oxford	0.0			
Plymth	0.0			
Ports	99.2	6.1	91.9	2.0
Prestn	0.0			
Redng	100.0	0.4	99.6	0.0
Salford	98.7	1.6	81.9	16.5
Sheff	99.4	3.5	96.5	0.0
Shrew	99.4	5.5	93.3	1.2
Stevng	98.9	5.3	93.6	1.1
Sthend	100.0	15.0	85.0	0.0
Stoke	100.0	0.4	90.6	9.0
Sund	98.3	0.0	90.9	9.1
Truro	95.7	9.0	87.2	3.8
Wirral	97.3	2.2	90.0	7.8
Wolve	0.0			
York	86.3	2.0	90.1	7.9
N Ireland				
Antrim	100.0	0.9	99.1	0.0
Belfast	99.0	0.5	96.8	2.6
Newry	100.0	4.7	95.3	0.0
Ulster	100.0	1.0	96.9	2.1
West NI	99.1	0.9	91.7	7.4
Scotland				
Abrdn	99.0	1.5	97.0	1.5
Airdrie	97.7	0.0	100.0	0.0
D & Gall	95.5	2.4	83.3	14.3
Dundee	96.3	0.0	94.9	5.1
Edinb	97.1	0.0	98.7	1.3
Glasgw	93.1	0.4	99.0	0.6
Inverns	94.3	0.0	96.0	4.0
Klmarnk	96.1	0.8	99.2	0.0
Krkcldy	94.2	0.0	100.0	0.0
Wales				
Bangor	85.7	1.9	96.3	1.9
Cardff	0.0			
Clwyd	97.0	1.5	95.4	3.1
Swanse	0.0			
Wrexm	100.0	2.1	96.9	1.0
England	**59.8**	**2.8**	**95.1**	**2.0**
N Ireland	**99.5**	**1.3**	**96.1**	**2.5**
Scotland	**95.6**	**0.4**	**98.0**	**1.6**
Wales	**23.0**	**1.9**	**96.3**	**1.9**
UK	**62.2**	**2.4**	**95.6**	**2.0**

Blank cells denote no data returned by that centre

Table 6.4. Time per dialysis session for prevalent patients on HD by centre, on 30/9/2013

Centre	Percentage completeness	Percentage per dialysis session		
		<3.5 hours	3.5–5 hours	>5 hours
England				
B Heart	81.0	5.1	91.0	3.9
B QEH	0.0			
Basldn	99.3	15.0	83.7	1.4
Bradfd	97.3	6.6	93.4	0.0
Brightn	99.4	2.5	97.5	0.0
Bristol	100.0	6.1	93.9	0.0
Camb	0.0			
Carlis	85.2	11.5	88.5	0.0
Carsh	0.0			
Chelms	100.0	4.0	96.0	0.0
Colchr	97.1	0.0	100.0	0.0
Covnt	6.5	40.9	59.1	0.0
Derby	76.4	0.7	99.3	0.0
Donc	99.3	9.9	90.1	0.0
Dorset	99.6	3.7	96.3	0.0
Dudley	100.0	6.6	93.4	0.0
Exeter	100.0	19.7	80.3	0.0
Glouc	0.0			
Hull	2.4	28.6	71.4	0.0
Ipswi	87.8	1.0	99.0	0.0
Kent	98.3	13.0	86.4	0.6
L Barts	0.0			
L Guys	15.5	0.0	100.0	0.0
L Kings	100.0	19.0	81.1	0.0
L Rfree	0.0			
L St.G	72.4	0.5	99.5	0.0
L West	45.4	4.4	94.2	1.5
Leeds	99.8	5.8	94.2	0.0
Leic	88.1	1.7	98.1	0.2
Liv Ain	100.0	11.1	88.9	0.0
Liv Roy	99.7	15.2	84.8	0.0
M RI	38.1	3.7	95.0	1.2
Middlbr	100.0	22.6	77.1	0.3
Newc	100.0	7.4	90.9	1.7
Norwch	98.6	18.8	81.2	0.0
Nottm	15.1	10.2	89.8	0.0
Oxford	0.0			
Plymth	0.0			
Ports	0.0			
Prestn	0.6	0.0	100.0	0.0
Redng	97.6	1.2	98.4	0.4
Salford	94.3	7.1	92.6	0.3
Sheff	82.2	52.8	46.9	0.2
Shrew	99.4	15.2	84.8	0.0
Stevng	98.9	51.1	48.7	0.3
Sthend	100.0	20.6	79.4	0.0
Stoke	100.0	6.5	92.8	0.7
Sund	88.2	10.2	89.8	0.0
Truro	90.6	22.2	77.0	0.8
Wirral	99.5	18.5	81.0	0.5
Wolve	0.0			
York	88.0	4.9	95.2	0.0

Table 6.4. Continued

Centre	Percentage completeness	Percentage per dialysis session		
		<3.5 hours	3.5–5 hours	>5 hours
N Ireland				
Antrim	100.0	3.5	96.5	0.0
Belfast	99.5	16.8	83.2	0.0
Newry	100.0	9.3	90.7	0.0
Ulster	100.0	5.2	94.9	0.0
West NI	99.1	13.9	86.1	0.0
Scotland				
Abrdn	99.0	1.5	96.6	2.0
Airdrie	97.7	5.3	94.7	0.0
D & Gall	97.7	7.0	93.0	0.0
Dundee	96.3	5.7	93.7	0.6
Edinb	97.5	9.0	88.9	2.1
Glasgw	93.4	0.4	94.2	5.4
Inverns	94.3	4.0	96.0	0.0
Klmarnk	96.1	0.0	92.7	7.3
Krkcldy	94.9	13.0	85.5	1.5
Wales				
Bangor	85.7	9.3	90.7	0.0
Cardff	0.0			
Clwyd	97.0	38.5	61.5	0.0
Swanse	0.0			
Wrexm	99.0	5.3	94.7	0.0
England	**54.1**	**12.7**	**86.8**	**0.4**
N Ireland	**99.7**	**10.8**	**89.2**	**0.0**
Scotland	**95.9**	**4.1**	**92.9**	**3.0**
Wales	**22.9**	**16.4**	**83.6**	**0.0**
UK	**57.3**	**11.5**	**87.7**	**0.7**

Blank cells denote no data returned by that centre

centres that reported data, the most frequently reported dialysis session length was 3.5–5 hours.

Achieved URR

For prevalent patients, the median URR (75.0% for UK, centre range 71.0–83.0%) and percentage of patients attaining the RA guideline of a URR >65% (88.6% for the UK, centre range 77.1–97.6%) are shown in figures 6.1a and 6.2 respectively. The UK median URR in women was 78.0% (centre range 73.0–85.0%) compared with a UK median in men of 74.0% (centre range 69.0–81.0%) (figures 6.1b, 6.1c).

There continued to be variation between renal centres in the percentage of prevalent patients with a URR of >65%, with 22 centres attaining the RA clinical practice guideline in >90% of patients and 37 centres reporting attainment of the guideline in 70%–90% of patients (figure 6.2).

Changes in URR over time

The change in the percentage attainment of the current RA clinical practice guidelines (URR >65%) and the median URR for the UK from 2000 to 2013 is shown in figure 6.3. The proportion of patients attaining the RA guideline increased from 69% to 89% whilst the median URR has risen from 69% to 75% during the same time period. There has been no substantial change in the median URR between 2011 and 2013 in the UK.

Variation of achieved URR with time on dialysis

The proportion of patients who attained the RA guideline for HD was greater in those who had been on RRT for the longest time (figure 6.4). In 2013, of those dialysed for less than six months, 74% had a URR >65%, whilst 91% of patients who had survived and continued on RRT for more than two years had a URR within the guideline target. In all strata of time on dialysis, there

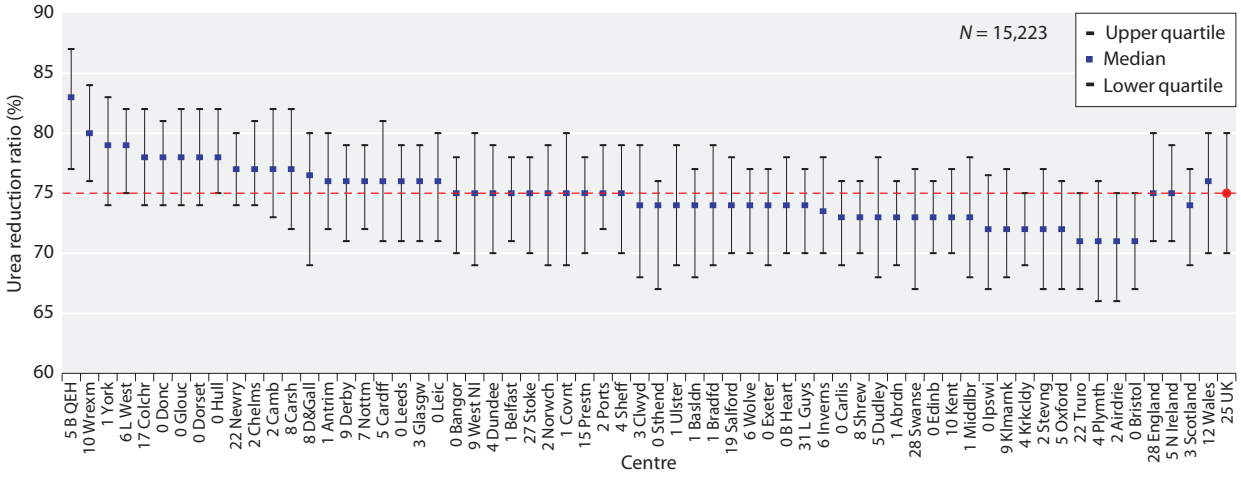

Fig. 6.1a. Median URR achieved in prevalent patients on HD by centre, 30/9/2013

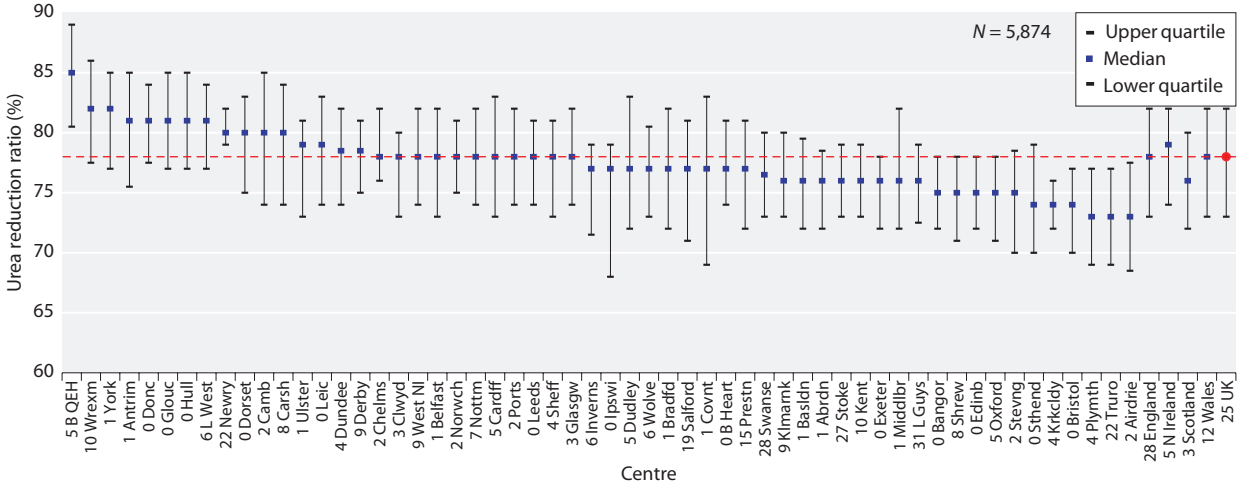

Fig. 6.1b. Median URR achieved in female prevalent patients on HD by centre, 30/9/2013

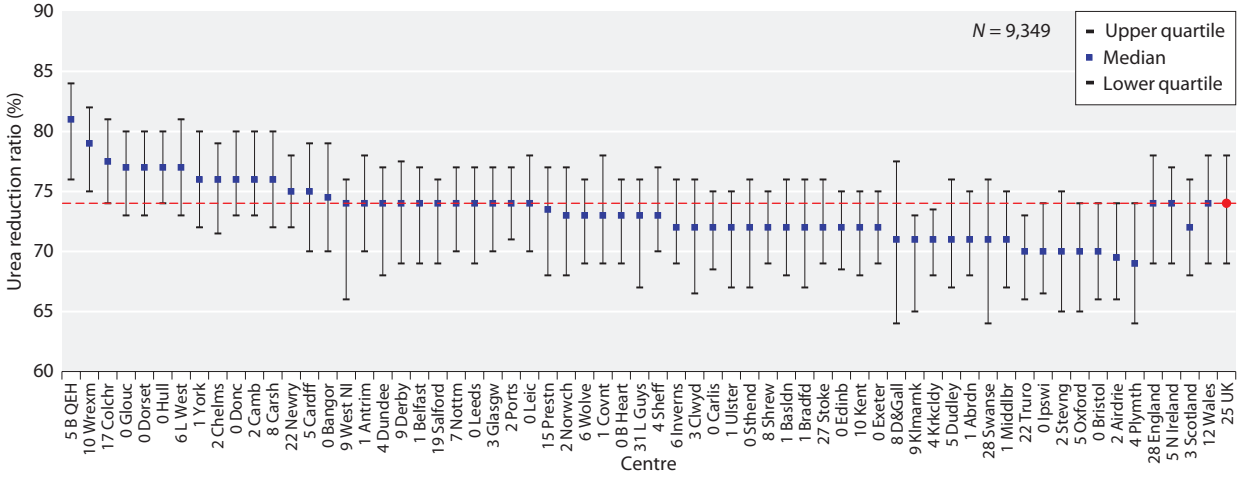

Fig. 6.1c. Median URR achieved in male prevalent patients on HD by centre, 30/9/2013

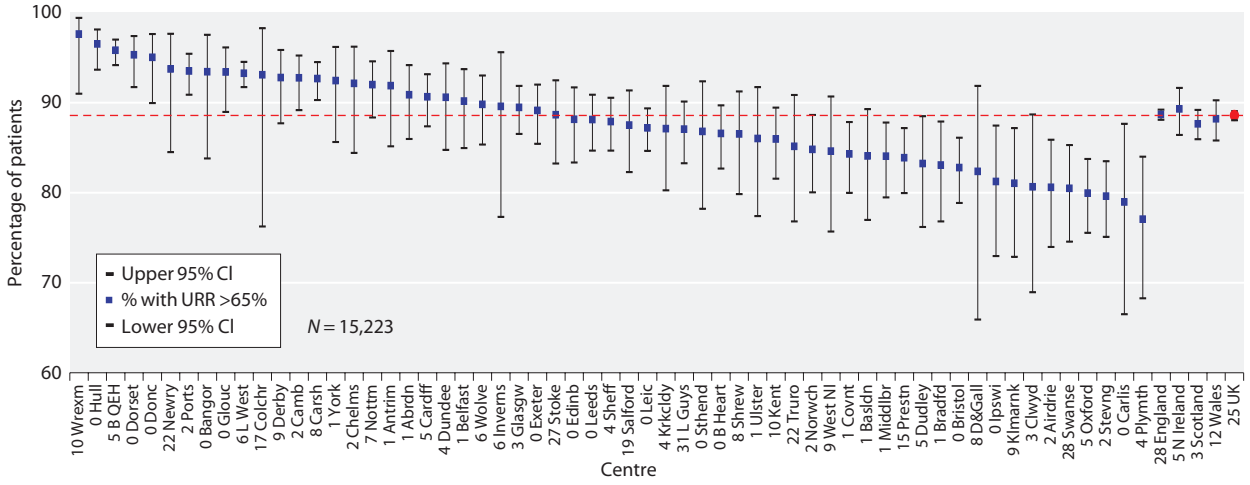

Fig. 6.2. Percentage of prevalent patients with URR >65% on HD by centre, 30/9/2013

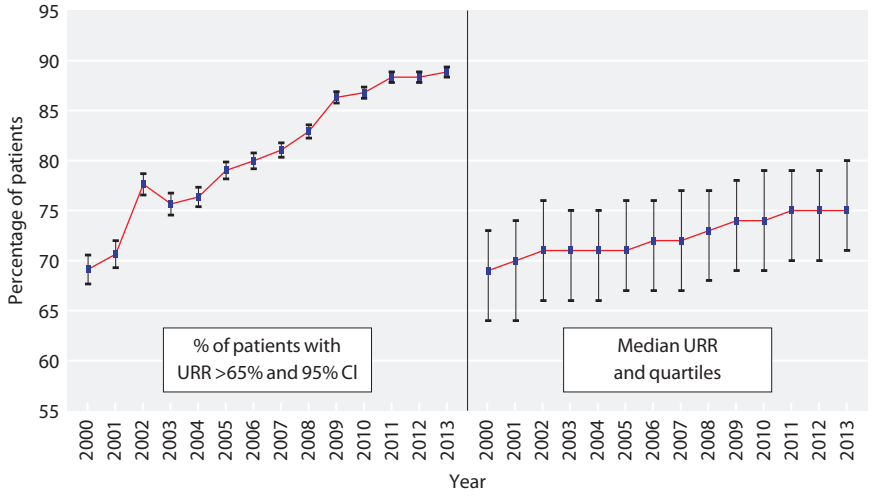

Fig. 6.3. Change in the percentage of prevalent patients on HD with URR >65% and the median URR between 2000 and 2013 in the UK

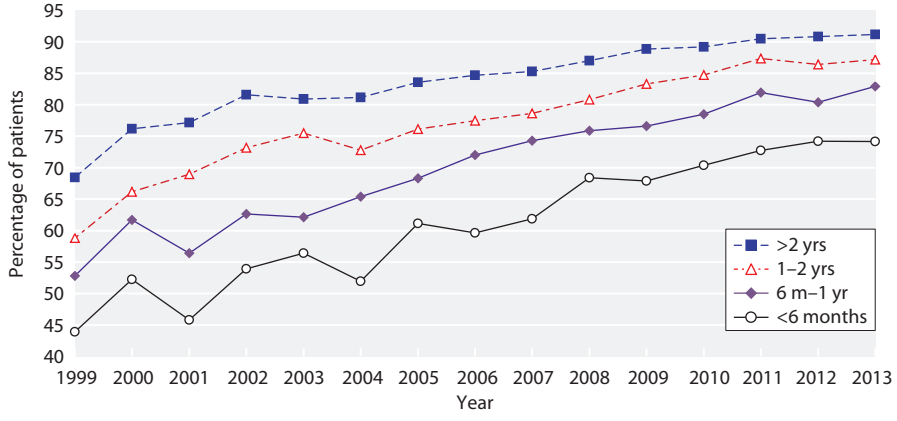

Fig. 6.4. Percentage of prevalent patients on HD achieving URR >65% by time on RRT between 1999 and 2013

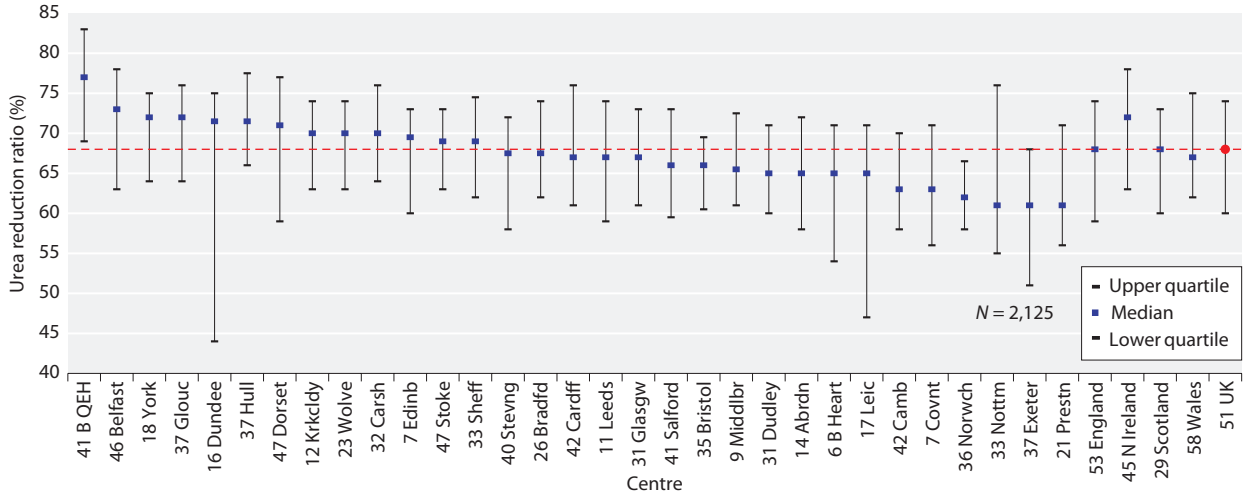

Fig. 6.5a. Median URR in the first quarter of starting RRT in incident patients who started haemodialysis in 2012

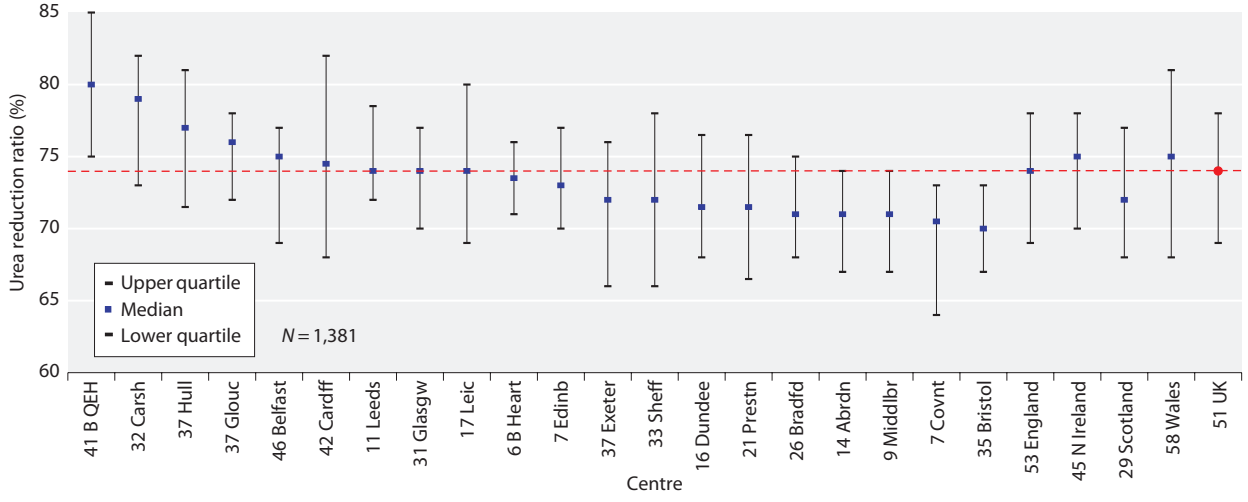

Fig. 6.5b. Median URR one year after starting RRT for patients who started haemodialysis in 2012

has been an improvement in the proportion of patients receiving the target dose of HD over the last 14 years.

The median URR during the first quarter of starting HD treatment of the incident HD population in the UK in 2012 was 68% (centre range 61–77%) (figure 6.5a). At the end of one year for this incident cohort, the median URR was higher (median URR 74%, centre range 70–80%) (figure 6.5b).

Conclusions

The dose of delivered HD is recognised as potentially having an important influence on outcome in ERF patients treated with low flux HD. Patient well being has been shown to depend on achieving a minimum urea clearance target, but it remains unclear as to whether higher clearance targets add benefit [1–3]. It is therefore reassuring that the proportion of UK patients achieving the RA guideline for URR has increased in the last decade, with over 88% of the prevalent HD population achieving the URR guideline in 2013, with a median URR of 75%. This increment will not only reflect improvements in practice and delivery of dialysis, but also enhanced coverage and quality of the data collected by the UKRR and renal centres over the years.

Post hoc analyses of the HEMO study and observational studies have suggested that women may benefit from a higher dialysis dose than men [12, 13]. Current

RA guidelines do not differentiate on the basis of gender [9]. It is an interesting observation that the UK median URR achieved in women was higher than in men in this analysis, a similar finding to the analyses presented in last year's annual report. This may however simply reflect differences in dietary intake and lower pre-dialysis serum urea values in women, and as such does not necessarily imply improved dialysis clearance for women [14, 15].

In the prevalent haemodialysis population there continues to be a wide range (77.1–97.6%) of achievement of the RA guideline for URR between different centres which is likely to reflect genuine differences in HD dose with both individual and centre level contributors. Understanding more fully individual renal centre practice would be informative, as although most centres do not formally measure residual renal function, centres may adjust sessional times based on urine output. In the incident population, the variation in the between centre median URR within the first quarter for incident patients may represent variation in dialysis prescription practice for patients starting RRT. Some renal centres may use an incremental dialysis approach, whilst other centres use a standardised 'full-dose' approach to dialysis prescription, irrespective of residual function. Increasing URR with dialysis vintage in the prevalent patient group would support the suggestion that some centres operate an incremental dialysis policy, increasing dialysis dosing as residual renal function falls. Although observational evidence supports that preservation of residual renal function is associated with improved survival [16], maintaining patients overhydrated to try and preserve residual renal function [17] may increase cardiovascular mortality. How much individualisation of dialysis prescription based on residual renal function is practiced across UK renal centres and how this correlates with outcomes, remains to be determined. Similarly, it is not known whether the decline in residual renal function is affected by differences in centre practice approach to initiating dialysis. Varied completeness of data returns across other important factors such as dialysis session information also limits the interpretation of the data. Although RA guidelines recommend standardised methods for urea sampling, inconsistency in sampling methodology for the post-dialysis urea sample may also play a part in the variations reported [9].

Debate continues as to the toxicity of urea, and how representative urea clearance is of other azotaemic toxin clearances. In addition, the dialysis prescription should also encompass volume control, sodium and divalent cation balance and correct metabolic acidosis. As such basing and evaluating HD dose simply on urea clearance has been criticised by some [13] arguing that patient outcomes are improved by longer treatment times independent of urea removal [5, 18–23] and that clearance of 'middle molecules' have an important impact [24, 25]. However, no consensus has yet emerged on alternative markers of HD adequacy. The UKRR has historically reported URR, predominantly for logistical reasons with the URR being the easiest measure to calculate, and the measure of dialysis adequacy that is most complete when returned to the UKRR. However, limitations of the URR must be recognised.

The new UKRR dataset, recently distributed to renal units and to be embedded by 2016, should help contribute to further improvements in both URR data capture, as well as Kt/V reporting in addition to data on dialysis prescription practice.

Conflicts of interest: none

References

1 Gotch FA, Sargent JA: A mechanistic analysis of the National Cooperative Dialysis Study (NCDS). Kidney Int 1985;28:526–534

2 Owen WF, Lew NL, Liu Y, Lowrie EG, Lazarus JM: The Urea Reduction Ratio and Serum Albumin Concentration as Predictors of Mortality in Patients Undergoing Hemodialysis. N Engl J Med 1993;329:1001–1006

3 Held PJ, Port FK, Wolfe RA, Stannard DC, Carroll CE, Daugirdas JT, Bloembergen WE, Greer JW, Hakim RM: The dose of hemodialysis and patient mortality. Kidney Int 1996; 50:550–556

4 Tentori F, Hunt WC, Rohrscheib M, Zhu M, Stidley CA, Servilla K, Miskulin D, Meyer KB, Bedrick EJ, Johnson HK, Zager PG: Which Targets in Clinical Practice Guidelines Are Associated with Improved Survival in a Large Dialysis Organization? J Am Soc Nephrol 2007;18:2377–2384

5 Locatelli F, Buoncristiani U, Canaud B, Kohler H, Petitclerc T, Zucchelli P: Dialysis dose and frequency. Nephrol Dial Transplant 2005;20:285–296

6 Depner TA: Assessing adequacy of hemodialysis: urea modeling. Kidney Int 1994;45:1522–1535

7 Kumar S, Khosravi M, Massart A, Potluri M, Davenport A. The effects of racial differences on body composition and total body water measured by multifrequency bioelectrical impedance analysis influence delivered Kt/V dialysis dosing. Nephron Clin Pract. 2013;124(1–2):60–6

8 Vanbelleghem H, Vanholder R, Levin NW, Becker G, Craig JC, Ito S, Lau J, Locatelli F, Zoccali C, Solez K, Hales M, Lameire N, Eknoyan G: The Kidney Disease: Improving Global Outcomes website: Comparison of guidelines as a tool for harmonization. Kidney Int 2007;71: 1054–1061

9 UK Renal Association Clinical Practice Guidelines Committee. Haemodialysis, 2009 http://www.renal.org/Clinical/GuidelinesSection/Haemodialysis.aspx

10 European Best Practice Guidelines Expert Group on Haemodialysis. Nephrol Dial Transplant 2002: 17(suppl 7):S16–S31
11 NKF-KDOQI clinical practice guidelines; update 2006. Am J Kidney Dis 2006: 48(suppl 1):S2–S90
12 Depner T, Daugirdas J, Greene T, Allon M, Beck G, Chumlea C, Delmez J, Gotch F, Kusek J, Levin N, Macon E, Milford E, Owen W, Star R, Toto R, Eknoyan G, Hemodialysis Study Group Dialysis dose and the effect of gender and body size on outcome in the HEMO Study. Kidney Int. 2004;65(4):1386
13 Port FK, Wolfe RA, Hulbert-Shearon TE, McCullough KP, Ashby VB, Held PJ. High dialysis dose is associated with lower mortality among women but not among men. Am J Kidney Dis. 2004;43(6):1014
14 Lowrie EG: The Kinetic Behaviors of Urea and Other Marker Molecules During Hemodialysis. Am J Kidney Dis 2007;50:181–183
15 Spalding EM, Chandna SM, Davenport A, Farrington K. Kt/V underestimates the haemodialysis dose in women and small men. Kidney Int 2008; 74: 348–355
16 Hanson JA, Hulbert-Shearon TE, Ojo AO, et al: Prescription of twice-weekly hemodialysis in the USA. Am J Nephrol 19:625–633, 1999
17 McCafferty K, Fan S, Davenport A Extracellular volume expansion, measured by multifrequency bioimpedance, does not help preserve residual renal function in peritoneal dialysis patients. Kidney Int. 2014;85(1):151–7
18 Vanholder R, Eloot S, Van Biesen W: Do we need new indicators of dialysis adequacy based on middle-molecule removal? Nature Clinical Practice Nephrology 2008;4:174–175
19 Tattersall J, Martin-Malo A, Pedrini L, Basci A, Canaud B, Fouque D, Haage P, Konner K, Kooman J, Pizzarelli F, Tordoir J, Vennegoor M, Wanner C, ter Wee P, Vanholder R: EBPG guideline on dialysis strategies. Nephrol Dial Transplant 2007;22:ii5–21
20 Saran R, Bragg-Gresham JL, Levin NW, Twardowski ZJ, Wizemann V, Saito A, Kimata N, Gillespie BW, Combe C, Bommer J, Akiba T, Mapes DL, Young EW, Port FK: Longer treatment time and slower ultrafiltration in hemodialysis: Associations with reduced mortality in the DOPPS. Kidney Int 2006;69:1222–1228
21 Marshall MR, Byrne BG, Kerr PG, McDonald SP: Associations of hemodialysis dose and session length with mortality risk in Australian and New Zealand patients. Kidney Int 2006;69:1229–1236
22 Eloot S, Van Biesen W, Dhondt A, Van de Wynkele H, Glorieux G, Verdonck P, Vanholder R: Impact of hemodialysis duration on the removal of uremic retention solutes. Kidney Int 2007;73:765–770
23 Basile C, Lomonte C: Dialysis time is the crucial factor in the adequacy of hemodialysis. Kidney Int 2008;74:965–966
24 Eloot S, Torremans A, De Smet R, Marescau B, De Deyn PP, Verdonck P, Vanholder R: Complex Compartmental Behavior of Small Water-Soluble Uremic Retention Solutes: Evaluation by Direct Measurements in Plasma and Erythrocytes. Am J Kidney Dis 2007;50:279–288
25 Davenport A. How best to improve survival in haemodialysis patients: solute clearance or volume control? Kidney Int. 2011;80(10):1018–20

UK Renal Registry 17th Annual Report: Chapter 7 Haemoglobin, Ferritin and Erythropoietin amongst UK Adult Dialysis Patients in 2013: National and Centre-specific Analyses

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Key Words
Anaemia · Chronic kidney disease · Dialysis · End stage renal disease · Epidemiology · Erythropoietin · Erythropoietin stimulating agent · European Best Practice Guidelines · Ferritin · Haemodialysis · Haemoglobin · NICE · Peritoneal dialysis · Renal Association

Summary

In the UK in 2013:

- The median haemoglobin (Hb) of patients at the time of starting dialysis was 100 g/L with 50% of patients having a Hb $\geqslant$100 g/L.
- The median Hb in patients starting haemodialysis (HD) was 97 g/L (IQR 88–106) and in patients starting peritoneal dialysis (PD) was 109 g/L (IQR 99–118).
- At start of dialysis, 53% of patients presenting early had Hb $\geqslant$100 g/L whilst only 36% of patients presenting late had Hb $\geqslant$100 g/L.
- The median Hb of prevalent patients on HD was 112 g/L with an IQR of 103–120 g/L.
- The median Hb of prevalent patients on PD was 113 g/L with an IQR of 103–122 g/L.
- For both HD and PD patients, 83% had Hb $\geqslant$100 g/L.
- 59% of HD patients and 55% of PD patients had Hb $\geqslant$100 and $\leqslant$120 g/L.
- The median ferritin in HD patients was 424 μg/L (IQR 280–616) and 95% of HD patients had a ferritin $\geqslant$100 μg/L.

In England, Wales and Northern Ireland in 2013:

- The median ferritin in PD patients was 285 μg/L (IQR 167–473) with 88% of PD patients having a ferritin $\geqslant$100 μg/L.
- The median erythropoietin stimulating agent (ESA) dose was higher for HD than PD patients (7,333 vs. 4,000 IU/week).

Introduction

This chapter describes analyses of the UK Renal Registry (UKRR) data relating to the management of anaemia in dialysis patients during 2013.

The diagnosis and management of anaemia in chronic kidney disease and the standards to be achieved have been detailed in the Kidney Disease Improving Global Outcomes (KDIGO), Kidney Disease Outcomes Quality Initiative (KDOQI), European Best Practice Guidelines (EBPG) and UK Renal Association guidelines [1–4]. The health economics of anaemia therapy using ESAs has also been subject to a NICE systematic review which concluded that treating to a target haemoglobin (Hb) 110–120 g/L is cost effective in HD patients [5].

This chapter reports on the analyses of data items collected by the UKRR largely in the context of the 5th edition of the UK Renal Association's Anaemia in CKD guidelines and recommendations which was published at the end of 2010 [4]. Table 7.1 lists the audit measures from these guidelines along with explanations for why some of the measures were not reported on.

Methods

The incident and prevalent renal replacement therapy (RRT) cohorts for 2013 were analysed. The UKRR extracted quarterly data electronically from renal centres in England, Wales and Northern Ireland; data from Scotland were provided by the Scottish Renal Registry. Haemoglobin levels are given in g/L as the majority of UK laboratories have now switched to reporting using these units rather than g/dl.

For the analyses of Hb for incident patients, those patients commencing RRT on PD or HD were included whilst those receiving a pre-emptive transplant were excluded. Hb measurements from after starting dialysis but still within the same quarter of the year were used. Therefore, depending on when in the quarter a patient started RRT the Hb data could be from zero to 90 days later. The haemoglobin values the UKRR receives should be the closest available measurement to the end of the quarter. Patients who died within the first 90 days on treatment were excluded. Results are also shown with the cohort subdivided into early and late presenters (date first seen by a nephrologist, 90 or more days and less than 90 days before starting dialysis respectively).

For the analyses of prevalent patients, those patients receiving dialysis on 31st December 2013 were included if they had been on the same modality of dialysis in the same centre for at least three months. In order to improve completeness the last available

Table 7.1. Summary of recommended Renal Association audit measures relevant to anaemia management

	RA audit measure	Included in UKRR annual report?	Reason for non-inclusion
1.	Proportion of CKD patients with eGFR <30 ml/min by 4 variable MDRD method with an annual Hb level	No	UKRR does not currently collect CKD data
2.	Proportion of patients starting an ESA without prior measurement of serum ferritin and/or TSAT	No	UKRR does not know when all patients start ESA treatment UKRR does not collect TSAT data
3.	Proportion of patients on renal replacement therapy with Hb level <10 who are not prescribed an ESA	Yes	
4.	Each renal unit should audit the type, route and frequency of administration and weekly dose of ESA prescribed	UKRR reports the completeness of these data items	
5.	The proportion of CKD stage 4–5 patients with Hb 10–12 g/dl	No	UKRR does not currently collect CKD data
6.	The proportion of patients treated with an ESA with Hb >12 g/dl	Yes	
7.	Each renal unit should monitor ESA dose adjustments	No	UKRR does not collect this data
8.	Proportion of patients with serum ferritin levels <100 ng/ml at start of treatment with ESA	No	UKRR does not know when all patients start ESA treatment
9.	Proportion of pre-dialysis and PD patients receiving iron therapy; type: oral vs. parenteral	No	UKRR does not currently collect CKD data/poor data completeness
10.	Proportion of HD patients receiving IV iron	No	Poor data completeness
11.	Prevalence of resistance to ESA among renal replacement therapy patients	Yes	
12.	Proportion of HD patients who received a blood transfusion within the past year	No	Data held at NHS Blood and Transplant

measurement for each patient from the last two quarters was used for Hb and from the last three quarters for ferritin. Scotland was excluded from the analysis for ferritin for PD patients as this data was not included in its return.

The completeness of data items were analysed at both centre and country level. As in previous years, all patients were included in analyses but centres with less than 50% completeness were excluded from the caterpillar and funnel plots showing centre level results. Centres providing relevant data from less than 10 patients were also excluded from the plots. The number preceding the centre name in the caterpillar plots is the percentage of patients who have data missing.

Summary statistics including minimum, maximum, interquartile ranges (IQR), averages (mean and median) and standard deviations were calculated. The median values and the IQRs are shown using caterpillar plots. The percentages achieving standards were also calculated. These are displayed using caterpillar plots with the percentages meeting the targets and 95% confidence intervals (CIs) shown. Funnel plots show the distribution of the percentages meeting the targets and also whether any of the centres are significantly different from the average. Longitudinal analysis was performed to show overall changes in achievement of standards from 1998 to 2013.

Erythropoietin data from the last quarter of 2013 were used to define which patients were receiving ESAs. Scotland was excluded from this analysis as data regarding ESA was not included in its return. Each individual was defined as being on ESA if a drug type and/or a dose was present in the data. Centres reporting fewer than 60% of HD patients or fewer than 45% of PD patients being treated with ESAs were considered to have incomplete data and were excluded from further analysis. It is recognised that these exclusion criteria are relatively arbitrary but they are in part based upon the frequency distribution graph of centres' ESA use as it appears in the data. The percentage of patients on ESAs was calculated from these data and incomplete data returns risk seriously impacting on any conclusions drawn.

For analyses of ESA dose, values are presented as weekly erythropoietin dose. Doses of less than 150 IU/week (likely to be darbepoietin) were harmonised with erythropoietin data by multiplying by 200. No adjustments were made with respect to route of administration. Patients who were not receiving ESAs were not included in analyses of dose (rather than being included with dose = 0).

Until two years ago, UKRR annual reports only used the dose from the final quarter of the year. Now, starting with the cohort of patients receiving ESAs in the final quarter and having a dose value present for that quarter, any further dose values available from the earlier three quarters of the year were used (provided the patient was on the same treatment and receiving the same drug in those quarters). The average (mean) of the available values was then used in analyses rather than the dose in the final quarter.

The ESA data were collected electronically from renal IT systems but in contrast to laboratory linked variables the ESA data required manual data entry. The reliability depended upon the data source, whether the entry was linked to the prescription or whether the prescriptions were provided by the primary care physician. In the latter case, doses may not be as reliably updated as the link between data entry and prescription is indirect.

Results

Anaemia management in incident dialysis patients

Haemoglobin in incident dialysis patients

The Hb at the time of starting RRT gives the only indication of concordance with current anaemia management recommendations in the pre-dialysis (CKD 5 not yet on dialysis) group.

The percentage of data returned and outcome Hb are listed in table 7.2. Results are not shown for two centres (Carshalton, London Guys) because data completeness was less than 50%, results are not shown for Dumfries & Galloway as there were less than 10 patients with data.

The median Hb of patients at the time of starting dialysis in the UK was 100 g/L. The median starting Hb by centre is shown in figure 7.1. The percentage of patients having a Hb $\geqslant$100 g/L has fallen over the last several years to 50% from 55% in the 2009 cohort. The percentage starting with a Hb $\geqslant$100 g/L by centre is given in figure 7.2.

The variation in the proportion of patients starting dialysis with Hb $\geqslant$100 g/L between centres remained high (27–90%). Using only centres with time of presentation data, the median Hb in the late presenters was 94 g/L with only 36% of patients having a Hb $\geqslant$100 g/L compared with a median Hb of 101 g/L and 53% of patients having a Hb $\geqslant$100 g/L in the early presenters group. In both groups there was a large amount of variation between centres in the percentage of patients having a Hb $\geqslant$100 g/L (7–66% in the late presenters and 29–93% in the early presenters). The lower median Hb in late presenters may reflect inadequate pre-dialysis care with limited anaemia management, anaemia of multisystem disease or inter-current illness.

Median Hb of patients at the time of starting HD was 97 g/L (IQR 88–106 g/L) and in those starting PD it was 109 g/L (IQR 99–118 g/L). When starting dialysis, 43% of HD patients had a Hb $\geqslant$100 g/L, compared with 74% of PD patients.

Incident dialysis patients from 2012 were followed for one year and the median haemoglobin (and percentage with a Hb $\geqslant$100 g/L) of survivors on the same treatment at the same centre after a year was calculated for each quarter. Only patients who had Hb data for each of the four time points were included in this analysis. This was sub-analysed by modality and length of pre-RRT care (figures 7.3, 7.4). Hb was higher in the second quarter on dialysis than during the quarter at start of dialysis reflecting the benefits of treatment administered. Over 79% of incident patients surviving to a year had Hb

Table 7.2. Haemoglobin data for incident patients starting haemodialysis or peritoneal dialysis during 2013, both overall and by presentation time

	All incident patients				Early presenters only (⩾90 days)		Late presenters only (<90 days)	
Centre	% data return	*N* with data	Median Hb g/L	% Hb ⩾100 g/L	Median Hb g/L	% Hb ⩾100 g/L	Median Hb g/L	% Hb ⩾100 g/L
England								
B Heart	100	88	96	40	97	41		
B QEH	92	150	99	47	100	51	94	37
Basldn	100	31	94	32	92	32		
Bradfd	88	46	95	43	94	43		
Brightn	97	114	103	55	106	57	95	46
Bristol	100	141	105	84				
Camb	81	76	102	53	102	53	104	54
Carlis	100	32	111	72	111	69		
Carsh	38	68						
Chelms	86	32	106	56	106	61		
Colchr	79	22	93	27	94	36		
Covnt	95	69	97	46	97	45	107	60
Derby	100	70	101	54	102	58		
Donc	100	50	102	56	104	59		
Dorset	100	66	101	53	103	61	93	27
Dudley	100	38	96	42	96	47		
Exeter	100	92	107	90	107	93		
Glouc	100	40	101	53	101	54		
Hull	77	65	100	51	102	55		
Ipswi	94	33	100	52	101	58		
Kent	99	126	97	43	98	46	92	30
L Barts	99	249	99	49				
L Guys	20	20						
L Kings	100	154	94	36	97	40	88	21
L Rfree	99	194	101	53	101	55	98	47
L St.G	84	48	94	40				
L West	68	175	104	63	104	62	104	66
Leeds	98	134	93	28	94	29	93	25
Leic	100	249	97	43	98	48	92	24
Liv Ain	98	49	99	49	101	54		
Liv Roy	100	62	98	47	103	54	90	23
M RI	98	143	99	47	99	47	101	50
Middlbr	99	95	97	44	98	48	87	30
Newc	99	69	101	52	102	54	93	33
Norwch	100	63	97	43				
Nottm	100	84	96	37	98	45	83	7
Oxford	100	128	101	52	102	54	95	39
Plymth	100	51	100	51				
Ports	100	167	103	56	104	59	98	42
Prestn	100	125	97	44	96	43	99	48
Redng	99	99	100	53	102	59	87	30
Salford	98	104	95	40				
Sheff	100	117	96	42	99	47	86	20
Shrew	100	52	102	62	102	61		
Stevng	99	141	98	43	97	43	98	42
Sthend	100	37	101	51	101	56		
Stoke	93	79	102	58	106	70	91	25
Sund	95	40	100	50	102	58		
Truro	100	36	103	64	107	72		
Wirral	93	52	103	58				
Wolve	96	77	96	38	97	44	91	8
York	86	31	94	29				

Table 7.2. Continued

Centre	All incident patients				Early presenters only (⩾90 days)		Late presenters only (<90 days)	
	% data return	*N* with data	Median Hb g/L	% Hb ⩾100 g/L	Median Hb g/L	% Hb ⩾100 g/L	Median Hb g/L	% Hb ⩾100 g/L
N Ireland								
Antrim	96	23	92	35	96	42		
Belfast	94	46	98	46	98	47	94	36
Newry	100	21	107	71	107	74		
Ulster	96	24	101	50	102	50		
West NI	96	24	109	79	109	82		
Scotland								
Abrdn	100	49	96	45				
Airdrie	68	34	105	59				
D & Gall	88	7						
Dundee	88	36	96	44				
Edinb	98	57	100	54				
Glasgw	82	118	97	43				
Inverns	89	17	104	65				
Klmarnk	69	25	97	44				
Krkcldy	97	32	101	53				
Wales								
Bangor	100	21	98	48	96	42		
Cardff	99	140	104	61	104	62	100	50
Clwyd	100	12	104	58				
Swanse	100	88	100	51	100	51	101	53
Wrexm	91	29	107	66	109	73		
England	**92**	**4,573**	**99**	**50**	**100**	**52**	**94**	**36**
N Ireland	**96**	**138**	**102**	**54**	**102**	**58**	**94**	**33**
Scotland	**86**	**375**	**98**	**49**				
Wales	**98**	**290**	**102**	**57**	**102**	**58**	**100**	**50**
UK	**92**	**5,376**	**100**	**50**	**101**	**53**	**94**	**36**

Blank cells: centres excluded from analyses due to poor data completeness or low patient numbers or because presentation time data not available

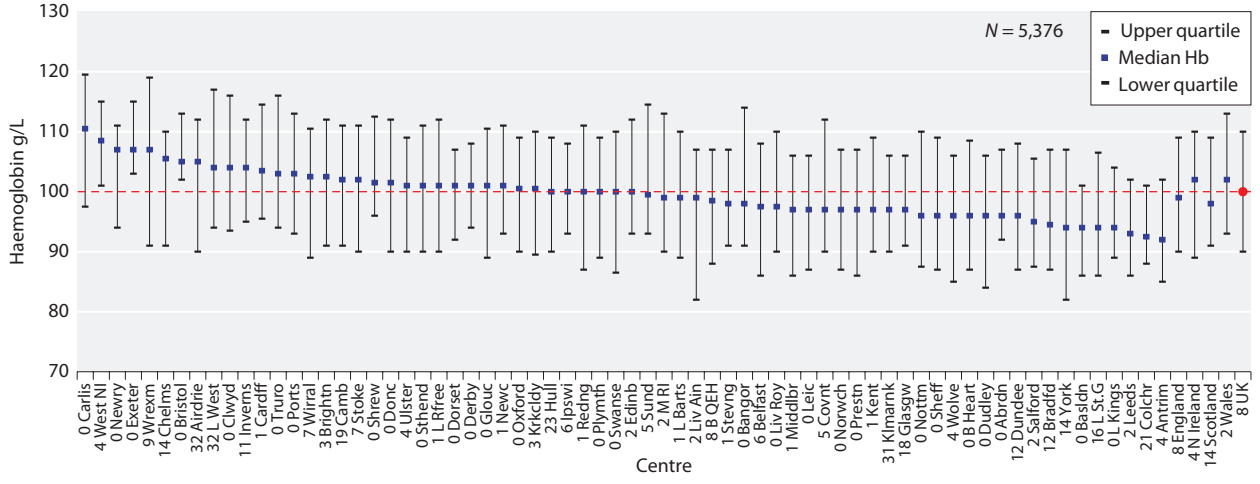

Fig. 7.1. Median haemoglobin for incident dialysis patients at start of dialysis treatment in 2013

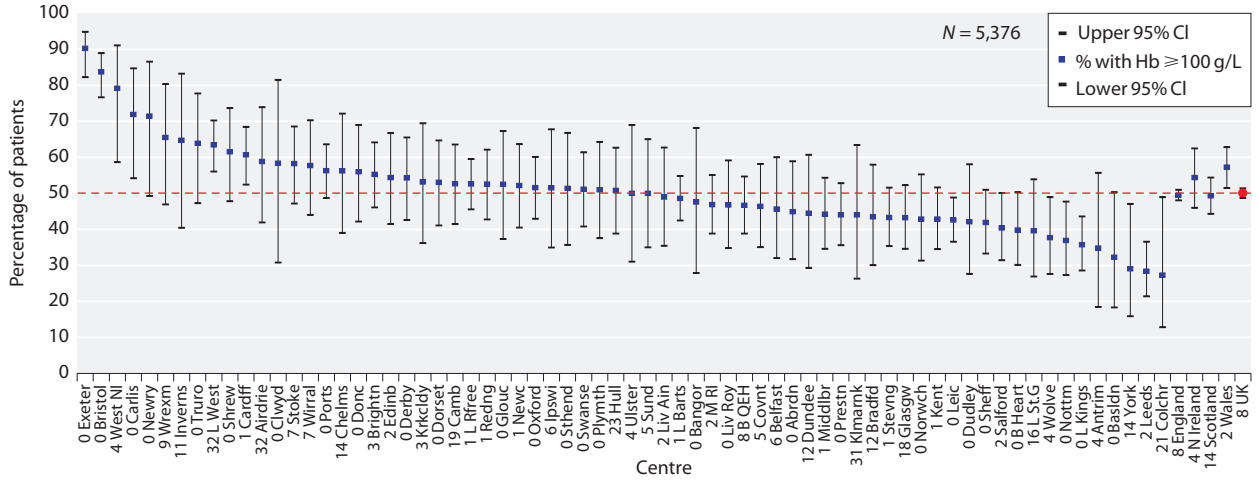

Fig. 7.2. Percentage of incident dialysis patients with Hb ⩾100 g/L at start of dialysis treatment in 2013

⩾100 g/L regardless of the modality or the length of pre-RRT care.

The annual distribution of Hb in incident dialysis patients is shown in figure 7.5. Since 2006, the proportion of incident patients with Hb ⩾120 g/L has fallen from 17% to 10% and the proportion of patients with Hb <100 g/L continues to gradually increase over the years from 40% to 50%. In the 2013 cohort with presentation time data, 64% of patients in the late presentation group had Hb <100 g/L compared with 47% in the early presentation group.

ESA by time on dialysis in early vs. late presenters

Incident dialysis patients from 2012 were followed for one year and the percentages receiving an ESA were calculated for each quarter for survivors on the same treatment at the same centre after a year. This was sub-analysed by modality and length of pre-RRT care

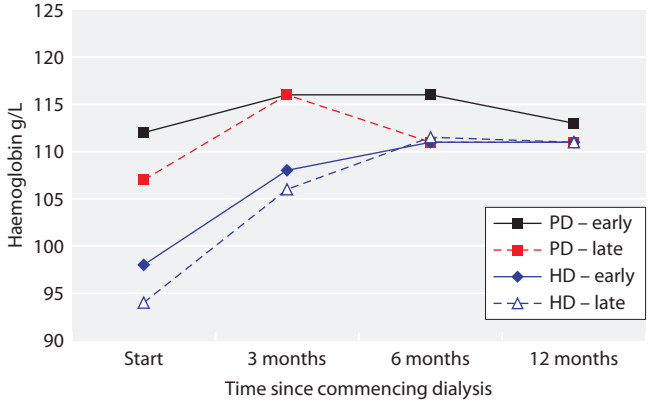

Fig. 7.3. Median haemoglobin, by time on dialysis and length of pre-RRT care, for incident dialysis patients in 2012

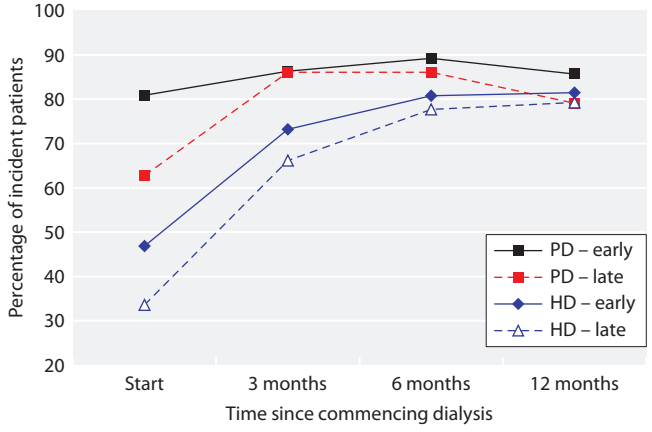

Fig. 7.4. Percentage of incident dialysis patients in 2012 with Hb ⩾100 g/L, by time on dialysis and by length of pre-RRT care

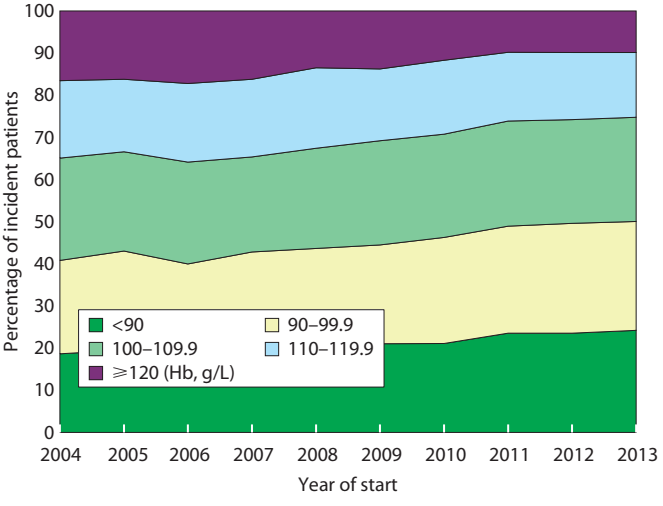

Fig. 7.5. Distribution of haemoglobin in incident dialysis patients by year of start

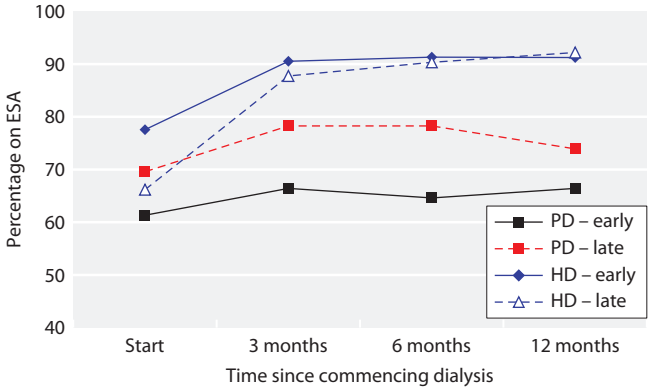

Fig. 7.6. Percentage of incident dialysis patients in 2012 on ESA, by time on dialysis and by length of pre-RRT care

(figure 7.6). For HD patients at the start of treatment there was a difference between early and late presenters in the percentage of patients receiving an ESA. This difference was greatly reduced by three months after starting and had disappeared within one year of starting dialysis. For PD patients there was a similar difference between the early and late group and this difference persisted over the first year after starting dialysis. However, caution is advised in interpreting this figure as the number (23) of patients in the PD late group was relatively small.

Anaemia management in prevalent dialysis patients

Compliance with data returns for haemoglobin and serum ferritin and percentages on ESA are shown for the 71 renal centres in the UK in table 7.3 for both HD and PD patients. Completeness of data returns was generally good for Hb and ferritin. The percentages on ESA are shown as they appear in the data received by the UKRR. For some centres, the ESA data was completely missing and for others it appears to be partially complete (i.e. very low percentages of patients appearing to be on

Table 7.3. Percentage completeness of data returns for haemoglobin and serum ferritin and percentages on ESA for prevalent HD and PD patients in 2013

	HD				PD			
Centre	*N*	Hb	Ferritin	% on ESA	*N*	Hb	Ferritin	% on ESA
England								
B Heart	401	100	99	77	35	100	100	60
B QEH	885	100	99	88	129	100	99	59
Basldn	152	99	99	91	30	100	100	63
Bradfd	186	100	99	96	26	100	100	62
Brightn	372	98	82	0	66	100	80	0
Bristol	485	100	99	91	57	100	95	63
Camb	356	51	76	52	19	95	100	53
Carlis	58	100	43	76	23	100	96	78
Carsh	698	95	93	0	105	94	94	0
Chelms	109	99	99	93	20	100	100	50
Colchr	109	93	91	5				
Covnt	354	100	100	86	72	99	90	50
Derby	203	100	100	0	78	99	97	0
Donc	146	100	99	90	30	100	97	80
Dorset	244	100	99	95	39	100	100	72
Dudley	163	95	94	2	47	100	96	2
Exeter	376	100	100	92	63	100	100	75
Glouc	188	100	98	89	31	100	81	81
Hull	299	100	100	77	72	100	99	49
Ipswi	112	100	100	77	24	100	100	71
Kent	376	100	99	91	57	100	95	54
L Barts	883	100	99	0	178	99	92	0
L Guys	591	0	74	18	28	0	64	0
L Kings	466	100	99	93	79	99	99	72
L Rfree	688	99	99	0	108	100	81	0
L St.G	255	99	98	0	45	98	100	0
L West	1,317	99	98	0	52	100	100	0
Leeds	470	100	100	86	62	100	100	79
Leic	828	100	100	97	135	97	96	74

Table 7.3. Continued

	HD				PD			
Centre	*N*	Hb	Ferritin	% on ESA	*N*	Hb	Ferritin	% on ESA
Liv Ain	148	99	99	0	26	100	100	0
Liv Roy	334	99	100	0	51	100	100	0
M RI	486	93	90	0	69	99	96	0
Middlbr	322	98	98	75	11	100	100	64
Newc	257	100	100	63	36	89	86	0
Norwch	305	100	99	91	35	100	100	77
Nottm	354	100	100	88	68	100	100	69
Oxford	405	100	100	91	83	99	99	78
Plymth	120	100	98	0	29	100	79	0
Ports	545	100	99	10	77	100	96	10
Prestn	508	99	100	91	52	100	100	83
Redng	260	100	100	83	64	100	100	5
Salford	362	88	0	52	75	97	0	0
Sheff	556	100	100	88	61	100	100	59
Shrew	176	100	99	90	26	100	100	62
Stevng	431	99	98	0	37	97	84	0
Sthend	110	100	100	95	15	100	100	60
Stoke	288	85	80	1	81	99	98	0
Sund	177	100	99	91	8	100	100	75
Truro	139	100	100	0	18	100	100	0
Wirral	198	99	99	0	27	78	70	0
Wolve	277	100	100	83	78	100	100	63
York	129	100	100	89	25	100	100	64
N Ireland								
Antrim	120	99	99	95	15	100	100	80
Belfast	199	100	99	92	26	100	100	88
Newry	84	95	21	92	17	100	100	88
Ulster	103	100	100	96	4	100	100	100
West NI	107	97	62	94	14	100	100	79
Scotland								
Abrdn	206	98	96		21	100		
Airdrie	177	99	95		12	100		
D & Gall	44	100	95		11	91		
Dundee	163	99	79		18	94		
Edinb	255	100	93		25	100		
Glasgw	561	99	89		39	100		
Inverns	63	100	65		13	92		
Klmarnk	126	100	88		39	97		
Krkcldy	142	99	92		18	94		
Wales								
Bangor	84	100	100	79	12	100	100	33
Cardff	460	100	100	38	66	100	80	12
Clwyd	72	100	100	86	14	100	100	14
Swanse	311	100	100	86	53	100	96	74
Wrexm	96	100	73	89	19	100	53	58
England	**18,657**	**95**	**95**	**90**	**2,762**	**98**	**93**	**74**
N Ireland	**613**	**99**	**82**	**92**	**76**	**100**	**100**	**78**
Scotland	**1,737**	**99**	**89**		**196**	**97**		
Wales	**1,023**	**100**	**97**	**89**	**164**	**100**	**85**	**58**
UK	**22,030**	**95**	**94**	**88***	**3,198**	**98**	**92***	**68***

Blank cells: centres with no PD patients or because data was not available
Percentages on ESA are shown, but it is believed that there were data problems for those centres with apparently less than 60% of HD patients or 45% of PD patients on ESA
The country level averages for the % on ESA are based only on those centres whose % was above the limits mentioned above
*These overall averages are for E,W & NI (not UK)

ESAs). It is believed that there were problems with data entry and/or data transfer for those centres where the percentage on ESA was less than 60% for HD patients or 45% for PD patients. These centres have been excluded from further analyses of ESA use.

Summary statistics for haemoglobin, serum ferritin and ESA are shown for the 71 renal centres in the UK in tables 7.4 for HD and 7.5 for PD patients respectively.

Haemoglobin in prevalent haemodialysis patients

The median Hb of patients on HD in the UK was 112 g/L with an IQR of 103–120 g/L and 83% of HD patients had a Hb $\geqslant$100 g/L (table 7.4). The median Hb by centre is shown in figure 7.7. Compliance with the target range of Hb $\geqslant$100 and $\leqslant$120 g/L (figure 7.8) continues to increase year on year, 53% in 2010, 56% in 2011, 57% in 2012 and 59% in 2013. The percentages of HD patients with Hb below 100 g/L and above 120 g/L, as well as the percentages meeting the target, are shown by centre in figure 7.9.

Funnel plots are shown for the minimum (Hb $\geqslant$100 g/L) and target range (Hb $\geqslant$100 and $\leqslant$120 g/L) in figures 7.10 and 7.11 respectively. Many centres complied well with respect to both the minimum and target range Hb standards. Some centres complied well with the percentage with Hb $\geqslant$100 g/L (figure 7.10) but had a poor compliance with percentage of patients with Hb $\geqslant$100 and $\leqslant$120 g/L (figure 7.11). Table 7.4 can be used in conjunction with figures 7.10 and 7.11 to identify centres.

Haemoglobin in prevalent peritoneal dialysis patients

Overall, 83% of patients on PD had a Hb $\geqslant$100 g/L (table 7.5). The median Hb of patients on PD in the UK in 2013 was 113 g/L with an IQR of 103–122 g/L. The median Hb by centre is shown in figure 7.12. The

Table 7.4. Summary statistics for haemoglobin, serum ferritin and ESA for prevalent HD patients in 2013

Centre	*N* with Hb data	Median Hb g/L	% Hb $\geqslant$100 g/L	% Hb 100–120 g/L	Median ferritin μg/L	% ferritin $\geqslant$100 μg/L	% ferritin >200 and $\leqslant$500 μg/L	% on ESA	Median ESA dose (IU/week)	% with Hb $\geqslant$100 g/L and not on ESA
England										
B Heart	401	111	81	59	344	96	62	77	7,500	21
B QEH	881	110	79	63	351	94	68	88	6,500	11
Basldn	151	108	72	54	348	93	69	91	6,000	6
Bradfd	186	114	81	55	538	99	38	96	6,500	4
Brightn	363	109	77	58	535	99	36			
Bristol	485	112	96	69	560	98	33	91	7,500	9
Camb	180	110	82	62	322	92	60			
Carlis	58	120	97	50				76	4,000	24
Carsh	660	111	83	65	351	95	70			
Chelms	108	116	90	61	627	99	19	93	8,000	7
Colchr	101	114	80	46	556	99	37			
Covnt	354	109	76	63	364	97	65	86	10,000	10
Derby	203	115	87	58	449	95	44			
Donc	146	115	82	49	388	98	55	90	6,250	10
Dorset	244	114	86	62	515	97	40	95	8,000	5
Dudley	155	111	83	60	317	93	66			
Exeter	376	114	97	76	266	86	52	92	7,250	8
Glouc	188	114	91	60	361	90	44	89		11
Hull	299	113	84	56	387	96	67	77	6,000	20
Ipswi	112	111	81	56	622	96	27	77	6,000	19
Kent	376	111	83	58	470	95	38	91	8,250	7
L Barts	882	110	78	58	438	95	52			
L Guys	0				657	96	24			
L Kings	465	107	76	68	564	97	34	93	7,500	7
L Rfree	681	111	83	63	496	95	37			
L St.G	253	111	78	57	407	97	59			
L West	1,303	115	90	63	360	96	67			
Leeds	470	109	81	65	473	96	43	86	4,500	12
Leic	827	112	79	52	348	96	63	97	6,000	2

Table 7.4. Continued

Centre	*N* with Hb data	Median Hb g/L	% Hb ⩾100 g/L	% Hb 100–120 g/L	Median ferritin μg/L	% ferritin ⩾100 μg/L	% ferritin >200 and ⩽500 μg/L	% on ESA	Median ESA dose (IU/week)	% with Hb ⩾100 g/L and not on ESA
Liv Ain	147	114	81	55	516	94	33			
Liv Roy	332	115	81	47	482	90	34			
M RI	452	113	83	56	378	95	56			
Middlbr	317	113	83	54	817	96	24	75	5,000	21
Newc	257	111	81	54	421	95	47	63	11,900	32
Norwch	304	116	87	52	486	94	37	91	8,000	9
Nottm	354	110	80	64	579	98	26	88	6,750	11
Oxford	405	112	82	55	296	93	60	91	8,000	8
Plymth	120	113	83	59	905	98	15			
Ports	544	115	85	50	507	96	38			
Prestn	504	110	79	62	577	95	30	91		8
Redng	260	115	82	50	496	98	46	83	14,000	10
Salford	319	107	73	55						
Sheff	555	113	83	53	457	97	49	88	7,500	11
Shrew	176	114	87	57	414	96	51	90	8,250	9
Stevng	426	111	82	62	616	97	29			
Sthend	110	108	76	70	346	100	83	95	9,500	5
Stoke	244	114	83	53	310	93	55			
Sund	177	115	85	57	524	97	35	91	9,423	9
Truro	139	112	82	63	416	97	58			
Wirral	196	113	84	58	458	96	54			
Wolve	277	114	83	50	479	95	42	83	7,500	17
York	129	111	83	63	429	96	67	89	4,250	10
N Ireland										
Antrim	119	113	88	62	462	97	45	95	6,375	5
Belfast	198	112	80	55	435	94	38	92	8,250	8
Newry	80	113	86	59				92	4,500	8
Ulster	103	111	84	66	626	100	25	96	6,000	3
West NI	104	110	82	64	605	94	26	94	8,000	6
Scotland										
Abrdn	202	107	70	56	648	97	26			
Airdrie	176	112	84	64	606	99	35			
D & Gall	44	109	80	66	664	100	26			
Dundee	161	110	81	65	335	89	50			
Edinb	254	117	90	52	476	94	34			
Glasgw	556	114	85	54	421	94	41			
Inverns	63	112	86	71	292	98	80			
Klmarnk	126	113	79	53	302	84	50			
Krkcldy	141	116	86	55	517	89	24			
Wales										
Bangor	84	114	90	64	386	95	58	79	8,250	18
Cardff	460	112	79	55	293	95	64			
Clwyd	72	118	89	53	348	100	79	86		14
Swanse	311	111	82	62	372	92	43	86	8,000	14
Wrexm	96	109	78	55	419	99	60	89	5,500	10
England	**17,652**	**112**	**83**	**59**	**427**	**95**	**49**	**88**	**7,500**	**11**
N Ireland	**604**	**112**	**83**	**60**	**522**	**96**	**35**	**94**	**6,500**	**6**
Scotland	**1,723**	**113**	**83**	**57**	**458**	**94**	**38**			
Wales	**1,023**	**112**	**81**	**58**	**331**	**94**	**58**	**85**	**7,500**	**14**
UK	**21,002**	**112**	**83**	**59**	**424**	**95**	**48**	**88***	**7,333***	**11***

Blank cells: centres excluded from analyses due to poor data completeness or low patient numbers or because the data item was not available
ESA data only shown for those centres for which the % on ESA was 60% or more
*For ESA, these overall averages are for E,W & NI (not UK)

Table 7.5. Summary statistics for haemoglobin, serum ferritin and ESA for prevalent PD patients in 2013

Centre	*N* with Hb data	Median Hb g/L	% Hb ⩾100 g/L	% Hb 100–120 g/L	Median ferritin μg/L	% ferritin ⩾100 μg/L	% ferritin >100 and ⩽500 μg/L	% on ESA	Median ESA dose (IU/week)	% with Hb ⩾100 g/L and not on ESA
England										
B Heart	35	110	80	54	271	91	69	60	5,000	34
B QEH	129	112	80	51	306	88	66	59	4,000	40
Basldn	30	110	77	63	138	70	63	63	4,000	33
Bradfd	26	112	77	42	250	77	58	62	6,750	35
Brightn	66	117	92	58	428	94	53			
Bristol	57	115	95	67	358	96	72	63	5,500	37
Camb	18	111	89	67	283	95	95	53	3,450	44
Carlis	23	116	96	57	474	100	55	78	4,000	22
Carsh	99	110	66	44	191	80	74			
Chelms	20	116	95	55	167	80	80	50	3,000	50
Colchr	n/a									
Covnt	71	115	85	49	267	80	65	50	8,000	46
Derby	77	115	78	49	446	97	51			
Donc	30	116	83	57	390	97	69	80	4,500	20
Dorset	39	115	82	49	301	97	77	72	3,950	28
Dudley	47	109	85	62	150	60	51			
Exeter	63	112	98	70	204	83	73	75	3,000	24
Glouc	31	108	74	58	154	60	60	81		19
Hull	72	113	82	53	311	97	76	49	4,000	46
Ipswi	24	112	83	67	439	79	33	71	5,000	25
Kent	57	111	84	61	280	91	63	54	4,000	42
L Barts	177	113	80	49	228	90	71			
L Guys	0				216	72	67			
L Kings	78	111	81	62	242	87	73	72	4,375	24
L Rfree	108	110	70	46	508	98	48			
L St.G	44	113	82	55	237	89	76			
L West	52	106	65	50	268	88	75			
Leeds	62	111	77	58	333	94	71	79	4,250	21
Leic	131	113	89	63	307	92	69	74	4,000	25
Liv Ain	26	106	65	50	328	92	65			
Liv Roy	51	112	75	47	302	82	59			
M RI	68	114	81	43	207	82	74			
Middlbr	11	117	100	64	336	100	73	64	3,000	36
Newc	32	115	84	56	400	94	48			
Norwch	35	116	91	51	189	69	51	77	3,400	23
Nottm	68	111	81	60	387	91	65	69	2,875	29
Oxford	82	113	84	55	247	83	68	78	6,000	16
Plymth	29	115	76	41	306	83	48			
Ports	77	114	88	56	381	97	64			
Prestn	52	115	88	50	372	94	60	83		17
Redng	64	119	92	50	441	95	56			
Salford	73	112	79	51						
Sheff	61	113	77	44	480	95	51	59	6,000	38
Shrew	26	112	88	46	253	81	62	62	4,000	38
Stevng	36	117	92	64	223	71	58			
Sthend	15	117	93	67	146	93	93	60		40
Stoke	80	115	85	54	415	91	53			
Sund	8									
Truro	18	115	89	56	176	72	67			
Wirral	21	103	57	48	588	100	42			
Wolve	78	112	81	56	204	81	73	63	6,000	36
York	25	117	80	40	217	88	76	64	2,438	36

Table 7.5. Continued

Centre	*N* with Hb data	Median Hb g/L	% Hb ⩾100 g/L	% Hb 100–120 g/L	Median ferritin μg/L	% ferritin ⩾100 μg/L	% ferritin >100 and ⩽500 μg/L	% on ESA	Median ESA dose (IU/week)	% with Hb ⩾100 g/L and not on ESA
N Ireland										
Antrim	15	114	87	67	346	100	73	80	6,000	20
Belfast	26	111	88	65	246	92	77	88	3,000	12
Newry	17	106	94	88	287	88	71	88	4,800	12
Ulster	4									
West NI	14	114	93	64	332	93	57	79	2,000	21
Scotland										
Abrdn	21	112	76	57						
Airdrie	12	114	92	67						
D & Gall	10	112	80	60						
Dundee	17	115	82	71						
Edinb	25	109	76	60						
Glasgw	39	111	92	74						
Inverns	12	119	92	58						
Klmarnk	38	113	76	47						
Krkcldy	17	113	88	71						
Wales										
Bangor	12	121	92	42	212	75	67			
Cardff	66	112	88	53	112	57	55			
Clwyd	14	114	86	57	246	71	57			
Swanse	53	113	91	64	380	94	69	74	4,000	26
Wrexm	19	112	84	47	256	100	90	58	7,450	42
England	**2,702**	**113**	**82**	**54**	**288**	**88**	**65**	**67**	**4,000**	**31**
N Ireland	**76**	**111**	**91**	**71**	**308**	**93**	**71**	**86**	**4,000**	**14**
Scotland	**191**	**112**	**83**	**62**						
Wales	**164**	**113**	**88**	**55**	**201**	**76**	**64**	**69**	**4,688**	**31**
UK	**3,133**	**113**	**83**	**55**	**285***	**88***	**65***	**68***	**4,000***	**31***

Blank cells: centres excluded from analyses due to poor data completeness or low patient numbers or because the data item was not available
n/a – no PD patients
ESA data only shown for those centres for which the % on ESA was 45% or more
*For ferritin and for ESA these overall averages are for E,W & NI (not UK)

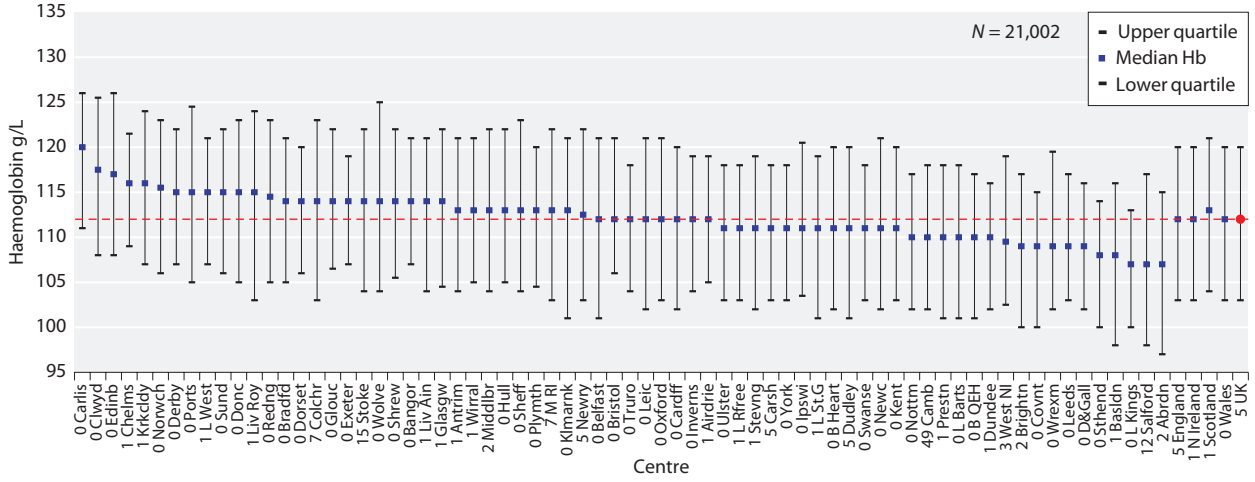

Fig. 7.7. Median haemoglobin in patients treated with HD by centre in 2013

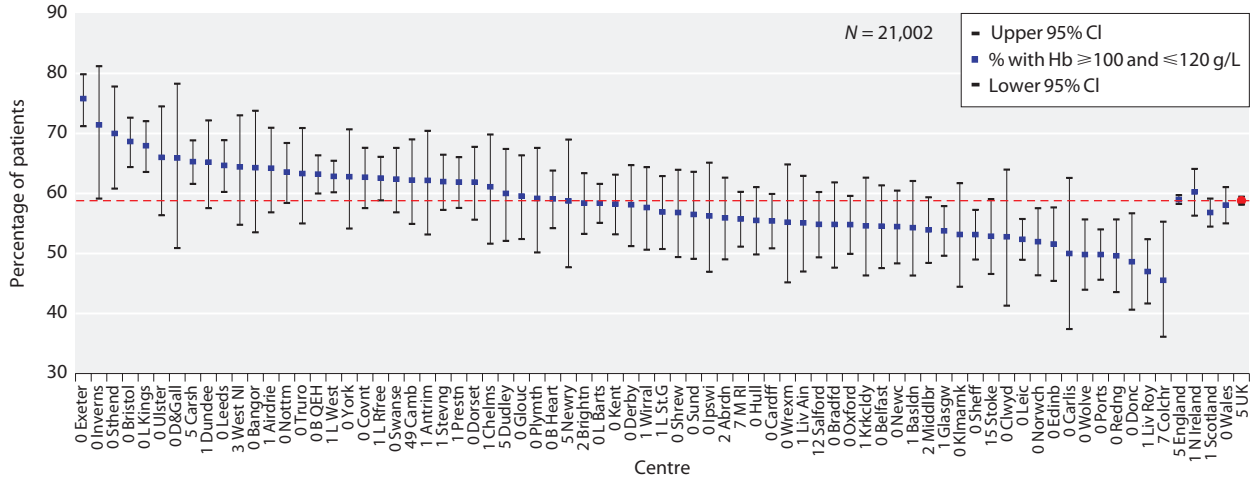

Fig. 7.8. Percentage of HD patients with Hb ⩾100 and ⩽120 g/L by centre in 2013

compliance with Hb ⩾100 and ⩽120 g/L is shown in figure 7.13. In 2013, 55% of prevalent PD patients had a Hb within the target range. The distribution of Hb in PD patients by centre is shown in figure 7.14. The funnel plots for percentage with Hb ⩾100 g/L and for the percentage of patients with Hb ⩾100 and ⩽120 g/L are shown in figures 7.15 and 7.16 respectively. Table 7.5 can be used in conjunction with figures 7.15 and 7.16 to identify centres in the funnel plot.

Relationship between Hb in incident and prevalent dialysis patients in 2013

The relationship between the percentage of incident and prevalent dialysis (HD and PD) patients with a Hb ⩾100 g/L is shown in figure 7.17. As expected, all centres had a higher percentage of prevalent patients achieving a Hb ⩾100 g/L than that for incident patients. Overall in the UK, 83% of prevalent patients, compared with 50% of incident patients, had a Hb ⩾100 g/L in 2013. Compliance with the current minimum standard (Hb ⩾100 g/L) is shown by year (1998–2013) for incident and prevalent patients (all dialysis patients) in figure 7.18. The decline in achieving this standard appears to be levelling off.

Ferritin in prevalent haemodialysis patients

The median and IQR for serum ferritin for patients treated with HD are shown in figure 7.19. The percentages with serum ferritin ⩾100 μg/L, >200 μg/L to

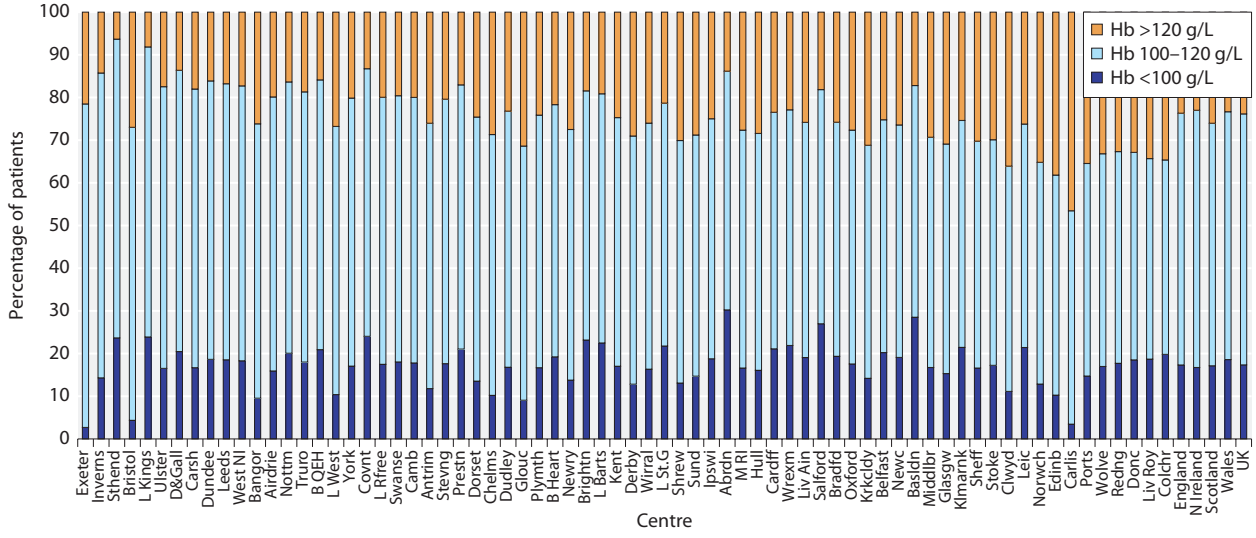

Fig. 7.9. Distribution of haemoglobin in patients treated with HD by centre in 2013

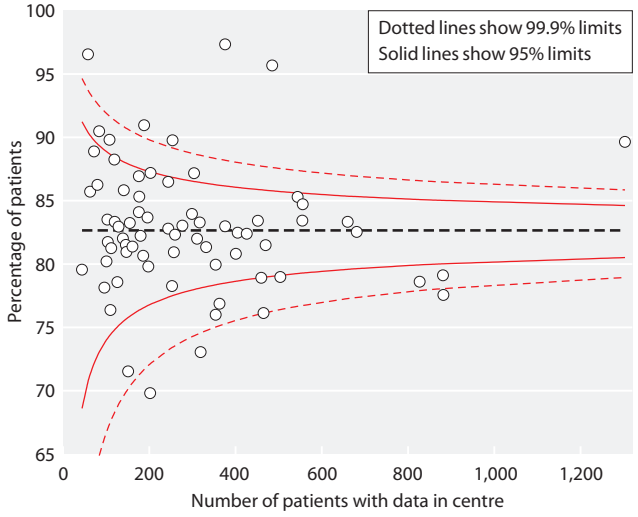

Fig. 7.10. Funnel plot of percentage of HD patients with Hb ⩾100 g/L by centre in 2013

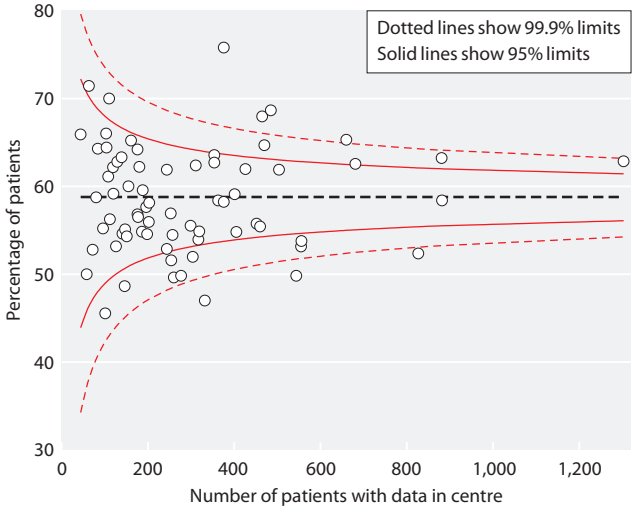

Fig. 7.11. Funnel plot of percentage of HD patients with Hb ⩾100 and ⩽120 g/L by centre in 2013

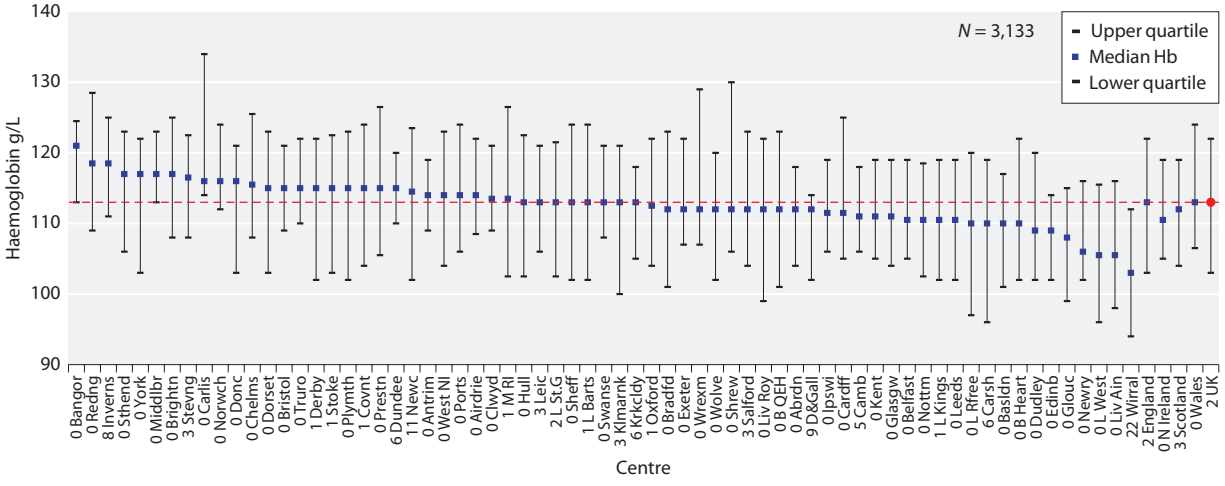

Fig. 7.12. Median haemoglobin in patients treated with PD by centre in 2013

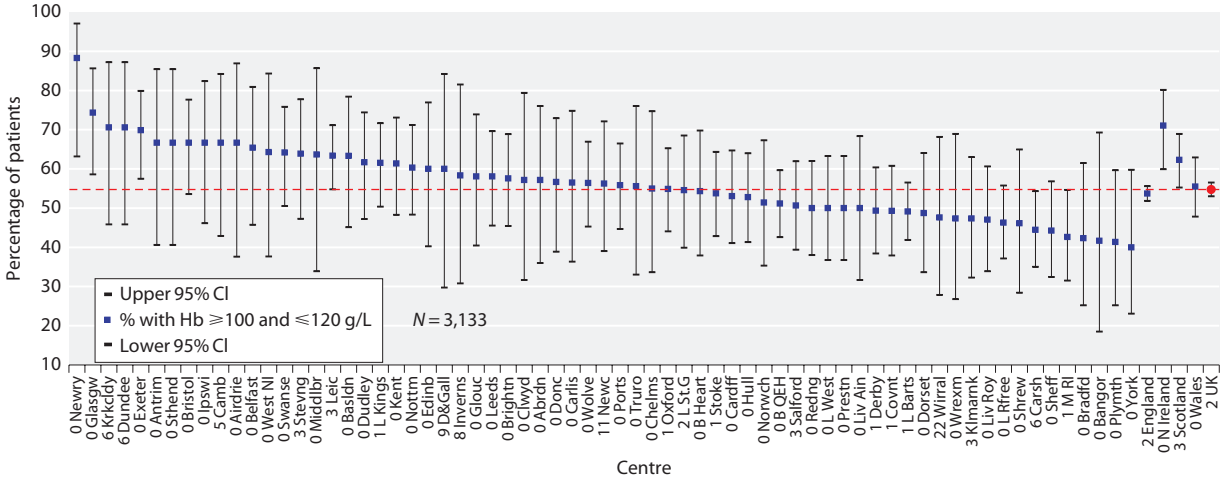

Fig. 7.13. Percentage of PD patients with Hb ⩾100 and ⩽120 g/L by centre in 2013

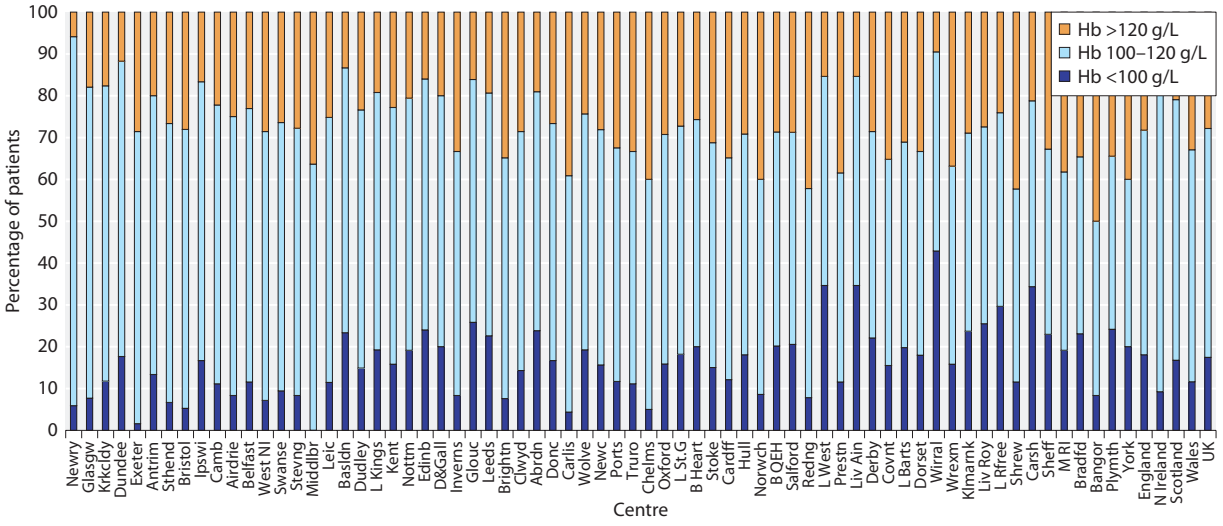

Fig. 7.14. Distribution of haemoglobin in patients treated with PD by centre in 2013

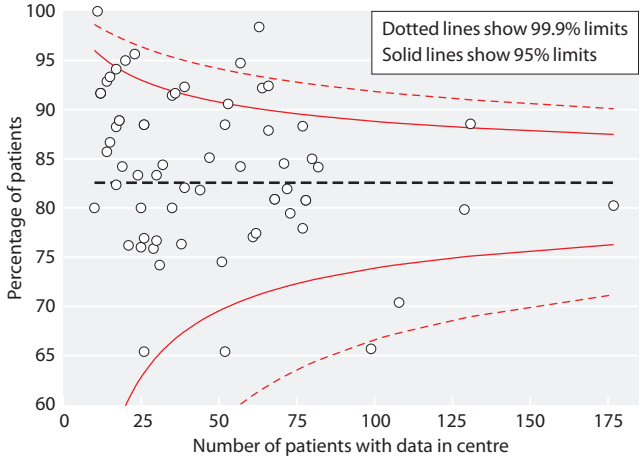

Fig. 7.15. Funnel plot of percentage of PD patients with Hb ⩾100 g/L by centre in 2013

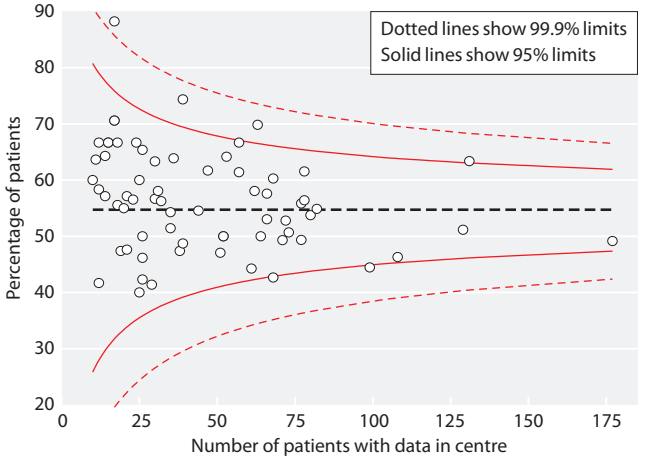

Fig. 7.16. Funnel plot of percentage of PD patients with Hb ⩾100 g/L and ⩽120 g/L by centre in 2013

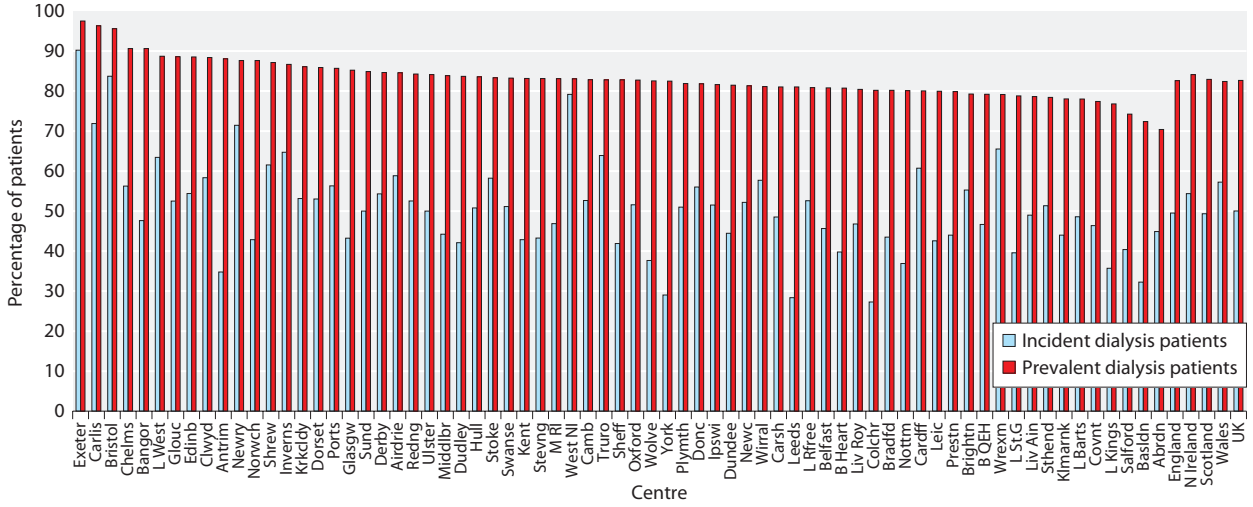

Fig. 7.17. Percentage of incident and prevalent dialysis patients with Hb ⩾100 g/L by centre in 2013

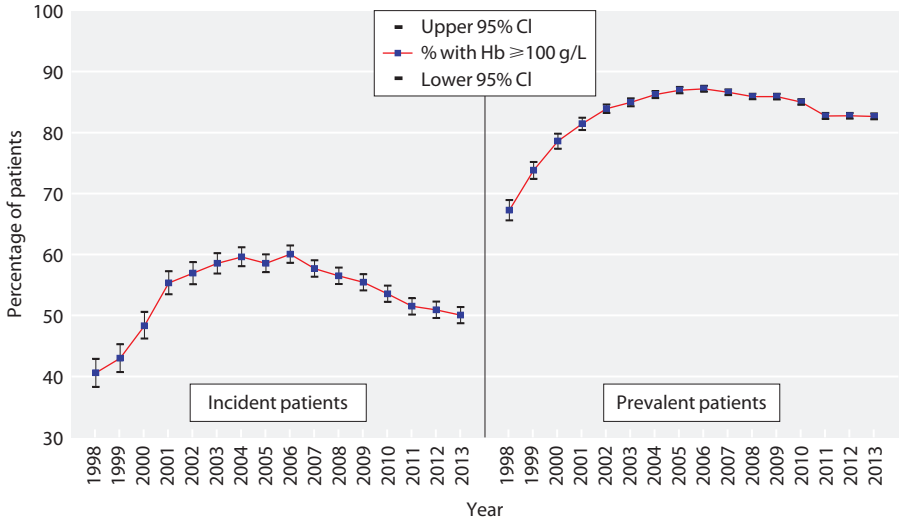

Fig. 7.18. Percentage of incident and prevalent dialysis patients (1998–2013) with Hb ⩾100 g/L

⩽500 μg/L, and ⩾800 μg/L are shown in figures 7.20, 7.21 and 7.22 respectively. Most centres achieved greater than 90% compliance with a serum ferritin ⩾100 μg/L for HD patients. The HD population had a median ferritin value of 424 μg/L, IQR 280–616. Twenty centres had greater than 20% (20–60%) of their patients having ferritin ⩾800 μg/L (figure 7.22). Twelve of these 20 had values over 25%. The serum ferritin correlated poorly with median Hb achieved and ESA dose (table 7.4).

Ferritin in prevalent peritoneal dialysis patients

The median and IQR for serum ferritin for patients treated with PD are shown in figure 7.23. The percentages with serum ferritin ⩾100 μg/L, >100 μg/L and ⩽500 μg/L, and ⩾800 μg/L are shown in figures 7.24, 7.25 and 7.26 respectively. The PD population had a lower median ferritin value (285 μg/L, IQR 167–473) than the HD population. Twenty-nine centres reported less than 90% of PD patients being compliant with serum ferritin ⩾100 μg/L, although this appeared to have little bearing on their achieved median Hb or median ESA dose when compared with other centres (table 7.5).

Erythropoietin stimulating agents in prevalent haemodialysis patients

As shown in previous reports there was substantial variation in the average dose of ESA prescription used.

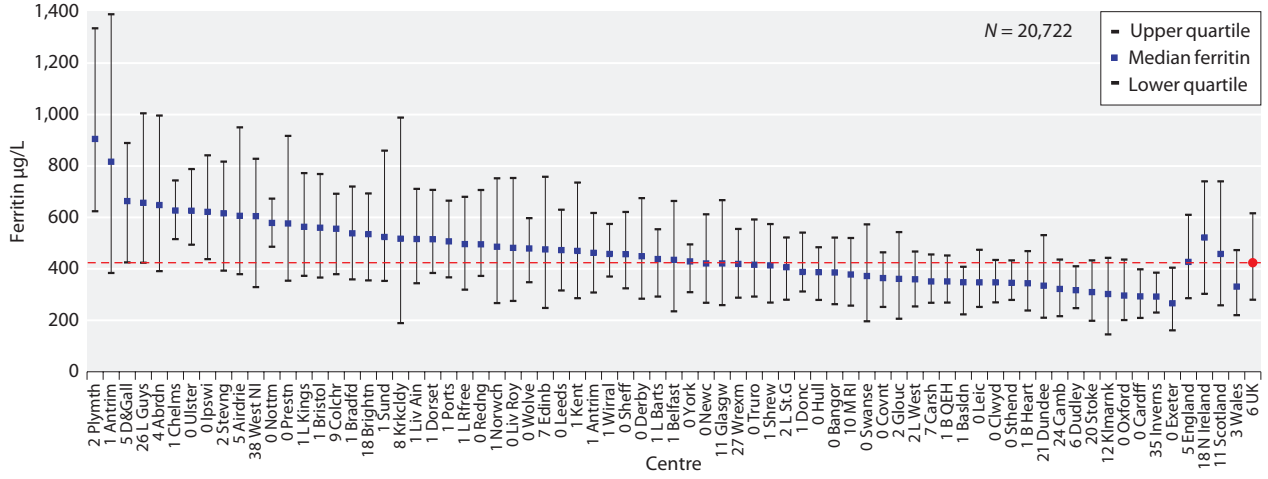

Fig. 7.19. Median ferritin in patients treated with HD by centre in 2013

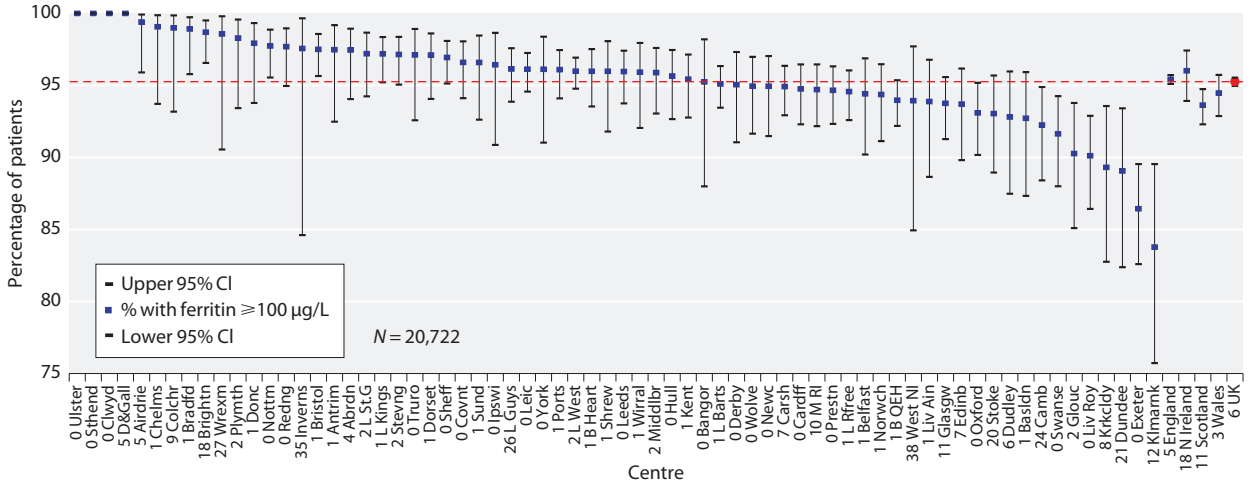

Fig. 7.20. Percentage of HD patients with ferritin ⩾100 µg/L by centre in 2013

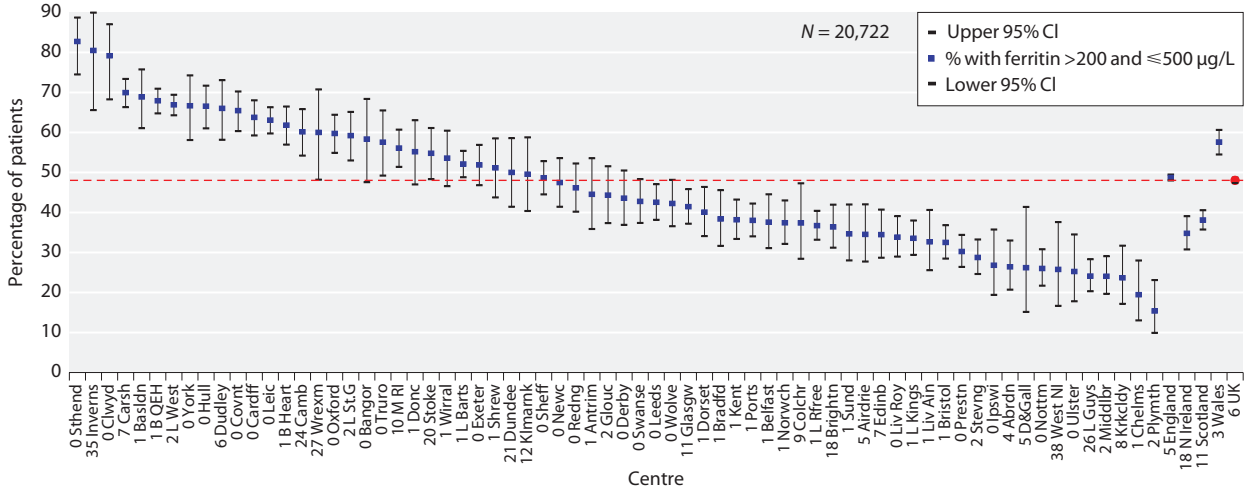

Fig. 7.21. Percentage of HD patients with ferritin >200 µg/L and ⩽500 µg/L by centre in 2013

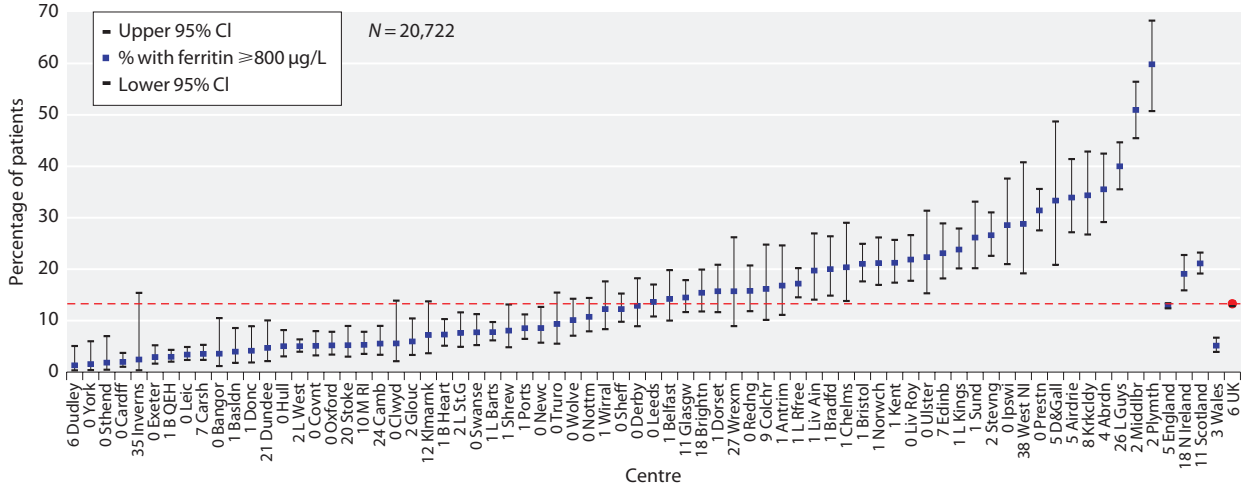

Fig. 7.22. Percentage of HD patients with ferritin ⩾800 µg/L by centre in 2013

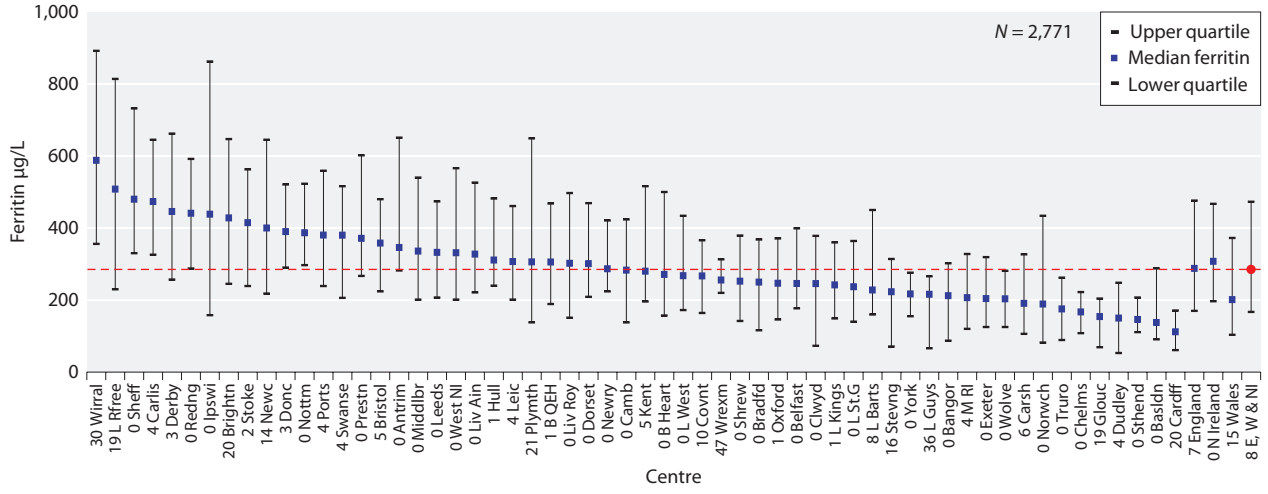

Fig. 7.23. Median ferritin in patients treated with PD by centre in 2013

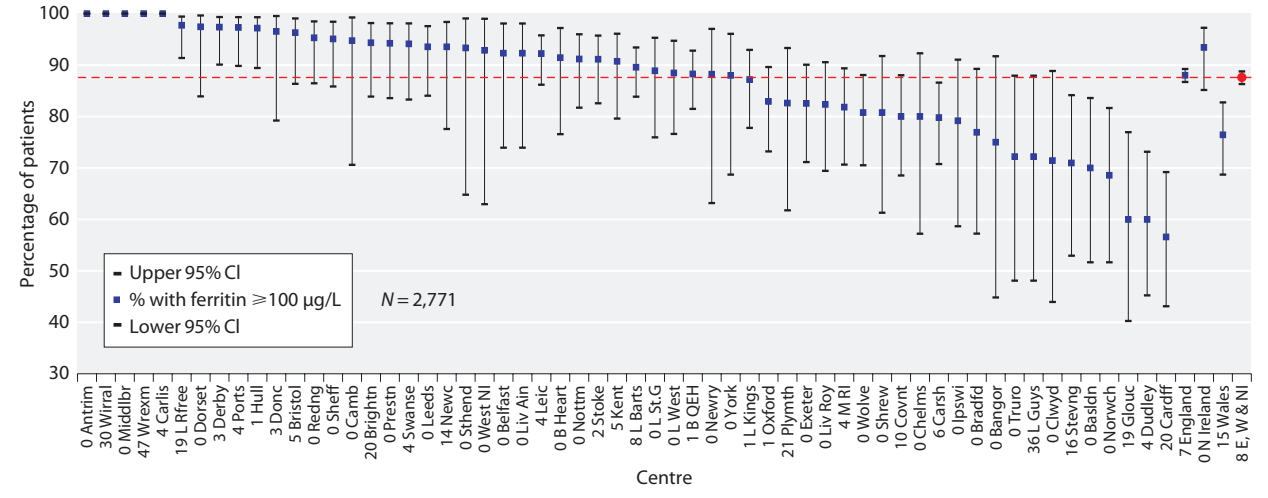

Fig. 7.24. Percentage of PD patients with ferritin ⩾100 µg/L by centre in 2013

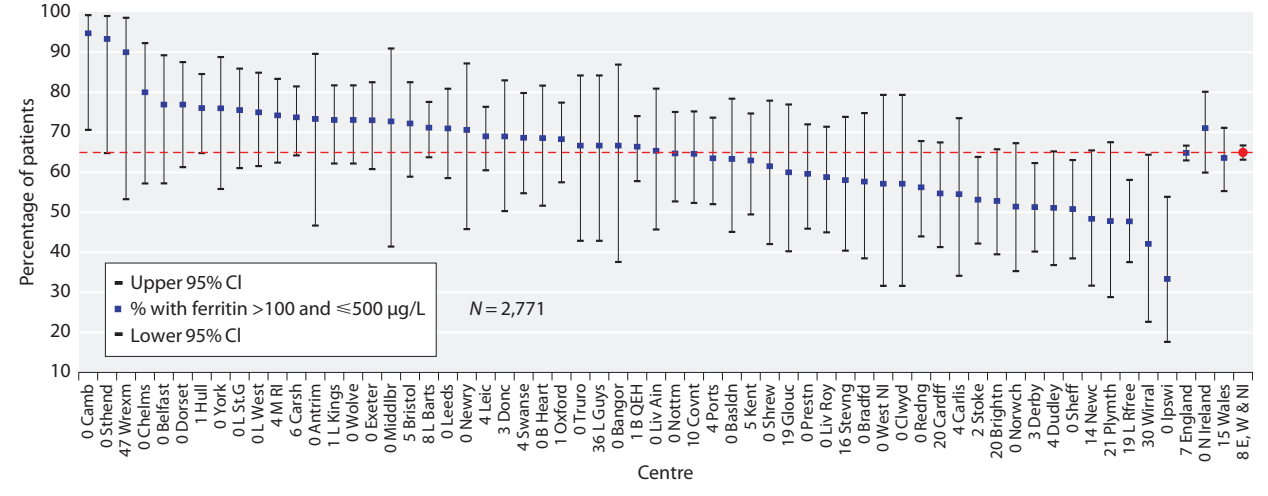

Fig. 7.25. Percentage of PD patients with ferritin >100 µg/L and ⩽500 µg/L by centre in 2013

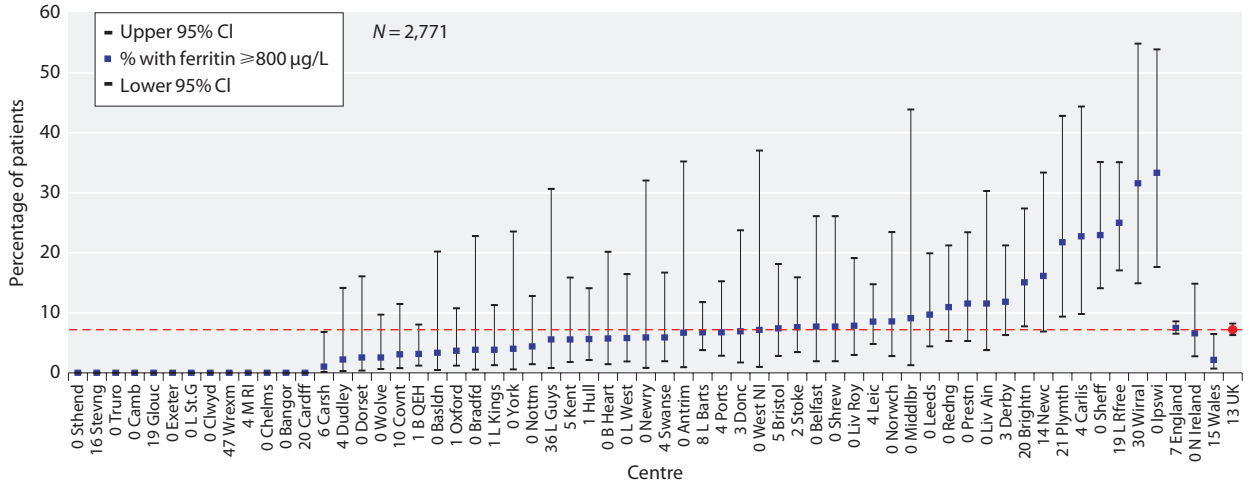

Fig. 7.26. Percentage of PD patients with ferritin ⩾800 µg/L by centre in 2013

The median dose for prevalent HD patients in England, Wales and Northern Ireland was 7,333 IU/week. The median dose varied from 4,000 IU/week (Carlisle) to 14,000 IU/week (Reading) with a median Hb for these centres of 120 g/L (Carlisle) and 115 g/L (Reading) (table 7.4). The 2013 median dose was similar to that for 2012 (7,248 IU/week).

Erythropoietin stimulating agents in prevalent peritoneal dialysis patients

For prevalent PD patients the median dose was substantially lower than for HD patients. The median dose was 4,000 IU/week with a range of 2,000 to 8,000 (table 7.5). The 2013 median dose is similar to that for 2012 (4,250 IU/week).

ESA prescription and association with achieved haemoglobin

For HD patients, centre level median Hb is plotted against median ESA dose in figure 7.27 and compliance with the RA standards for Hb ⩾100 g/L and ⩽120 g/L is plotted against median ESA dose in figure 7.28. For these figures, Hb data was only used for those patients who were receiving an ESA and had dose data available. There was no strong relationship in either figure.

It is known that not all patients treated with dialysis who have a Hb above 120 g/L are receiving ESA. It has been suggested that it may be inappropriate to include those patients not receiving ESA within the group not meeting this RA target. There are two reasons: firstly, the high Hb remains outside the control of the clinician, and secondly, the recent trials suggesting that it may be

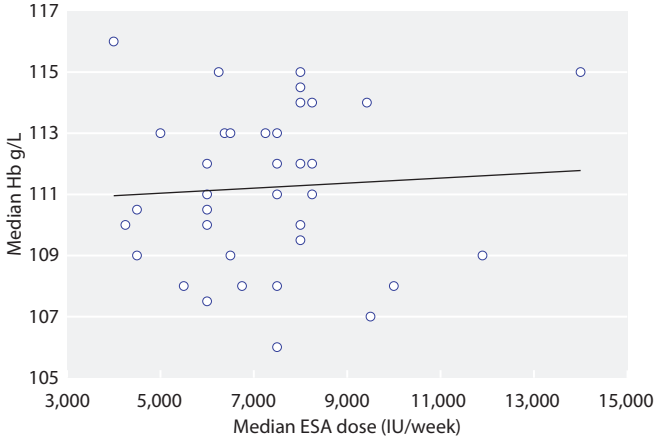

Fig. 7.27. Median Hb versus median ESA dose in HD patients on ESA, by centre in 2013

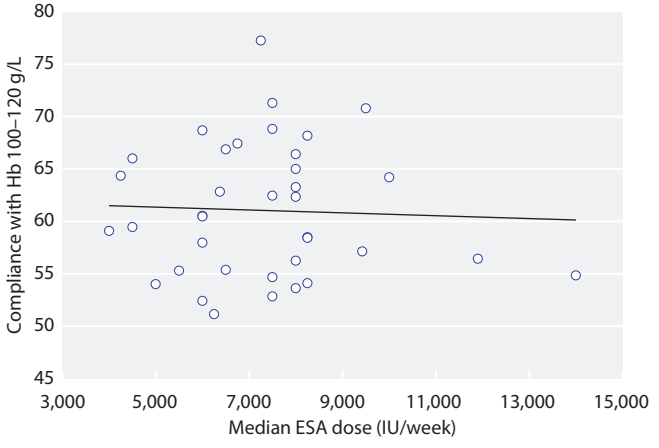

Fig. 7.28. Compliance with Hb 100–120 g/L versus median ESA dose in HD patients on ESA, by centre in 2013

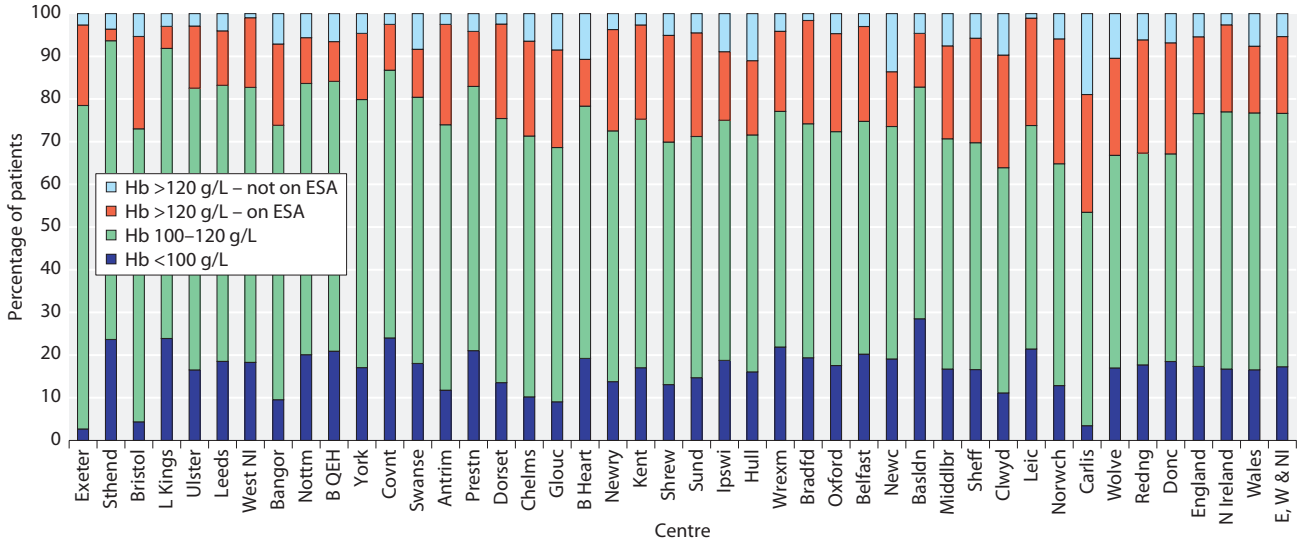

Fig. 7.29. Distribution of haemoglobin in patients treated with HD and the proportion of patients with Hb >120 g/L receiving ESA by centre in 2013

detrimental to achieve a high Hb in renal patients were based only upon patients treated with ESAs [6,7].

Figures 7.29 and 7.30 show the percentages of HD and PD patients in each centre whose Hb lies above, within or below the RA guidelines of 100–120 g/L. These charts also show the proportion of patients with a Hb above the upper limit who were receiving, or were not receiving an ESA. These analyses are restricted to the centres with acceptable ESA returns as stipulated above. These figures show that 23% of HD patients had a Hb >120 g/L. Most of these patients (77%) were on ESAs. Whereas for PD, 28% of patients had a Hb >120 g/L, but only about 47% of these were on ESAs.

ESA prescription: age and modality associations

The proportion of patients on an ESA was higher for HD (88%) than PD (68%) and this difference was present and similar across all age groups (figure 7.31). The

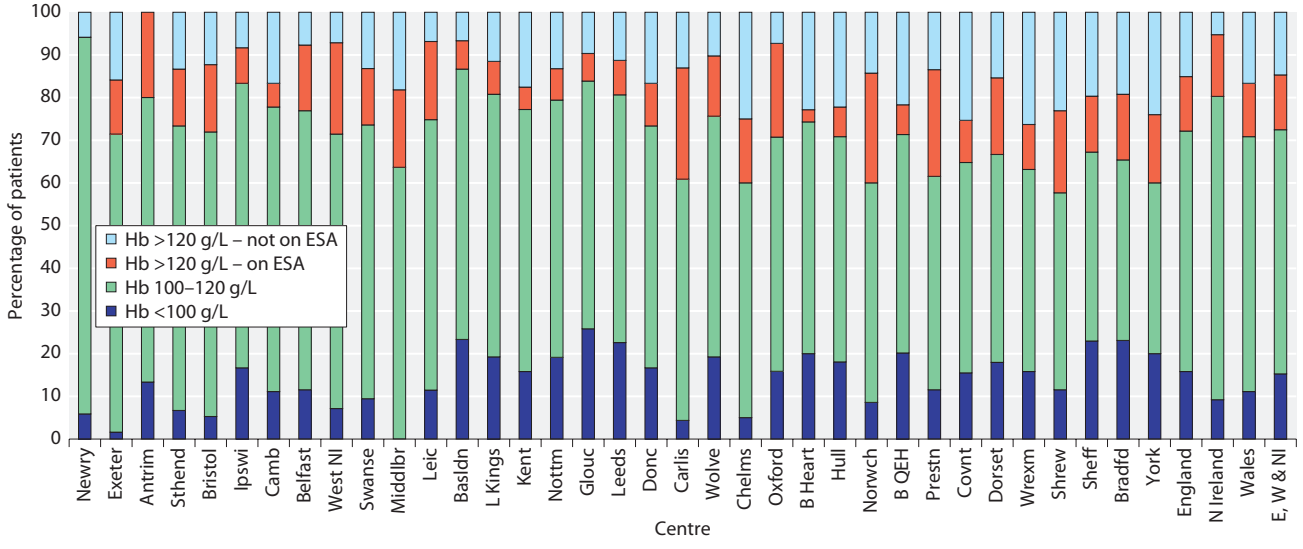

Fig. 7.30. Distribution of haemoglobin in patients treated with PD and the proportion of patients with Hb >120 g/L receiving ESA by centre in 2013

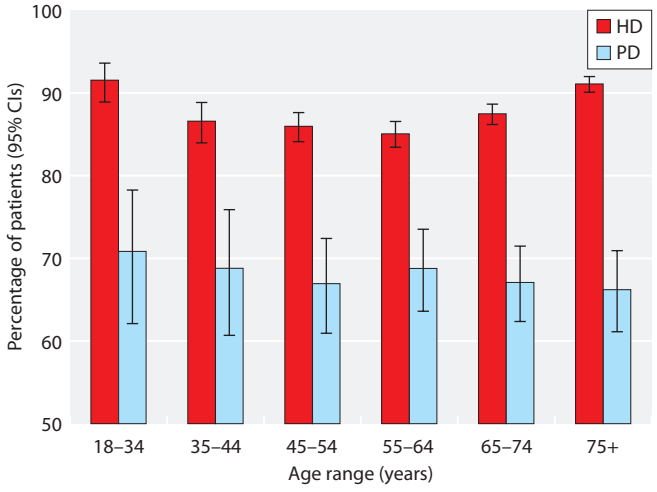

Fig. 7.31. Percentage of dialysis patients on ESA, by age group and treatment modality (2013)

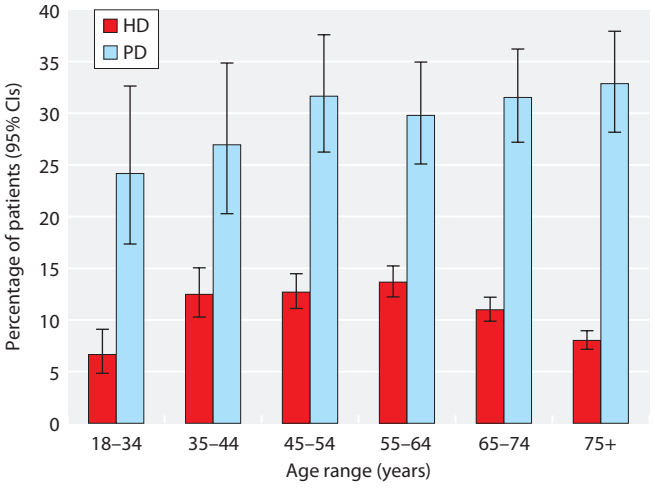

Fig. 7.32. Percentage of whole cohort (2013) who are not on ESA and have Hb ⩾100 g/L, by age group and treatment modality

proportion of patients who had a Hb ⩾100 g/L without requiring ESA (by age group and modality) is shown in figure 7.32.

ESAs and time on renal replacement therapy

The percentage of patients on ESA by time on RRT and dialysis modality is shown in figure 7.33. This is a cross-sectional analysis at the final quarter of 2013. Patients who had previously changed RRT modality were included in this analysis. The proportion of PD patients requiring ESA rises with duration of RRT from 63% after 3–12 months, to 80% after 10 or more years. This almost certainly reflects loss of residual renal function. For at least the first 10 years on RRT, a greater percentage of HD patients were receiving ESA treatment than patients on PD for any given duration on RRT.

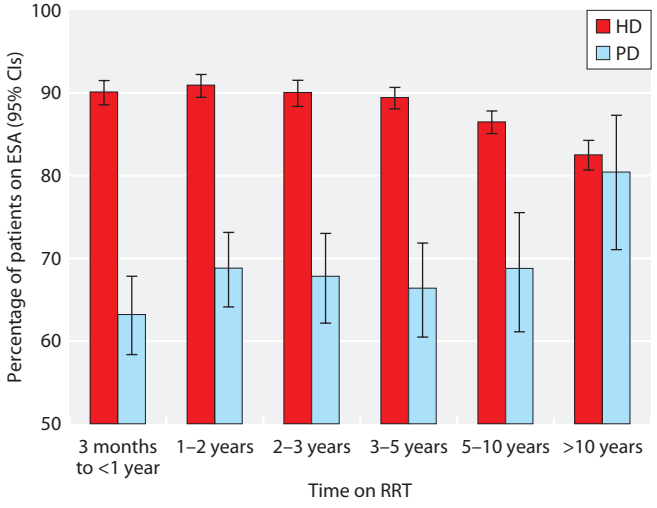

Fig. 7.33. Percentage of patients on ESA by time on RRT (2013)

Resistance to ESA therapy

Figure 7.34 shows the frequency distribution of weekly ESA dose adjusted for weight by treatment modality. Data in the literature on prevalence of ESA resistance in the ERF population is very sparse. RA guidelines define resistance to ESA therapy as '***failure to reach the target Hb level despite SC epoetin dose >300 IU/kg/week (450 IU/kg/week IV epoetin) or darbepoetin dose***

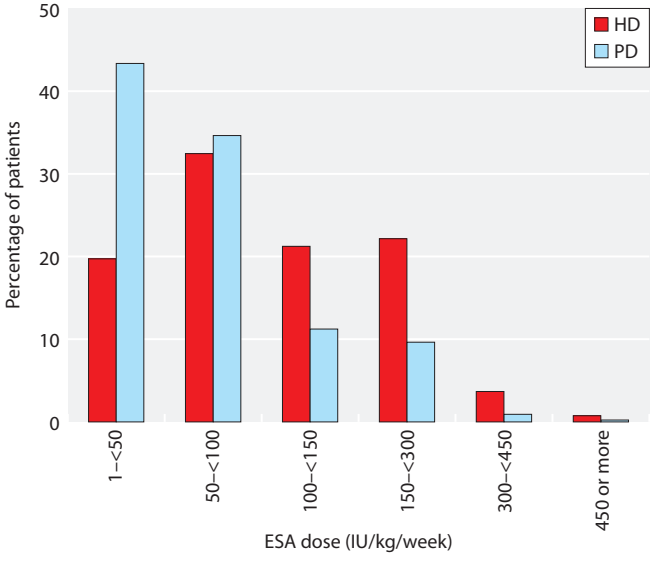

Fig. 7.34. Frequency distribution of mean weekly ESA dose corrected for weight in 2013

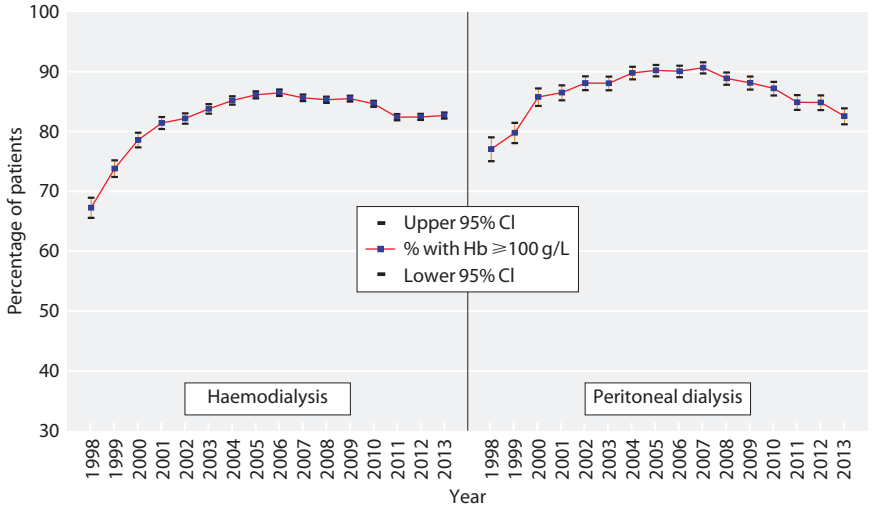

Fig. 7.35. Percentage of prevalent HD and PD patients (1998–2013) with Hb ⩾100 g/L

>1.5 mcg/kg/week'. For the purposes of this analysis the centres were restricted to those with good completeness for weight (over 75%) and ESA dose data (35 centres for HD and 18 centres for PD). As per the above definition and assuming that HD patients largely receive ESA intravenously and PD patients receive ESA subcutaneously, the prevalence of high doses of ESA was 0.7% ($n = 57$) and 1.1% ($n = 5$) for HD and PD patients respectively. For these patients the dose range for HD was 452–795 IU/kg/week and for PD 329–450 IU/kg/week. For patients on HD with high ESA doses, 44% ($n = 25$) had Hb <100 g/L and 39% were within 100–120 g/L. For patients on PD with high ESA doses, 40% ($n = 2$) had Hb <100 g/L and 60% were within 100–120 g/L. The percentage of patients with ESA resistance, defined by those failing to reach Hb ⩾100 g/L are 0.3% for HD and 0.5% for PD. Caution needs to be applied when interpreting these results as the numbers for the above calculations are small.

Success with guideline compliance

Compliance with current minimum standards by year (1998 to 2013) is shown in figure 7.35 for prevalent patients (by treatment modality).

Figure 7.36 shows the percentage of anaemic patients (Hb <100 g/L) receiving an ESA. A minority of patients had a Hb <100 g/L and were not receiving ESA therapy. Across the age groups this was between 3–9% for HD patients and 6–19% for PD patients. There are several potential explanations for this. Treatment with ESA may have been stopped in patients who were unresponsive or avoided in those with malignancy. Others may have been on ESA treatment but not had it recorded.

Table 7.6 shows that the percentage of all patients treated with an ESA and having Hb >120 g/L ranged between 3–29% for HD and between 0–26% for PD. For HD, there was a small percentage of patients having ferritin levels <100 μg/L and being on an ESA (0–10%). The percentages were somewhat higher for PD (0–31%).

Table 7.7 shows the percentage completeness for drug type, dose, route and frequency of administration for centres reporting ESA data. The completeness was generally good for drug type and dose but patchy for frequency and route of administration.

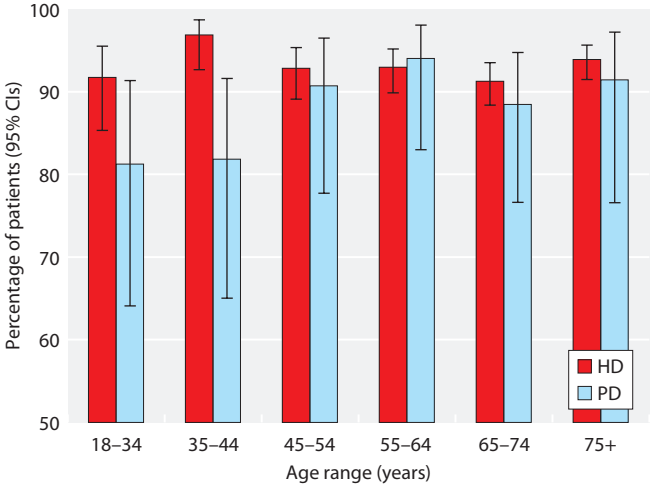

Fig. 7.36. Percentage of patients with Hb <100 g/L who were on ESA, by age group and treatment modality (2013)

Table 7.6. Percentage of patients with serum ferritin levels <100 μg/L and on ESA and percentage of patients with Hb >120 g/L and on ESA by modality

	HD		PD	
Centre	% with Hb >120 g/L and on ESA	% with ferr <100 μg/L and on ESA	% with Hb >120 g/L and on ESA	% with ferr <100 μg/L and on ESA
England				
B Heart	11	1	3	7
B QEH	9	1	7	1
Basldn	13	5	7	13
Bradfd	24	0	15	0
Bristol	22	2	16	0
Camb			6	0
Carlis	28	0	26	0
Chelms	22	1	15	6
Covnt	11	2	10	5
Donc	26	1	10	0
Dorset	22	2	18	3
Exeter	19	10	13	8
Glouc	23	7	6	31
Hull	17	2	7	2
Ipswi	16	1	8	0
Kent	22	3	5	0
L Kings	5	1	8	9
Leeds	13	2	8	2
Leic	25	4	18	3
Middlbr	22	3	18	0
Newc	13	2		
Norwch	29	3	26	21
Nottm	11	0	7	0
Oxford	23	6	22	11
Prestn	13	2	25	6
Redng	27	2		
Sheff	25	1	13	0
Shrew	25	2	19	0
Sthend	3	0	13	0
Sund	24	2		
Wolve	23	2	14	12
York	16	1	16	0
N Ireland				
Antrim	24	0	20	0
Belfast	22	5	15	9
Newry	24	8	0	12
Ulster	15	0		
West NI	16	3	21	9
Wales				
Bangor	19	1		
Clwyd	26	0		
Swanse	11	3	13	0
Wrexm	19	2	11	0
England	**18**	**2**	**13**	**5**
N Ireland	**20**	**2**	**14**	**7**
Wales	**16**	**2**	**13**	**0**
E, W & NI	**18**	**2**	**13**	**5**

Blank cells: centres excluded from analyses due to poor completeness or small numbers with data

Table 7.7. Percentage completeness for type, dose, route and frequency of administration of ESA

	HD					PD				
Centre	*N* on ESA	% with drug type	% with dose	% with frequency	% with administration route	*N* on ESA	% with drug type	% with dose	% with frequency	% with administration route
England										
B Heart	310	100	100	0	0	21	100	100	0	0
B QEH	776	100	100	100	0	76	100	100	100	0
Basldn	138	100	100	100	100	19	100	100	100	100
Bradfd	179	100	99	99	97	16	100	100	100	100
Bristol	439	100	100	0	0	36	100	100	0	0
Camb						10	100	100	0	0
Carlis	44	100	100	0	0	18	100	100	0	0
Chelms	101	100	100	100	100	10	100	100	100	100
Covnt	305	100	98	0	0	36	100	100	0	0
Donc	131	100	100	100	100	24	100	100	100	100
Dorset	231	100	100	97	100	28	100	100	96	100
Exeter	346	100	99	0	0	47	100	100	0	0
Glouc	167	100	0	0	0	25	100	0	0	0
Hull	229	100	100	100	98	35	100	100	100	100
Ipswi	86	100	100	0	0	17	100	100	0	0
Kent	344	100	100	99	100	31	100	100	100	100
L Kings	434	100	100	0	0	57	100	100	0	0
Leeds	406	100	100	100	100	49	100	100	100	98
Leic	806	100	100	0	0	100	100	100	0	0
Middlbr	240	100	100	0	0	7	100	100	0	0
Newc	163	100	100	0	0					
Norwch	277	100	100	98	100	27	100	100	85	96
Nottm	313	100	97	0	0	47	100	60	0	0
Oxford	369	100	100	0	0	65	100	100	0	0
Prestn	462	100	16	0	0	43	100	5	0	0
Redng	217	100	100	0	0					
Sheff	487	100	99	0	0	36	100	100	0	0
Shrew	159	100	100	91	95	16	100	100	94	100
Sthend	104	100	86	0	0	9	100	44	0	0
Sund	161	100	100	0	0					
Wolve	229	100	100	100	100	49	100	100	98	100
York	115	100	100	100	99	16	100	100	100	100
N Ireland										
Antrim	114	100	100	100	100	12	100	100	100	100
Belfast	183	100	100	99	100	23	100	100	100	100
Newry	77	100	100	99	100	15	100	100	80	100
Ulster	99	100	100	100	100					
West NI	101	100	100	98	100	11	100	100	100	100
Wales										
Bangor	66	100	100	0	0					
Clwyd	62	100	18	98	100					
Swanse	266	100	100	100	99	39	100	100	100	100
Wrexm	85	100	100	98	100	11	100	100	82	100
England	**8,768**	**100**	**93**	**37**	**29**	**976**	**100**	**91**	**40**	**33**
N Ireland	**574**	**100**	**100**	**99**	**100**	**65**	**100**	**100**	**95**	**100**
Wales	**479**	**100**	**89**	**85**	**86**	**50**	**100**	**100**	**96**	**100**
E, W & NI	**9,821**	**100**	**93**	**43**	**36**	**1,091**	**100**	**92**	**46**	**40**

Blank cells: centres excluded from analyses due to poor completeness or small numbers with data

Conclusions

Renal centres strive to meet the Renal Association standards in order to prevent adverse outcomes associated with low Hb such as impaired quality of life, increased hospitalisation, increased cardiovascular events and increased cardiovascular and all-cause mortality.

Haemoglobin outcomes for patients on HD and PD were largely compliant with the RA minimum standard of Hb $\geqslant$100 g/L (both 83%). As would be anticipated, a greater proportion of prevalent patients (83%) than incident patients (50%) had a Hb $\geqslant$100 g/L in 2013. The median Hb of patients on HD was 112 g/L with an IQR of 103–120 g/L, and the median Hb of patients on PD was 113 g/L with an IQR of 103–122 g/L.

Compliance with advice regarding iron stores as reflected by ferritin remained stable with 95% of HD patients and 88% of PD patients achieving a serum ferritin greater than 100 μg/L.

The analysis of ESA usage was limited by incomplete data returns. From the available data, 88% of HD patients and 68% of PD patients were on ESA treatment. The percentage of patients treated with an ESA and having Hb $>$120 g/L ranged between centres from 3–29% for HD and from 0–26% for PD. There was a small percentage of patients with ferritin levels $<$100 μg/L and receiving an ESA. There was substantial variation between centres in the average dose of ESA prescribed. Attainment of Hb targets correlated poorly with median ferritin and ESA usage.

The prevalence of ESA resistance was 0.3% and 0.5% for HD and PD patients respectively.

Conflicts of interest: none

References

1 Kidney Disease: Improving Global Outcomes (KDIGO) Anemia Work Group: KDIGO Clinical Practice Guideline for Anemia in Chronic Kidney Disease. Kidney inter., Suppl. 2012;2:279–335
2 Clinical Practice Guidelines and Clinical Practice Recommendations for Anemia in Chronic Kidney Disease in Adults: American Journal of Kidney Diseases;47:S16
3 Locatelli F, et al.: Anaemia management in patients with chronic kidney disease: a position statement by the Anaemia Working Group of European Renal Best Practice (ERBP). Nephrology Dialysis Transplantation, 2009;24(2):348–354
4 Renal Association Clinical Practice Guidelines Committee: Haemodialysis, 5th Edition. 2010. http://www.renal.org/guidelines/modules/anaemia-in-ckd#sthash.5wfKhfzW.dpbs
5 National Institute for Health and Clinical Excellence (NICE): Anaemia management in people with chronic kidney disease (CG114);2011
6 Pfeffer MA, et al.: A Trial of Darbepoetin Alfa in Type 2 Diabetes and Chronic Kidney Disease. New England Journal of Medicine, 2009; 361(21):2019–2032
7 Gomez-Alamillo C, et al.: Erythropoietin Resistance as Surrogate Marker of Graft and Patient Survival in Renal Transplantation: 3-Year Prospective Multicenter Study. Transplantation Proceedings, 2010;42(8):2935–2937

UK Renal Registry 17th Annual Report: Chapter 8 Biochemical Variables amongst UK Adult Dialysis Patients in 2013: National and Centre-specific Analyses

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Key Words
Bicarbonate · Biochemical variables · Calcium · Dialysis · Haemodialysis · Parathyroid hormone · Peritoneal dialysis · Phosphate · Quality improvement

Summary

In 2013

- 57% of HD patients and 62% of PD patients achieved the audit measure for phosphate.
- 30% of HD and 31% of PD patients had a serum phosphate above the audit standard range.
- 78% of HD and PD patients had adjusted calcium between 2.2–2.5 mmol/L.
- 57% of HD and 63% of PD patients had a serum PTH between 16–72 pmol/L.
- 17% of HD and 13% of PD patients had a serum PTH >72 pmol/L.
- Simultaneous control of all three parameters within current audit standards was achieved by 49% of HD and 50% of PD patients.
- 59% of HD and 79% of PD patients achieved the audit measure for bicarbonate.

Introduction

The UK Renal Registry (UKRR) collects routine biochemical data from clinical information systems in renal centres in England, Wales and Northern Ireland and receives data from Scotland via the Scottish Renal Registry. Annual cross sectional analyses are undertaken on some of these variables to determine centre level performance against national (Renal Association (RA)) clinical performance measures [1]. This enables UK renal centres to compare their own performance against each other and to the UK average performance. Currently the 5th edition of the UK Renal Association clinical practice guidelines is in practice [1]. This edition commenced in a graded manner in 2009 and includes an expanded number of guideline modules compared to previous editions.

Audit measures for kidney disease increasingly include tighter specification limits in conjunction with a growing evidence base. Out of range observations (e.g. hyperphosphataemia and hypophosphataemia) need to be interpreted cautiously as they may relate to different clinical problems or population characteristics. These will therefore require different strategies to improve centre performance of clinical audit measures. Summary statistical data have been provided to enhance understanding of the population characteristics of each centre and longitudinal analyses to demonstrate changes over time.

Data are also available on the UKRR data portal at www.renalregistry.org.

Table 8.1 lists the recommended biochemical based audit measures from the RA which are relevant to the dialysis population. Several of the audit measures are not currently reported by the UKRR in its 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.

Methods

The analyses presented in this chapter relate to biochemical variables in the prevalent dialysis cohort in England, Wales and Northern Ireland in 2013. Scotland is also included in analyses of phosphate control. The cohort studied were patients prevalent on dialysis treatment on 31st December 2013. Patients receiving dialysis for less than 90 days and those who had changed modality or renal centre in the last 90 days were excluded. Haemodialysis (HD) and peritoneal dialysis (PD) cohorts were analysed separately. A full definition of the cohort including inclusion and exclusion criteria is available in appendix B (www.renalreg.org).

The biochemical variables analysed in this chapter were serum phosphate, calcium, parathyroid hormone and bicarbonate. The method of data collection and validation by the UKRR has been previously described [2]. In brief, for each quarter of 2013 the UKRR extracted biochemical data electronically from clinical information systems in UK dialysis centres. The UKRR does not currently collect data regarding different assay methods mainly because a single dialysis centre may process samples in several different laboratories. Scottish centres have only been included in analyses relating to phosphate control, with data for their prevalent dialysis cohort being supplied directly by the Scottish Renal Registry. The audit measure used for serum phosphate was 1.1–1.7 mmol/L in both the HD and PD cohorts [1, 3]. For centres providing adjusted calcium values, these data were analysed directly as it is these values on which clinical decisions within centres are based. For centres providing unadjusted calcium values, a formula in widespread use was used to calculate adjusted calcium [4]. The audit measure for adjusted calcium depends on the local reference range [3]. For the purposes of these analyses, the UKRR has used the RA guideline standard of adjusted calcium between 2.2–2.5 mmol/L as the audit measure [3]. There are also a variety of methods and reference ranges in use to measure parathyroid hormone (PTH). To enable some form of comparative audit the UKRR has used 2–9 times the median upper limit of the reference range (8 pmol/L) as the audit measure in line with the 5th edition of the RA clinical practice guidelines and KDIGO 2009 guidance [3, 5]. This equates to a PTH range of 16–72 pmol/L. The audit measure used for serum bicarbonate in the HD cohort was 18–24 mmol/L as per the updated haemodialysis guidelines and in the PD cohort was 22–30 mmol/L. A summary of the current RA audit measures for these variables and conversion factors to SI units are given in table 8.2.

Quarterly values were extracted from the database for the last two quarters for calcium, phosphate and bicarbonate and the last three quarters for PTH. Patients who did not have these data were excluded from the analyses. Data completeness was analysed at centre and country level. All patients were included in analyses but centres with less than 50% completeness were excluded from plots and tables showing centre level performance. Data were also excluded from plots and tables when there were less than 20 patients with data both at centre or country level. These data were analysed to calculate summary descriptive statistics (maximum, minimum, means with the corresponding standard deviation, medians and interquartile ranges). Where applicable, the percentage achieving the Renal Association standard or other surrogate clinical performance measure was also calculated.

The simultaneous control of all three components of bone and mineral disorder (BMD) parameters were analysed in combination. The proportion of patients with control of none, one, two or three parameters are presented. For the purpose of these analyses a corrected calcium between 2.2–2.5 mmol/L, a phosphate level being maintained at or below 1.7 mmol/L and a PTH level being at or below 72 pmol/L, were evaluated in combination.

Centres report several biochemical variables with different levels of accuracy, leading to problems in comparative evaluation.

Table 8.1. Summary of Renal Association audit measures for biochemical variables [1]

RA audit measure and clinical guideline	Currently included in UKRR annual report	Reason
CKD-MBD in CKD stage 5D Guidance		
Audit measure: Serum calcium in dialysis patients (pre-dialysis for haemodialysis patients)	Yes Yes	
Audit measure: Serum phosphate in dialysis patients (pre-dialysis for haemodialysis patients)	Yes Yes	
Audit measure: Proportion of PTH values within range 0/4, 1/4, 2/4, 3/4, and 4/4 of the 4 annual measurements of PTH in CKD stage 5D patients	Yes	Summary measures using data from the last three quarters for PTH-based analyses are presented, rather than stratified by quarter
Audit measure: Percentage of patients with all parameters (calcium/phosphate/PTH) within target range	Yes	
Peritoneal Dialysis Guidelines		
Audit measure: cumulative frequency curves of plasma bicarbonate	Yes	Summary measures at centre and country level are presented in various formats but not as cumulative frequency curves
Haemodialysis Guidelines		
Audit measure: cumulative frequency curves of potassium concentration	No	It is hoped for the next report that data completeness will enable analysis. There are also concerns that potential delays in blood sample processing may result in over estimates of potassium concentrations
Audit measure: Cumulative frequency curves of pre-dialysis serum calcium and phosphate concentrations	Yes No	Summary measures at centre and country level are presented in various formats but not as cumulative frequency curves
Audit measure: Cumulative frequency curves of pre-dialysis serum calcium and phosphate concentrations	Yes No	Summary measures at centre and country level are presented in various formats but not as cumulative frequency curves
Cardiovacular Disease in CKD Guidance		
Audit measure: Record of HbA1c concentrations in IFCC (mmol/mol) and/or DCCT (%) units	No	Poor data completeness
Audit measure: Cholesterol concentrations in patients prescribed HMG CoA reductase inhibitors	Partially	The UKRR report summary statistics for total cholesterol. These summary data were presented in 2013 and will be presented again in 2015. Information on LDL, and changes in cholesterol are not currently available within the UKRR data or reliable information on statin prescription

Table 8.2. Summary of clinical audit measures and conversion factors from SI units

Biochemical variable	Clinical audit measure	Conversion factor from SI units
Phosphate	HD patients: 1.1–1.7 mmol/L PD patients: 1.1–1.7 mmol/L	mg/dl = mmol/L × 3.1
Calcium (adjusted)	Normal range (ideally <2.5 mmol/L)	mg/dl = mmol/L × 4
Parathyroid hormone	2–9 times upper limit of normal	ng/L = pmol/L × 9.5
Bicarbonate	HD patients: 18–24 mmol/L PD patients: 22–30 mmol/L	mg/dl = mmol/L × 6.1

For example, in the case of serum bicarbonate, data can be submitted as integer values but some centres submit data to one decimal place. All data has been rounded in an attempt to make all centres more comparable.

The number preceding the centre name in each figure indicates the percentage of missing data for that centre. Funnel plot analyses were used to identify 'outlying centres' [6]. The percentage within range for each standard was plotted against centre size along with the upper and lower 95% and 99.9% limits. Centres can be identified on these plots by looking up the number of patients treated in each centre provided in the relevant table and finding this value on the x-axis. Longitudinal analyses were performed for some data to calculate overall changes in achievement of a performance measure annually from 2003 to 2013 and were recalculated for each previous year using the rounding procedure.

All data are presented unadjusted for case-mix.

Results

Mineral and bone variables

Phosphate

In 2013 the following Renal Association clinical practice guideline regarding phosphate management was applicable:

Guideline 3.2 CKD-MBD: Serum phosphate in dialysis patients

'We suggest that serum phosphate in dialysis patients, measured before a "short-gap" dialysis session in haemodialysis patients, should be maintained between 1.1 and 1.7 mmol/L (2C)' [3].

The data completeness for serum phosphate across the UK was 97% for HD patients and 98% for PD patients although there was considerable variation between centres (tables 8.3, 8.5). The individual centre means and standard deviations are shown in tables 8.3 and 8.5. Fifty-seven percent (95% CI 56–58%) of HD patients and 62% (95% CI 60–63%) of PD patients achieved a phosphate level within the target range specified by the RA clinical audit measure (tables 8.4, 8.6). The proportion of HD patients with hyperphosphataemia was 30% and the proportion with hypophosphataemia was 13% (table 8.4, figures 8.1, 8.2). The proportion of PD patients with hyperphosphataemia was 31% and the proportion with hypophosphataemia was 7% (table 8.6, figures 8.3, 8.4). There was wide between centre variation

Table 8.3. Summary statistics for phosphate in haemodialysis patients in 2013

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	401	1.6	0.6	1.5	1.3	1.9
B QEH	97.1	859	1.6	0.5	1.5	1.3	1.8
Basldn	99.3	151	1.4	0.5	1.4	1.1	1.7
Bradfd	100.0	186	1.5	0.5	1.4	1.1	1.8
Brightn	96.2	358	1.6	0.5	1.5	1.2	1.8
Bristol	100.0	485	1.6	0.5	1.5	1.2	1.8
Camb	94.9	338	1.5	0.5	1.5	1.2	1.8
Carlis	100.0	58	1.7	0.5	1.6	1.2	2.0
Carsh	95.3	665	1.6	0.5	1.5	1.2	1.8
Chelms	100.0	109	1.4	0.4	1.4	1.2	1.7
Colchr	92.7	101	1.5	0.4	1.5	1.3	1.7
Covnt	100.0	354	1.6	0.5	1.5	1.3	1.9
Derby	99.5	202	1.5	0.5	1.4	1.2	1.8
Donc	100.0	146	1.5	0.4	1.5	1.3	1.7
Dorset	100.0	244	1.5	0.5	1.5	1.2	1.7
Dudley	95.1	155	1.6	0.5	1.6	1.3	1.8
Exeter	100.0	376	1.6	0.5	1.5	1.3	1.8
Glouc	100.0	188	1.5	0.5	1.5	1.2	1.8
Hull	100.0	299	1.5	0.5	1.5	1.3	1.8
Ipswi	100.0	112	1.3	0.5	1.2	0.9	1.6
Kent	99.2	373	1.7	0.6	1.6	1.3	1.9
L Barts	99.9	882	1.6	0.5	1.5	1.2	1.9
L Guys	77.3	457	1.5	0.5	1.4	1.1	1.8
L Kings	99.8	465	1.5	0.4	1.4	1.2	1.7
L Rfree	99.0	681	1.5	0.5	1.5	1.2	1.8
L St.G	98.4	251	1.5	0.5	1.5	1.2	1.8

Table 8.3. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
L West	99.2	1,307	1.5	0.5	1.5	1.2	1.8
Leeds	100.0	470	1.6	0.5	1.5	1.2	1.9
Leic	99.9	827	1.6	0.5	1.6	1.3	1.9
Liv Ain	99.3	147	1.4	0.5	1.3	1.0	1.6
Liv Roy	99.7	333	1.5	0.5	1.4	1.1	1.7
M RI	94.0	457	1.6	0.5	1.5	1.2	1.9
Middlbr	99.4	320	1.6	0.5	1.5	1.3	1.8
Newc	100.0	257	1.5	0.5	1.4	1.1	1.8
Norwch	100.0	305	1.6	0.5	1.5	1.2	1.8
Nottm	100.0	354	1.5	0.5	1.5	1.2	1.8
Oxford	100.0	405	1.6	0.6	1.5	1.2	1.9
Plymth	100.0	120	1.5	0.5	1.5	1.2	1.8
Ports	99.8	544	1.6	0.5	1.6	1.3	1.9
Prestn	99.8	507	1.7	0.5	1.6	1.3	1.9
Redng	100.0	260	1.5	0.4	1.4	1.2	1.7
Salford	87.9	318	1.5	0.5	1.4	1.2	1.8
Sheff	99.8	555	1.6	0.5	1.5	1.2	1.8
Shrew	98.9	174	1.7	0.5	1.6	1.3	1.9
Stevng	97.5	420	1.6	0.5	1.5	1.2	1.9
Sthend	100.0	110	1.6	0.4	1.6	1.3	1.8
Stoke	82.6	238	1.5	0.5	1.4	1.2	1.8
Sund	0.0	0					
Truro	100.0	139	1.5	0.5	1.4	1.2	1.7
Wirral	98.5	195	1.5	0.5	1.5	1.2	1.8
Wolve	100.0	277	1.5	0.5	1.4	1.1	1.8
York	100.0	129	1.4	0.4	1.4	1.1	1.7
N Ireland							
Antrim	100.0	120	1.3	0.4	1.3	1.0	1.5
Belfast	98.0	195	1.5	0.6	1.4	1.1	1.8
Newry	100.0	84	1.6	0.5	1.6	1.3	1.8
Ulster	100.0	103	1.5	0.5	1.4	1.1	1.8
West NI	100.0	107	1.5	0.5	1.5	1.2	1.8
Scotland							
Abrdn	95.6	197	1.6	0.5	1.5	1.3	1.9
Airdrie	98.9	175	1.5	0.5	1.4	1.1	1.8
D & Gall	100.0	44	1.5	0.5	1.4	1.2	1.8
Dundee	95.7	156	1.7	0.6	1.7	1.4	2.0
Edinb	95.7	244	1.7	0.5	1.6	1.4	2.0
Glasgw	95.9	538	1.7	0.5	1.6	1.3	2.0
Inverns	85.7	54	1.7	0.5	1.6	1.3	1.9
Klmarnk	97.6	123	1.6	0.5	1.6	1.2	1.9
Krkcldy	95.1	135	1.6	0.4	1.5	1.3	1.8
Wales							
Bangor	100.0	84	1.5	0.4	1.5	1.2	1.8
Cardff	100.0	460	1.6	0.5	1.6	1.3	1.9
Clwyd	100.0	72	1.6	0.5	1.6	1.3	1.9
Swanse	100.0	311	1.5	0.4	1.5	1.2	1.8
Wrexm	100.0	96	1.4	0.5	1.3	1.1	1.7
England	**96.8**	**18,064**	**1.6**	**0.5**	**1.5**	**1.2**	**1.8**
N Ireland	**99.4**	**609**	**1.5**	**0.5**	**1.4**	**1.2**	**1.7**
Scotland	**95.9**	**1,666**	**1.7**	**0.5**	**1.6**	**1.3**	**1.9**
Wales	**100.0**	**1,023**	**1.6**	**0.5**	**1.5**	**1.2**	**1.8**
UK	**97.0**	**21,362**	**1.6**	**0.5**	**1.5**	**1.2**	**1.8**

Blank cells: centres excluded from analyses due to low patient numbers or poor data completeness

Table 8.4. Percentage of haemodialysis patients within, below and above the range specified in the RA audit measure for phosphate (1.1–1.7 mmol/L) in 2013

Centre	*N*	% phos 1.1–1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.7 mmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
England									
B Heart	401	54.9	50.0	59.7	10.2	34.9	2.5	−4.4	9.4
B QEH	859	62.9	59.6	66.0	9.3	27.8	4.8	0.1	9.4
Basldn	151	55.0	47.0	62.7	21.2	23.8	−7.8	−19.0	3.4
Bradfd	186	53.2	46.0	60.3	21.0	25.8	3.0	−7.2	13.1
Brightn	358	58.4	53.2	63.4	14.3	27.4	3.3	−4.2	10.7
Bristol	485	58.6	54.1	62.9	11.8	29.7	4.8	−1.6	11.1
Camb	338	61.2	55.9	66.3	11.8	26.9	−3.9	−11.3	3.5
Carlis	58	53.5	40.7	65.8	6.9	39.7	0.8	−17.4	19.1
Carsh	665	56.5	52.7	60.3	12.3	31.1	−2.2	−7.5	3.2
Chelms	109	67.0	57.6	75.1	16.5	16.5	1.7	−10.6	13.9
Colchr	101	70.3	60.7	78.4	6.9	22.8	−0.7	−13.3	11.9
Covnt	354	59.9	54.7	64.9	7.6	32.5	3.2	−4.2	10.5
Derby	202	62.4	55.5	68.8	12.4	25.3	6.4	−3.1	15.9
Donc	146	65.1	57.0	72.4	13.7	21.2	0.5	−10.2	11.3
Dorset	244	59.8	53.6	65.8	15.6	24.6	5.1	−3.7	13.9
Dudley	155	53.6	45.7	61.3	11.6	34.8	0.9	−10.2	12.1
Exeter	376	60.6	55.6	65.5	12.2	27.1	2.6	−4.5	9.8
Glouc	188	60.1	53.0	66.9	13.3	26.6	1.4	−8.5	11.2
Hull	299	64.2	58.6	69.5	10.0	25.8	4.9	−2.8	12.7
Ipswi	112	45.5	36.6	54.8	37.5	17.0	−14.1	−26.8	−1.5
Kent	373	53.4	48.3	58.4	9.4	37.3	−0.3	−7.6	6.9
L Barts	882	52.6	49.3	55.9	14.1	33.3	1.1	−3.6	5.8
L Guys	457	54.7	50.1	59.2	19.5	25.8	−4.4	−10.6	1.8
L Kings	465	65.4	60.9	69.6	14.4	20.2	1.5	−4.7	7.6
L Rfree	681	59.3	55.6	63.0	13.5	27.2	2.4	−3.2	7.9
L St.G	251	59.4	53.2	65.3	14.7	25.9	4.4	−4.2	12.9
L West	1,307	56.5	53.8	59.1	16.1	27.4	−1.4	−5.2	2.4
Leeds	470	51.7	47.2	56.2	14.7	33.6	−1.4	−7.8	5.1
Leic	827	53.8	50.4	57.2	10.6	35.6	1.5	−3.4	6.3
Liv Ain	147	53.7	45.7	61.6	26.5	19.7	−2.4	−13.5	8.7
Liv Roy	333	59.5	54.1	64.6	18.0	22.5	6.1	−1.4	13.6
M RI*	457	51.6	47.1	56.2	15.8	32.6	0.5	−6.1	7.0
Middlbr	320	57.2	51.7	62.5	12.8	30.0	1.8	−5.9	9.6
Newc	257	57.2	51.1	63.1	16.3	26.5	0.7	−7.8	9.2
Norwch	305	59.0	53.4	64.4	10.8	30.2	−0.5	−8.3	7.3
Nottm	354	57.1	51.9	62.1	13.8	29.1	−0.8	−8.1	6.4
Oxford	405	50.6	45.8	55.5	17.3	32.1	−3.7	−10.7	3.2
Plymth	120	57.5	48.5	66.0	13.3	29.2	−2.2	−14.6	10.3
Ports	544	50.7	46.5	54.9	14.3	34.9	−1.3	−7.4	4.7
Prestn	507	57.0	52.7	61.3	7.9	35.1	5.4	−0.8	11.5
Redng	260	62.3	56.3	68.0	13.5	24.2	4.1	−4.3	12.6
Salford*	318	53.8	48.3	59.2	19.8	26.4	0.8	−7.0	8.7
Sheff	555	60.7	56.6	64.7	9.0	30.3	1.4	−4.3	7.2
Shrew	174	57.5	50.0	64.6	6.3	36.2	3.4	−6.9	13.7
Stevng	420	54.3	49.5	59.0	11.9	33.8	−2.1	−9.0	4.8
Sthend	110	60.9	51.5	69.6	8.2	30.9	13.7	0.6	26.8
Stoke	238	62.2	55.9	68.1	10.9	26.9	4.4	−4.3	13.1
Truro	139	58.3	49.9	66.2	18.0	23.7	1.1	−10.6	12.9
Wirral	195	54.9	47.8	61.7	15.4	29.7	−1.4	−11.7	8.8
Wolve	277	52.4	46.5	58.2	21.7	26.0	−1.7	−10.1	6.6
York	129	62.8	54.2	70.7	17.8	19.4	4.1	−8.0	16.2

Table 8.4. Continued

Centre	*N*	% phos 1.1–1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.7 mmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
N Ireland									
Antrim	120	60.8	51.8	69.1	30.0	9.2	4.0	−8.3	16.3
Belfast	195	51.3	44.3	58.2	20.5	28.2	−0.4	−10.2	9.4
Newry	84	58.3	47.6	68.4	10.7	31.0	7.7	−7.2	22.7
Ulster	103	54.4	44.7	63.7	18.5	27.2	−14.0	−27.2	−0.7
West NI	107	59.8	50.3	68.7	11.2	29.0	6.3	−6.3	19.0
Scotland									
Abrdn	197	55.3	48.3	62.1	11.2	33.5	−1.6	−11.3	8.1
Airdrie	175	61.1	53.7	68.1	12.6	26.3	12.1	1.5	22.6
D & Gall	44	56.8	42.0	70.5	18.2	25.0	0.3	−20.2	20.8
Dundee	156	50.0	42.2	57.8	9.0	41.0	−2.1	−12.9	8.8
Edinb	244	52.1	45.8	58.3	7.0	41.0	−2.4	−11.4	6.5
Glasgw	538	53.4	49.1	57.5	7.3	39.4	1.7	−4.3	7.8
Inverns	54	55.6	42.2	68.1	5.6	38.9	16.7	−1.9	35.2
Klmarnk	123	47.2	38.5	56.0	16.3	36.6	−5.7	−18.1	6.8
Krkcldy	135	60.0	51.5	67.9	8.2	31.9	3.6	−8.2	15.4
Wales									
Bangor	84	64.3	53.5	73.8	8.3	27.4	−0.3	−14.9	14.2
Cardff	460	55.7	51.1	60.1	9.8	34.6	−2.8	−9.3	3.6
Clwyd	72	55.6	44.0	66.6	11.1	33.3	1.6	−14.4	17.7
Swanse	311	62.7	57.2	67.9	10.9	26.4	0.1	−7.5	7.7
Wrexm	96	55.2	45.2	64.8	22.9	21.9	−4.6	−18.9	9.8
England	**18,064**	**57.2**	**56.4**	**57.9**	**13.6**	**29.2**	**1.0**	**−0.1**	**2.0**
N Ireland	**609**	**56.2**	**52.2**	**60.1**	**19.1**	**24.8**	**0.7**	**−4.8**	**6.2**
Scotland	**1,666**	**54.1**	**51.7**	**56.5**	**9.4**	**36.5**	**1.5**	**−1.9**	**4.9**
Wales	**1,023**	**58.5**	**55.4**	**61.4**	**11.3**	**30.2**	**−1.6**	**−5.8**	**2.7**
UK	**21,362**	**57.0**	**56.3**	**57.6**	**13.3**	**29.7**	**0.9**	**−0.1**	**1.8**

*Salford and Manchester RI have been involved in the SPIRiT study – an RCT comparing low phosphate control (0.8 to 1.4 mmol/L) with high phosphate group control (1.8 to 2.4 mmol/L); HD patients only were recruited

Table 8.5. Summary statistics for phosphate in peritoneal dialysis patients in 2013

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	35	1.7	0.4	1.7	1.4	2.0
B QEH	100.0	129	1.6	0.4	1.5	1.2	1.9
Basldn	100.0	30	1.6	0.3	1.6	1.4	1.7
Bradfd	96.2	25	1.7	0.5	1.7	1.3	2.0
Brightn	100.0	66	1.6	0.5	1.5	1.2	1.8
Bristol	100.0	57	1.8	0.4	1.7	1.4	2.0
Camb	94.7	18					
Carlis	100.0	23	1.6	0.4	1.6	1.4	1.8
Carsh	97.1	102	1.6	0.4	1.5	1.3	1.7
Chelms	95.0	19					
Colchr							
Covnt	91.7	66	1.4	0.4	1.3	1.1	1.5
Derby	98.7	77	1.5	0.5	1.5	1.2	1.7
Donc	100.0	30	1.6	0.5	1.5	1.3	1.8
Dorset	89.7	35	1.6	0.4	1.6	1.4	1.8
Dudley	100.0	47	1.8	0.6	1.7	1.4	2.1
Exeter	100.0	63	1.5	0.4	1.5	1.3	1.8
Glouc	100.0	31	1.6	0.4	1.5	1.3	1.9
Hull	100.0	72	1.6	0.4	1.5	1.4	1.8
Ipswi	100.0	24	1.6	0.5	1.4	1.2	1.8
Kent	98.3	56	1.5	0.4	1.5	1.3	1.8
L Barts	98.9	176	1.5	0.4	1.5	1.2	1.8

Table 8.5. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
L Guys	85.7	24	1.6	0.5	1.5	1.2	1.8
L Kings	98.7	78	1.5	0.4	1.5	1.2	1.7
L Rfree	100.0	108	1.6	0.4	1.5	1.3	1.8
L St.G	97.8	44	1.6	0.3	1.5	1.3	1.8
L West	100.0	52	1.6	0.4	1.5	1.2	1.8
Leeds	100.0	62	1.8	0.5	1.7	1.5	2.0
Leic	97.8	132	1.6	0.4	1.6	1.3	1.8
Liv Ain	100.0	26	1.6	0.4	1.5	1.4	1.7
Liv Roy	100.0	51	1.6	0.4	1.5	1.3	1.8
M RI	98.6	68	1.6	0.4	1.6	1.3	1.8
Middlbr	100.0	11					
Newc	88.9	32	1.6	0.4	1.6	1.2	1.9
Norwch	100.0	35	1.5	0.3	1.5	1.3	1.6
Nottm	100.0	68	1.5	0.4	1.5	1.3	1.7
Oxford	100.0	83	1.7	0.4	1.6	1.4	1.9
Plymth	100.0	29	1.5	0.4	1.4	1.2	1.8
Ports	97.4	75	1.7	0.4	1.6	1.4	1.9
Prestn	100.0	52	1.7	0.4	1.6	1.4	1.9
Redng	100.0	64	1.5	0.3	1.5	1.4	1.8
Salford	97.3	73	1.6	0.4	1.5	1.3	1.8
Sheff	100.0	61	1.6	0.4	1.5	1.3	1.9
Shrew	100.0	26	1.5	0.4	1.5	1.3	1.7
Stevng	97.3	36	1.5	0.4	1.4	1.2	1.8
Sthend	100.0	15					
Stoke	98.8	80	1.7	0.5	1.6	1.3	2.0
Sund	100.0	8					
Truro	100.0	18					
Wirral	74.1	20	1.6	0.6	1.6	1.1	2.1
Wolve	100.0	78	1.7	0.5	1.6	1.3	2.0
York	100.0	25	1.5	0.3	1.5	1.1	1.7
N Ireland							
Antrim	100.0	15					
Belfast	100.0	26	1.6	0.4	1.6	1.4	1.9
Newry	100.0	17					
Ulster	100.0	4					
West NI	100.0	14					
Scotland							
Abrdn	95.2	20	1.6	0.4	1.6	1.4	1.8
Airdrie	100.0	12					
D & Gall	100.0	11					
Dundee	94.4	17					
Edinb	100.0	25	1.5	0.4	1.5	1.2	1.9
Glasgw	100.0	39	1.7	0.4	1.6	1.4	2.0
Inverns	92.3	12					
Klmarnk	97.4	38	1.6	0.4	1.6	1.3	1.9
Krkcldy	94.4	17					
Wales							
Bangor	100.0	12					
Cardff	100.0	66	1.6	0.4	1.5	1.3	1.8
Clwyd	100.0	14					
Swanse	100.0	53	1.6	0.4	1.5	1.3	1.8
Wrexm	94.7	18					
England	**98.3**	**2,715**	**1.6**	**0.4**	**1.5**	**1.3**	**1.8**
N Ireland	**100.0**	**76**	**1.5**	**0.4**	**1.6**	**1.2**	**1.8**
Scotland	**97.5**	**191**	**1.6**	**0.4**	**1.6**	**1.4**	**1.9**
Wales	**99.4**	**163**	**1.6**	**0.4**	**1.5**	**1.3**	**1.8**
UK	**98.3**	**3,145**	**1.6**	**0.4**	**1.5**	**1.3**	**1.8**

Blank cells: centres excluded from analyses due to low patient numbers or poor data completeness

Table 8.6. Percentage of peritoneal dialysis patients within, below and above the range specified in the RA audit measure for phosphate (1.1–1.7 mmol/L) in 2013

Centre	*N*	% phos 1.1–1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.7 mmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
England									
B Heart	35	48.6	32.7	64.7	5.7	45.7	5.7	−16.6	28.0
B QEH	129	58.1	49.5	66.3	8.5	33.3	−9.7	−21.1	1.7
Basldn	30	76.7	58.5	88.5	3.3	20.0	17.4	−6.5	41.3
Bradfd	25	48.0	29.6	66.9	8.0	44.0	−10.3	−38.1	17.5
Brightn	66	51.5	39.6	63.3	12.1	36.4	2.3	−14.8	19.4
Bristol	57	54.4	41.5	66.8	0.0	45.6	0.8	−17.6	19.2
Carlis	23	65.2	44.3	81.6	8.7	26.1	−11.0	−37.6	15.7
Carsh	102	69.6	60.0	77.7	6.9	23.5	5.4	−7.7	18.5
Covnt	66	60.6	48.4	71.6	19.7	19.7	−15.7	−30.9	−0.5
Derby	77	61.0	49.8	71.2	14.3	24.7	−2.1	−17.1	12.9
Donc	30	63.3	45.1	78.4	6.7	30.0	6.8	−19.8	33.4
Dorset	35	62.9	46.0	77.1	5.7	31.4	−1.8	−24.5	20.8
Dudley	47	46.8	33.2	61.0	4.3	48.9	3.4	−16.1	22.9
Exeter	63	65.1	52.6	75.8	7.9	27.0	1.8	−14.6	18.3
Glouc	31	64.5	46.6	79.1	0.0	35.5	0.0	−23.8	23.8
Hull	72	68.1	56.5	77.8	4.2	27.8	6.2	−9.1	21.6
Ipswi	24	75.0	54.4	88.3	0.0	25.0	11.7	−12.8	36.1
Kent	56	62.5	49.3	74.1	8.9	28.6	8.8	−9.6	27.2
L Barts	176	61.4	54.0	68.3	10.2	28.4	3.2	−7.2	13.6
L Guys	24	62.5	42.2	79.2	12.5	25.0	−10.6	−36.4	15.2
L Kings	78	71.8	60.9	80.7	6.4	21.8	9.5	−5.3	24.2
L Rfree	108	64.8	55.4	73.2	8.3	26.9	2.4	−10.6	15.5
L St.G	44	70.5	55.5	82.0	2.3	27.3	−3.5	−22.0	15.1
L West	52	71.2	57.5	81.8	1.9	26.9	0.9	−17.0	18.9
Leeds	62	46.8	34.8	59.1	6.5	46.8	−11.7	−28.3	4.9
Leic	132	65.2	56.7	72.8	6.1	28.8	1.6	−9.8	13.0
Liv Ain	26	69.2	49.5	83.8	7.7	23.1			
Liv Roy	51	70.6	56.8	81.4	5.9	23.5	−1.1	−18.5	16.3
M RI	68	60.3	48.3	71.2	10.3	29.4	7.7	−8.5	23.8
Newc	32	59.4	41.9	74.7	3.1	37.5	3.1	−21.1	27.3
Norwch	35	74.3	57.5	86.0	8.6	17.1	13.9	−6.2	33.9
Nottm	68	72.1	60.3	81.4	4.4	23.5	19.3	3.6	35.0
Oxford	83	55.4	44.6	65.7	4.8	39.8	−2.2	−18.2	13.9
Plymth	29	51.7	34.1	68.9	20.7	27.6	−10.4	−35.7	15.0
Ports	75	58.7	47.3	69.2	6.7	34.7	−6.7	−22.1	8.6
Prestn	52	59.6	45.9	72.0	7.7	32.7	1.0	−17.4	19.4
Redng	64	71.9	59.7	81.5	3.1	25.0	5.7	−10.2	21.7
Salford	73	56.2	44.7	67.0	12.3	31.5	0.7	−14.9	16.4
Sheff	61	62.3	49.6	73.5	6.6	31.2	3.2	−13.8	20.2
Shrew	26	69.2	49.5	83.8	7.7	23.1	6.7	−17.7	31.1
Stevng	36	58.3	41.9	73.1	16.7	25.0	−23.2	−44.9	−1.4
Stoke	80	57.5	46.5	67.8	5.0	37.5	1.3	−14.4	17.1
Wirral	20	45.0	25.3	66.4	10.0	45.0	−31.2	−59.6	−2.8
Wolve	78	56.4	45.3	66.9	3.9	39.7	−2.6	−18.1	12.9
York	25	72.0	51.8	86.0	12.0	16.0	16.4	−9.3	42.2
N Ireland									
Belfast	26	53.9	35.1	71.6	7.7	38.5	1.7	−26.3	29.7
Scotland									
Abrdn	20	50.0	29.4	70.6	10.0	40.0	0.0	−31.0	31.0
Edinb	25	56.0	36.6	73.7	8.0	36.0	11.6	−13.8	36.9
Glasgw	39	59.0	43.2	73.1	0.0	41.0	6.5	−15.4	28.3
Klmarnk	38	63.2	47.0	76.8	2.6	34.2	−1.8	−23.1	19.5

Table 8.6. Continued

Centre	*N*	% phos 1.1–1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos <1.1 mmol/L	% phos >1.7 mmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
Wales									
Cardff	66	68.2	56.1	78.3	6.1	25.8	3.9	−12.0	19.8
Swanse	53	67.9	54.3	79.0	5.7	26.4	−1.9	−19.5	15.7
England	**2,715**	**62.0**	**60.1**	**63.8**	**7.7**	**30.4**	**1.1**	**−1.5**	**3.6**
N Ireland	**76**	**59.2**	**47.9**	**69.6**	**7.9**	**32.9**	**−5.5**	**−21.3**	**10.3**
Scotland	**191**	**56.5**	**49.4**	**63.4**	**4.7**	**38.7**	**2.5**	**−7.3**	**12.2**
Wales	**163**	**65.0**	**57.4**	**72.0**	**6.1**	**28.8**	**−1.6**	**−11.8**	**8.5**
UK	**3,145**	**61.7**	**60.0**	**63.4**	**7.4**	**30.9**	**0.9**	**−1.5**	**3.3**

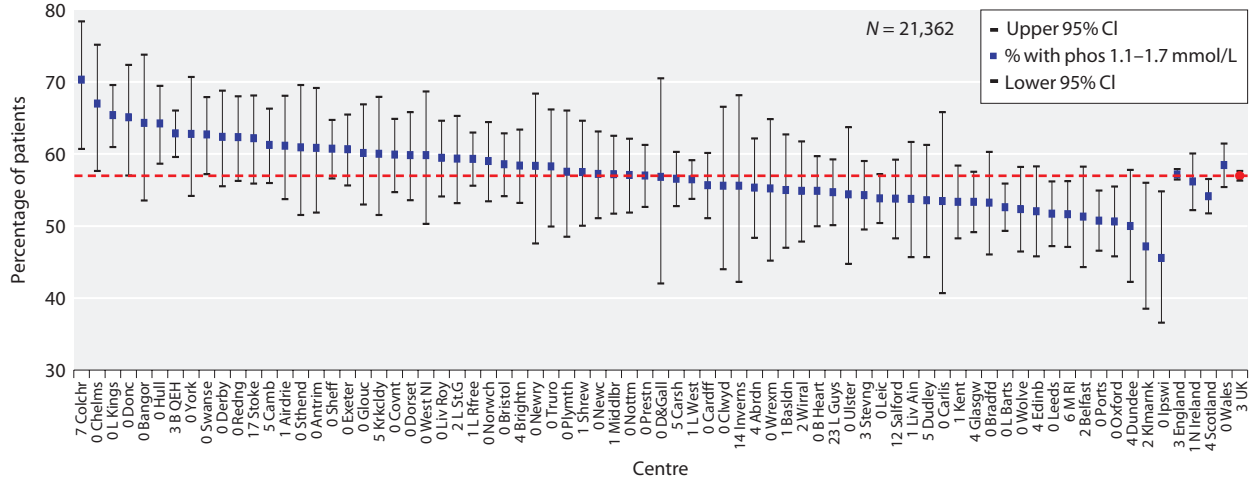

Fig. 8.1. Percentage of haemodialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.7 mmol/L) by centre in 2013

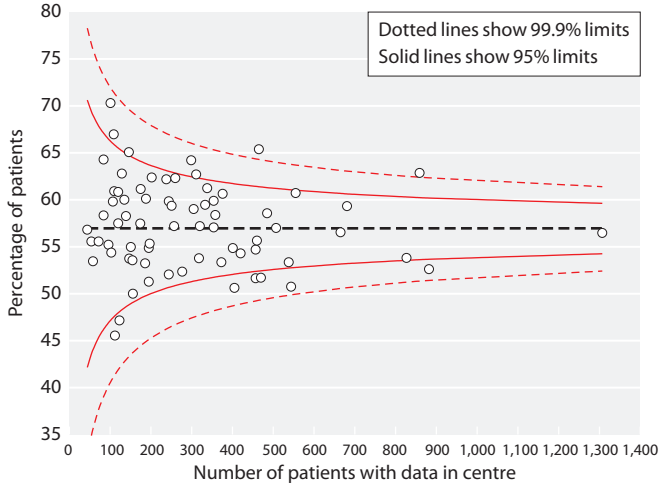

Fig. 8.2. Funnel plot of percentage of haemodialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.7 mmol/L) by centre in 2013

in the proportion of patients below, within and above the phosphate range specified by the clinical performance measure (figures 8.1–8.4).

Longitudinal analysis showed a trend towards improved phosphate control across England, Northern Ireland and Wales combined between 2003 and 2013 that has plateaued in more recent years (figure 8.5). However, this overall plateau masks substantial deterioration in a few centres achieving the standard this year (Ipswich, Ulster for HD patients; Coventry, Stevenage, Wirral for PD patients) that has been countered by improvements in other centres.

Adjusted calcium

In 2013, the following Renal Association clinical practice guideline regarding calcium management was applicable:

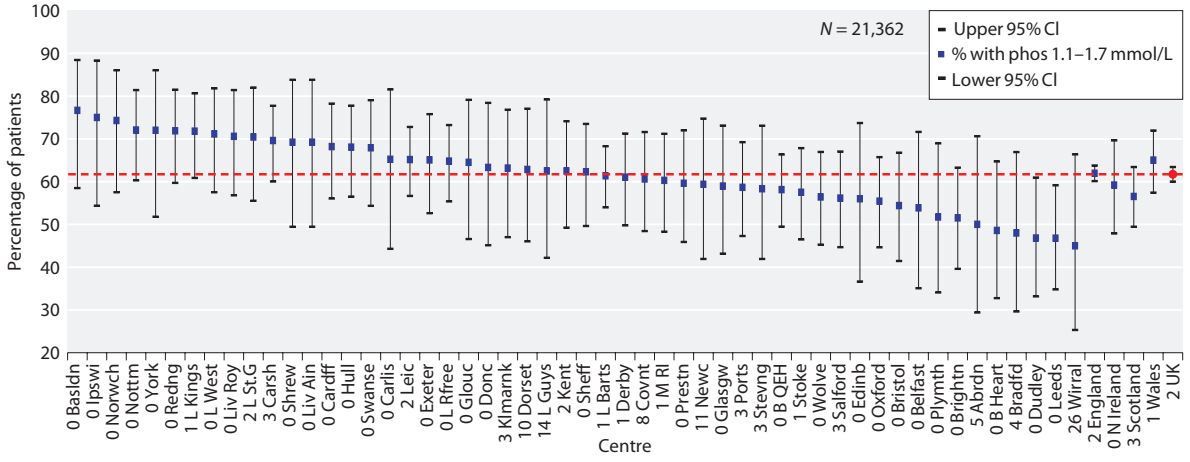

Fig. 8.3. Percentage of peritoneal dialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.7 mmol/L) by centre in 2013

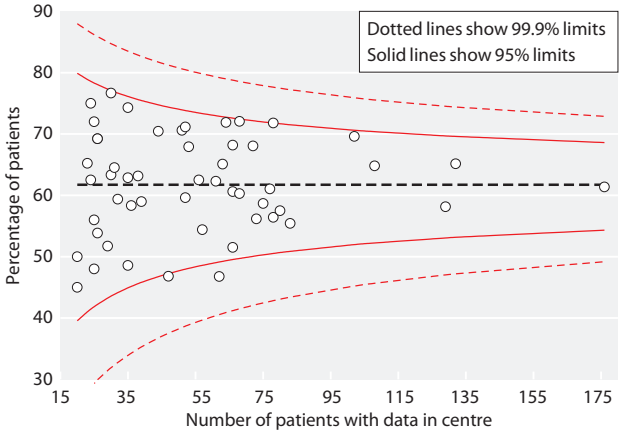

Fig. 8.4. Funnel plot of percentage of peritoneal dialysis patients with phosphate within the range specified by the RA clinical audit measure (1.1–1.7 mmol/L) by centre in 2013

Guideline 2.2 CKD-MBD: Serum calcium in dialysis patients (stage 5D)

'We suggest that serum calcium, adjusted for albumin concentration, should be maintained within the normal reference range for the laboratory used, measured before a "short-gap" dialysis session in haemodialysis patients. Ideally, adjusted serum calcium should be maintained between 2.2 and 2.5 mmol/L, with avoidance of hypercalcaemic episodes (2D)' [3].

In 2013, the data for adjusted calcium was 97% complete for HD patients and 98% complete for PD patients overall, although there was between centre variation (tables 8.7, 8.9). Seventy-eight percent (95% CI 78–79%) of HD patients and 78% of PD (95% CI

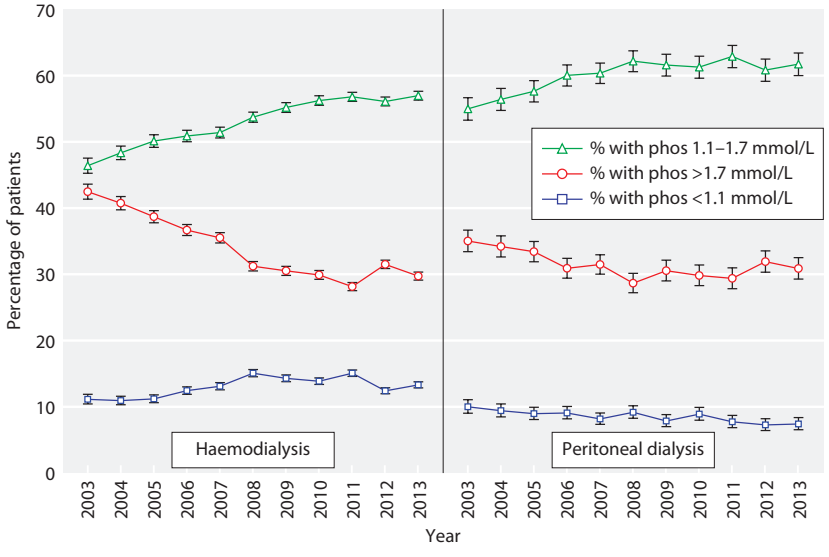

Fig. 8.5. Longitudinal change in percentage of patients with phosphate below, within and above the 2010 RA standard by dialysis modality 2003–2013

Table 8.7. Summary statistics for adjusted calcium in haemodialysis patients in 2013

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart[a]	100.0	401	2.5	0.2	2.5	2.3	2.6
B QEH	99.6	881	2.3	0.2	2.3	2.2	2.4
Basldn	99.3	151	2.4	0.2	2.4	2.3	2.4
Bradfd	100.0	186	2.4	0.2	2.4	2.3	2.5
Brightn[b]	78.5	292	2.3	0.2	2.3	2.2	2.4
Bristol	100.0	485	2.4	0.1	2.4	2.3	2.5
Camb	94.7	337	2.3	0.2	2.3	2.2	2.4
Carlis	100.0	58	2.3	0.2	2.3	2.2	2.4
Carsh	95.4	666	2.3	0.2	2.3	2.2	2.4
Chelms	100.0	109	2.3	0.2	2.3	2.2	2.4
Colchr	91.7	100	2.4	0.1	2.4	2.3	2.4
Covnt[b]	100.0	354	2.3	0.2	2.3	2.2	2.5
Derby	100.0	203	2.5	0.1	2.5	2.4	2.5
Donc	100.0	146	2.3	0.1	2.3	2.2	2.4
Dorset[b]	100.0	244	2.3	0.2	2.3	2.2	2.4
Dudley	95.1	155	2.4	0.2	2.4	2.3	2.5
Exeter	100.0	376	2.3	0.1	2.3	2.2	2.4
Glouc	100.0	188	2.4	0.2	2.4	2.3	2.5
Hull	100.0	299	2.4	0.2	2.4	2.3	2.5
Ipswi	100.0	112	2.4	0.2	2.4	2.3	2.5
Kent	98.4	370	2.4	0.2	2.4	2.3	2.6
L Barts	99.9	882	2.3	0.2	2.3	2.2	2.4
L Guys	77.3	457	2.3	0.2	2.3	2.2	2.4
L Kings	99.8	465	2.3	0.1	2.3	2.2	2.4
L Rfree	99.0	681	2.3	0.2	2.3	2.2	2.4
L St.G	98.4	251	2.3	0.2	2.3	2.2	2.4
L West[b]	90.7	1,194	2.4	0.2	2.4	2.2	2.5
Leeds	100.0	470	2.4	0.2	2.4	2.3	2.5
Leic	99.9	827	2.4	0.2	2.4	2.3	2.5
Liv Ain	99.3	147	2.4	0.2	2.3	2.2	2.4
Liv Roy	99.7	333	2.4	0.2	2.4	2.3	2.5
M RI	94.0	457	2.4	0.2	2.4	2.3	2.5
Middlbr	99.4	320	2.3	0.2	2.3	2.1	2.4
Newc[a]	100.0	257	2.3	0.2	2.3	2.3	2.4
Norwch	99.3	303	2.5	0.2	2.5	2.3	2.5
Nottm	100.0	354	2.4	0.2	2.4	2.3	2.5
Oxford	100.0	405	2.4	0.2	2.4	2.3	2.5
Plymth	99.2	119	2.4	0.2	2.4	2.3	2.4
Ports	99.6	543	2.4	0.2	2.4	2.3	2.5
Prestn	95.5	485	2.3	0.0	2.3	2.2	2.4
Redng	100.0	260	2.4	0.2	2.3	2.3	2.4
Salford	87.9	318	2.4	0.2	2.4	2.3	2.5
Sheff	99.8	555	2.3	0.2	2.3	2.2	2.4
Shrew	98.9	174	2.4	0.2	2.4	2.3	2.5
Stevng	97.5	420	2.3	0.2	2.3	2.2	2.4
Sthend	100.0	110	2.4	0.2	2.4	2.3	2.5
Stoke	79.2	228	2.4	0.2	2.4	2.3	2.5
Sund[b]	100.0	177	2.3	0.2	2.3	2.2	2.4
Truro	100.0	139	2.4	0.2	2.4	2.3	2.5
Wirral	98.5	195	2.3	0.2	2.3	2.2	2.4
Wolve	100.0	277	2.4	0.2	2.4	2.3	2.5
York	100.0	129	2.4	0.1	2.4	2.3	2.4

Table 8.7. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
N Ireland							
Antrim	100.0	120	2.5	0.1	2.5	2.4	2.6
Belfast[b]	99.5	198	2.4	0.2	2.4	2.3	2.5
Newry	97.6	82	2.3	0.2	2.3	2.2	2.4
Ulster	100.0	103	2.4	0.2	2.4	2.3	2.5
West NI	100.0	107	2.3	0.2	2.3	2.2	2.4
Wales							
Bangor	100.0	84	2.3	0.1	2.3	2.2	2.4
Cardff	100.0	460	2.4	0.2	2.4	2.3	2.5
Clwyd	100.0	72	2.3	0.2	2.3	2.2	2.4
Swanse	100.0	311	2.3	0.2	2.3	2.2	2.4
Wrexm	100.0	96	2.4	0.2	2.4	2.3	2.5
England	**96.7**	**18,045**	**2.4**	**0.2**	**2.3**	**2.2**	**2.5**
N Ireland	**99.5**	**610**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
Wales	**100.0**	**1,023**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
E, W & NI	**97.0**	**19,678**	**2.4**	**0.2**	**2.4**	**2.2**	**2.5**

[a]Newcastle had a change in calcium assay in April 2013; Birmingham Heartlands had a change in calcium assay in 2012
[b]These centres supplied uncorrected calcium and were corrected using the formula: adjusted calcium = unadjusted calcium + [(40-albumin) × 0.02]

77–80%) patients had an adjusted calcium between 2.2–2.5 mmol/L (tables 8.8, 8.10). The proportion of HD patients with hypercalcaemia was 12% and the proportion with hypocalcaemia was 10%. For PD patients the proportion of patients with hypercalcaemia was 15% and the proportion with hypocalcaemia was 7% (tables 8.8, 8.10, figures 8.6–8.9). Interestingly there was quite a large shift in the proportion of individuals on HD with an adjusted calcium greater than the target range in Northern Ireland when reviewed at aggregate level, with an increase from 9% to 14% between 2012 and 2013; corresponding changes in the proportion of patients with calcium >2.5 mmol/L in Antrim and Belfast centres were observed. A reversal of this pattern was observed in the PD population with the suggestion of a fall in the proportion of patients in Northern Ireland with hypercalcaemia from 20% in 2012 to 13% in 2013. In Wales, there was an increase in the proportion of the PD population with hypercalcaemia from 10% in 2012 to 20% in 2013.

Similar to that seen in the earlier presented phosphate analyses, there was significant between centre variation in unadjusted analyses for the proportion of patients below, within and above the range specified by the clinical performance measure (figures 8.6–8.10). There was greater variation in the proportion of patients within range for adjusted calcium than phosphate, most notably for HD patients. The funnel plot shows a greater number of centres outlying the three standard deviation limit indicating over dispersion in the data, possibly due to differences in calcium adjustment factors between centres.

The changes in the percentages above, below and within range for the period 2003 to 2013 for England, Northern Ireland and Wales combined are shown in figure 8.10. The percentage of patients achieving the audit standard for calcium appears to have plateaued for both HD and PD patients in recent years. As with the phosphate data, this overall plateau masks substantial deterioration in a few centres achieving the standard this year (Carlisle, Antrim, Wrexham for HD patients; London West, Newcastle, Cardiff for PD patients) that has been countered by improvements in other centres.

Parathyroid hormone

At the beginning of 2013 the following RA guideline for PTH applied:

Guideline 4.2.1 CKD-MBD: Target range of serum PTH in patients on dialysis

'We suggest that the target range for parathyroid hormone measured using an intact PTH assay should be between 2 and 9 times the upper limit of normal for the assay used (2C)' [3].

The data for parathyroid hormone were 93% complete for HD patients and 90% for PD patients overall,

Table 8.8. Percentage of haemodialysis patients within, below and above the range for adjusted calcium (2.2–2.5 mmol/L) in 2013

Centre	*N*	% adjusted Ca 2.2–2.5 mmol/L	Lower 95% CI	Upper 95% CI	% adjusted Ca <2.2 mmol/L	% adjusted Ca >2.5 mmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
England									
B Heart[a]	401	65.3	60.5	69.8	4.0	30.7	7.6	0.9	14.3
B QEH	881	77.1	74.2	79.7	20.7	2.3	6.4	2.3	10.6
Basldn	151	84.1	77.4	89.1	8.6	7.3	2.0	−6.5	10.6
Bradfd	186	81.2	74.9	86.2	5.4	13.4	8.2	−0.3	16.7
Brightn[b]	292	70.6	65.1	75.5	16.8	12.7	−7.4	−14.9	0.1
Bristol	485	86.4	83.0	89.2	1.7	12.0	9.8	4.9	14.7
Camb	337	82.2	77.7	85.9	11.0	6.8	−4.8	−10.4	0.7
Carlis	58	65.5	52.5	76.6	24.1	10.3	−13.4	−29.6	2.7
Carsh	666	80.9	77.8	83.7	11.9	7.2	−0.6	−4.8	3.7
Chelms	109	88.1	80.5	93.0	5.5	6.4	3.8	−5.1	12.7
Colchr	100	93.0	86.0	96.6	0.0	7.0	6.0	−2.3	14.3
Covnt[b]	354	75.7	71.0	79.9	12.2	12.2	−1.6	−7.9	4.7
Derby	203	74.9	68.5	80.4	2.0	23.2	−2.6	−10.9	5.6
Donc	146	91.1	85.3	94.8	8.2	0.7	4.4	−2.6	11.4
Dorset[b]	244	82.4	77.1	86.7	8.6	9.0	−2.4	−9.0	4.2
Dudley	155	80.7	73.7	86.1	8.4	11.0	2.4	−6.7	11.4
Exeter	376	88.3	84.6	91.2	3.2	8.5	12.6	7.0	18.1
Glouc	188	81.9	75.8	86.8	5.3	12.8	−4.7	−12.0	2.6
Hull	299	79.6	74.7	83.8	6.0	14.4	3.4	−3.2	10.1
Ipswi	112	76.8	68.1	83.7	6.3	17.0	−3.1	−13.6	7.5
Kent	370	70.8	66.0	75.2	4.1	25.1	0.6	−6.0	7.2
L Barts	882	71.0	67.9	73.9	22.8	6.2	4.2	−0.1	8.6
L Guys	457	76.6	72.5	80.2	12.9	10.5	2.6	−2.8	8.0
L Kings	465	88.4	85.1	91.0	8.0	3.7	6.4	1.9	11.0
L Rfree	681	85.8	82.9	88.2	9.5	4.7	9.2	4.8	13.6
L St.G	251	78.9	73.4	83.5	13.2	8.0	−2.0	−8.9	5.0
L West[b]	1,194	67.8	65.1	70.4	12.0	20.3	−3.6	−7.3	0.1
Leeds	470	81.1	77.3	84.4	6.4	12.6	0.0	−5.1	5.1
Leic	827	78.4	75.4	81.0	8.5	13.2	−0.5	−4.5	3.5
Liv Ain	147	82.3	75.3	87.7	6.8	10.9	2.7	−6.1	11.4
Liv Roy	333	77.8	73.0	81.9	6.3	15.9	−2.9	−9.0	3.3
M RI	457	77.9	73.9	81.5	5.7	16.4	3.1	−2.4	8.7
Middlbr	320	68.8	63.5	73.6	27.5	3.8	−7.5	−14.4	−0.5
Newc[a]	257	87.9	83.4	91.4	7.8	4.3	12.8	6.2	19.3
Norwch	303	72.3	67.0	77.0	3.3	24.4	2.5	−4.7	9.8
Nottm	354	78.0	73.4	82.0	5.7	16.4	−5.1	−10.9	0.7
Oxford	405	80.3	76.1	83.8	8.2	11.6	1.3	−4.3	6.9
Plymth	119	77.3	68.9	84.0	10.9	11.8	−10.1	−19.7	−0.5
Ports	543	78.6	75.0	81.9	7.0	14.4	−1.3	−6.2	3.6
Prestn	485	79.0	75.1	82.4	17.1	3.9	3.9	−1.4	9.1
Redng	260	84.2	79.3	88.2	7.3	8.5	3.8	−2.9	10.4
Salford	318	79.9	75.1	83.9	8.2	12.0	8.4	1.7	15.1
Sheff	555	79.8	76.3	83.0	15.3	4.9	2.1	−2.7	6.9
Shrew	174	82.2	75.8	87.2	7.5	10.3	10.4	1.8	19.1
Stevng	420	81.9	77.9	85.3	10.7	7.4	1.9	−3.6	7.3
Sthend	110	71.8	62.7	79.4	7.3	20.9	−5.0	−16.6	6.5
Stoke	228	83.3	77.9	87.6	4.8	11.8	5.1	−2.0	12.2
Sund[b]	177	74.6	67.7	80.5	16.4	9.0	−2.5	−11.3	6.4
Truro	139	81.3	73.9	86.9	5.0	13.7	7.6	−2.3	17.5
Wirral	195	84.1	78.3	88.6	10.8	5.1	2.7	−5.2	10.5
Wolve	277	77.3	72.0	81.8	6.5	16.3	0.8	−6.3	7.8
York	129	92.3	86.2	95.8	1.6	6.2	1.3	−5.6	8.2

Table 8.8. Continued

Centre	*N*	% adjusted Ca 2.2–2.5 mmol/L	Lower 95% CI	Upper 95% CI	% adjusted Ca <2.2 mmol/L	% adjusted Ca >2.5 mmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
N Ireland									
Antrim	120	69.2	60.4	76.8	1.7	29.2	−14.8	−25.3	−4.4
Belfast[b]	198	76.8	70.4	82.1	9.6	13.6	−5.7	−13.5	2.2
Newry	82	84.2	74.6	90.6	12.2	3.7	−0.6	−11.6	10.4
Ulster	103	82.5	74.0	88.7	2.9	14.6	1.3	−9.2	11.9
West NI	107	81.3	72.8	87.6	12.2	6.5	−2.4	−12.2	7.3
Wales									
Bangor	84	85.7	76.5	91.7	11.9	2.4	2.8	−8.3	13.8
Cardff	460	71.1	66.8	75.1	8.5	20.4	−2.1	−7.9	3.8
Clwyd	72	83.3	72.9	90.3	15.3	1.4	9.6	−3.5	22.8
Swanse	311	72.4	67.1	77.0	14.5	13.2	−3.1	−10.0	3.8
Wrexm	96	75.0	65.4	82.6	5.2	19.8	−13.5	−24.5	−2.6
England	**18,045**	**78.5**	**77.9**	**79.1**	**10.3**	**11.2**	**2.0**	**1.1**	**2.8**
N Ireland	**610**	**78.0**	**74.6**	**81.1**	**7.7**	**14.3**	**−5.1**	**−9.4**	**−0.7**
Wales	**1,023**	**73.9**	**71.1**	**76.5**	**10.8**	**15.4**	**−2.1**	**−5.9**	**1.6**
E, W & NI	**19,678**	**78.2**	**77.7**	**78.8**	**10.2**	**11.6**	**1.5**	**0.7**	**2.3**

[a]Newcastle had a change in calcium assay in April 2013; Birmingham Heartlands had a change in calcium assay in 2012
[b]These centres supplied uncorrected calcium and were corrected using the formula: adjusted calcium = unadjusted calcium + [(40-albumin) × 0.02]

Table 8.9. Summary statistics for adjusted calcium in peritoneal dialysis patients in 2013

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart[a]	100.0	35	2.4	0.2	2.4	2.3	2.5
B QEH	100.0	129	2.3	0.2	2.3	2.2	2.4
Basldn	100.0	30	2.4	0.1	2.4	2.3	2.5
Bradfd	96.2	25	2.5	0.1	2.4	2.4	2.5
Brightn[b]	100.0	66	2.4	0.2	2.4	2.3	2.4
Bristol	100.0	57	2.4	0.2	2.4	2.3	2.5
Camb	94.7	18					
Carlis	100.0	23	2.3	0.2	2.3	2.2	2.4
Carsh	97.1	102	2.4	0.2	2.4	2.3	2.5
Chelms	95.0	19					
Colchr[c]							
Covnt[b]	98.6	71	2.3	0.2	2.3	2.2	2.4
Derby	100.0	78	2.5	0.2	2.5	2.4	2.6
Donc	100.0	30	2.4	0.1	2.4	2.3	2.4
Dorset[b]	92.3	36	2.3	0.1	2.3	2.3	2.4
Dudley	100.0	47	2.4	0.2	2.4	2.3	2.5
Exeter	100.0	63	2.4	0.1	2.4	2.3	2.4
Glouc	100.0	31	2.4	0.1	2.4	2.3	2.4
Hull	100.0	72	2.4	0.2	2.4	2.3	2.5
Ipswi	100.0	24	2.3	0.2	2.4	2.2	2.4
Kent	98.3	56	2.5	0.2	2.5	2.4	2.6
L Barts	98.9	176	2.3	0.2	2.3	2.2	2.5

Table 8.9. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
L Guys	85.7	24	2.3	0.2	2.3	2.3	2.4
L Kings	98.7	78	2.3	0.1	2.3	2.2	2.4
L Rfree	100.0	108	2.4	0.2	2.3	2.3	2.5
L St.G	100.0	45	2.5	0.1	2.5	2.4	2.5
L West[b]	100.0	52	2.5	0.2	2.6	2.5	2.7
Leeds	100.0	62	2.4	0.2	2.4	2.3	2.5
Leic	97.8	132	2.4	0.2	2.4	2.3	2.5
Liv Ain	100.0	26	2.4	0.2	2.3	2.2	2.4
Liv Roy	100.0	51	2.4	0.1	2.4	2.3	2.5
M RI	98.6	68	2.4	0.2	2.4	2.3	2.5
Middlbr	100.0	11					
Newc[a]	88.9	32	2.4	0.2	2.4	2.3	2.5
Norwch	100.0	35	2.5	0.1	2.5	2.5	2.6
Nottm	100.0	68	2.4	0.2	2.4	2.3	2.5
Oxford	100.0	83	2.4	0.2	2.4	2.3	2.5
Plymth	100.0	29	2.4	0.1	2.4	2.4	2.5
Ports	97.4	75	2.4	0.1	2.4	2.3	2.5
Prestn	100.0	52	2.3	0.2	2.3	2.2	2.4
Redng	100.0	64	2.4	0.1	2.4	2.3	2.5
Salford	97.3	73	2.4	0.2	2.4	2.3	2.5
Sheff	100.0	61	2.3	0.2	2.3	2.2	2.4
Shrew	100.0	26	2.4	0.2	2.4	2.3	2.5
Stevng	100.0	37	2.4	0.1	2.4	2.3	2.4
Sthend	100.0	15					
Stoke	87.7	71	2.4	0.2	2.4	2.3	2.6
Sund[b]	100.0	8					
Truro	100.0	18					
Wirral	74.1	20	2.3	0.2	2.3	2.2	2.4
Wolve	100.0	78	2.4	0.2	2.4	2.2	2.5
York	100.0	25	2.4	0.1	2.4	2.4	2.5
N Ireland							
Antrim	93.3	14					
Belfast[b]	100.0	26	2.4	0.2	2.3	2.2	2.5
Newry	100.0	17					
Ulster	100.0	4					
West NI	100.0	14					
Wales							
Bangor	100.0	12					
Cardff	100.0	66	2.5	0.2	2.5	2.4	2.6
Clwyd	100.0	14					
Swanse	100.0	53	2.3	0.2	2.3	2.2	2.4
Wrexm	94.7	18					
England	**98.3**	**2,715**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
N Ireland	**98.7**	**75**	**2.4**	**0.2**	**2.3**	**2.3**	**2.5**
Wales	**99.4**	**163**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
E, W & NI	**98.4**	**2,953**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**

Blank cells: centres excluded from the analysis due to low patient numbers
[a]Newcastle had a change in calcium assay in April 2013; Birmingham Heartlands had a change in calcium assay in 2012
[b]These centres supplied uncorrected calcium and were corrected using the formula: adjusted calcium = unadjusted calcium + [(40-albumin) × 0.02]
[c]No PD patients

Table 8.10. Percentage of peritoneal dialysis patients within, below and above the range for adjusted calcium (2.2–2.5 mmol/L) in 2013

Centre	*N*	% adjusted Ca 2.2–2.5 mmol/L	Lower 95% CI	Upper 95% CI	% adjusted Ca <2.2 mmol/L	% adjusted Ca >2.5 mmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
England									
B Heart	35	85.7	70.0	93.9	5.7	8.6	14.3	−3.6	32.2
B QEH	129	77.5	69.5	83.9	14.0	8.5	−2.1	−11.8	7.6
Basldn	30	76.7	58.5	88.5	6.7	16.7	10.0	−13.3	33.3
Bradfd	25	76.0	55.8	88.8	0.0	24.0	−4.0	−26.9	18.9
Brightn*	66	86.4	75.8	92.8	4.6	9.1	4.8	−7.7	17.4
Bristol	57	84.2	72.4	91.6	0.0	15.8	7.4	−7.1	22.0
Carlis	23	82.6	61.8	93.3	8.7	8.7	1.7	−21.2	24.5
Carsh	102	78.4	69.4	85.4	7.8	13.7	−1.6	−12.9	9.8
Covnt*	71	87.3	77.4	93.3	9.9	2.8	5.0	−6.4	16.5
Derby	78	69.2	58.2	78.4	1.3	29.5	3.8	−10.7	18.2
Donc	30	86.7	69.4	94.9	6.7	6.7	4.1	−15.6	23.8
Dorset*	36	91.7	77.1	97.3	5.6	2.8	2.8	−12.1	17.7
Dudley	47	83.0	69.5	91.3	6.4	10.6	1.9	−13.2	16.9
Exeter	63	88.9	78.5	94.6	3.2	7.9	6.5	−5.4	18.5
Glouc	31	87.1	70.3	95.1	6.5	6.5	0.0	−16.7	16.7
Hull	72	77.8	66.8	85.9	5.6	16.7	1.5	−12.1	15.0
Ipswi	24	66.7	46.1	82.4	20.8	12.5	−10.0	−34.2	14.2
Kent	56	58.9	45.7	71.0	0.0	41.1	3.4	−15.1	21.9
L Barts	176	70.5	63.3	76.7	15.9	13.6	−5.3	−14.7	4.1
L Guys	24	79.2	58.7	91.1	8.3	12.5	−9.3	−29.7	11.1
L Kings	78	85.9	76.3	92.0	11.5	2.6	9.3	−2.9	21.5
L Rfree	108	85.2	77.2	90.7	7.4	7.4	11.9	1.0	22.8
L St.G	45	75.6	61.0	85.9	0.0	24.4	−11.4	−27.3	4.5
L West*	52	46.2	33.2	59.7	3.9	50.0	−17.7	−37.0	1.6
Leeds	62	75.8	63.7	84.9	3.2	21.0	−9.9	−23.1	3.3
Leic	132	81.1	73.5	86.9	3.0	15.9	3.2	−6.4	12.8
Liv Ain	26	80.8	61.3	91.8	7.7	11.5			
Liv Roy	51	86.3	73.9	93.3	2.0	11.8	7.0	−7.4	21.5
M RI	68	75.0	63.4	83.9	4.4	20.6	9.2	−5.6	24.0
Newc	32	71.9	54.2	84.7	12.5	15.6	−12.5	−32.5	7.5
Norwch	35	62.9	46.0	77.1	0.0	37.1	−1.7	−22.7	19.2
Nottm	68	80.9	69.8	88.6	4.4	14.7	−1.1	−14.0	11.8
Oxford	83	74.7	64.3	82.9	3.6	21.7	−2.6	−16.3	11.2
Plymth	29	72.4	53.8	85.6	3.5	24.1	−10.9	−32.0	10.1
Ports	75	85.3	75.4	91.7	2.7	12.0	7.1	−5.0	19.3
Prestn	52	75.0	61.6	84.9	13.5	11.5	−7.8	−23.0	7.5
Redng	64	87.5	76.9	93.6	3.1	9.4	−6.3	−16.3	3.6
Salford	73	76.7	65.7	85.0	2.7	20.6	11.7	−2.5	25.8
Sheff	61	82.0	70.3	89.7	9.8	8.2	−10.5	−22.0	1.1
Shrew	26	69.2	49.5	83.8	15.4	15.4	−2.6	−26.3	21.0
Stevng	37	86.5	71.4	94.3	2.7	10.8	1.3	−16.0	18.6
Stoke	71	69.0	57.4	78.7	5.6	25.4	−4.4	−19.7	10.8
Wirral	20	80.0	57.2	92.3	10.0	10.0	3.8	−21.5	29.1
Wolve	78	84.6	74.8	91.1	6.4	9.0	2.3	−9.3	14.0
York	25	84.0	64.3	93.9	0.0	16.0	−1.2	−20.8	18.5
N Ireland									
Belfast*	26	84.6	65.5	94.1	3.9	11.5	19.4	−4.5	43.3
Wales									
Cardff	66	56.1	44.0	67.5	3.0	40.9	−23.9	−39.1	−8.7
Swanse	53	84.9	72.6	92.3	11.3	3.8	3.8	−10.5	18.1
England	**2,715**	**78.5**	**76.9**	**80.0**	**6.6**	**15.0**	**0.5**	**−1.7**	**2.6**
N Ireland	**75**	**78.7**	**68.0**	**86.5**	**8.0**	**13.3**	**6.6**	**−7.5**	**20.7**
Wales	**163**	**71.2**	**63.8**	**77.6**	**8.6**	**20.3**	**−10.1**	**−19.2**	**−1.0**
E, W & NI	**2,953**	**78.1**	**76.6**	**79.6**	**6.7**	**15.2**	**0.0**	**−2.1**	**2.1**

*These centres supplied uncorrected calcium and were corrected using the formula: adjusted calcium = unadjusted calcium + [(40-albumin) × 0.02]

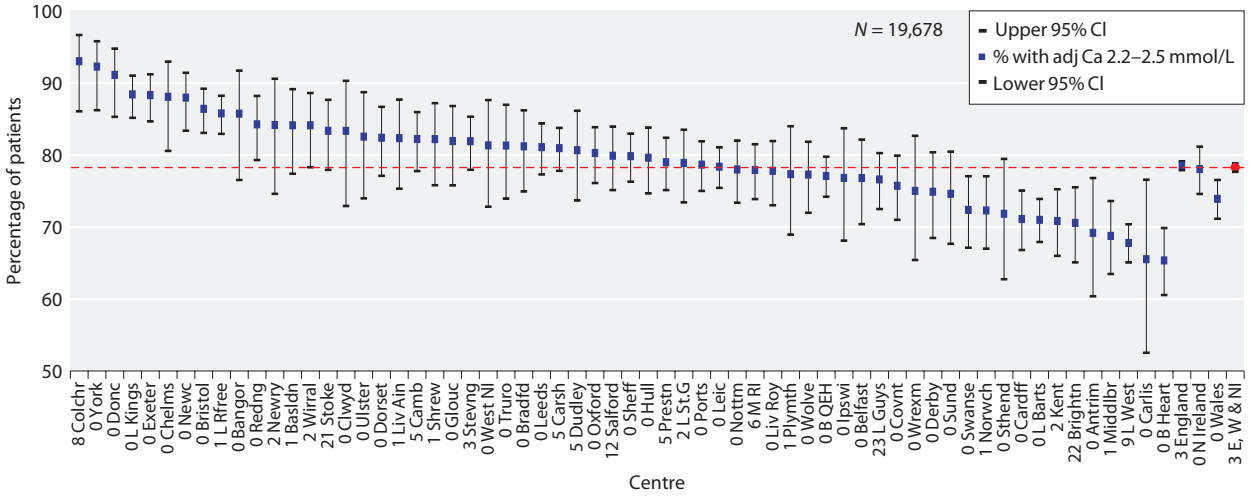

Fig. 8.6. Percentage of haemodialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2013

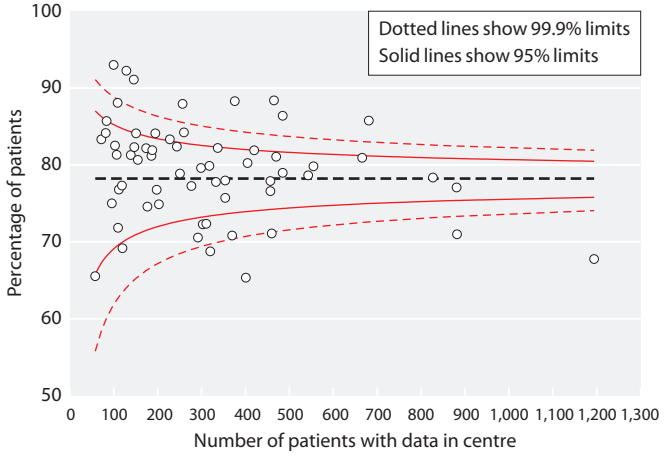

Fig. 8.7. Funnel plot of percentage of haemodialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2013

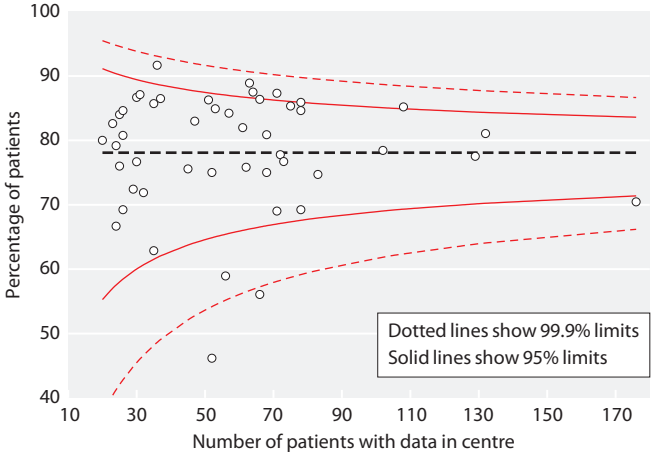

Fig. 8.9. Funnel plot of percentage of peritoneal dialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2013

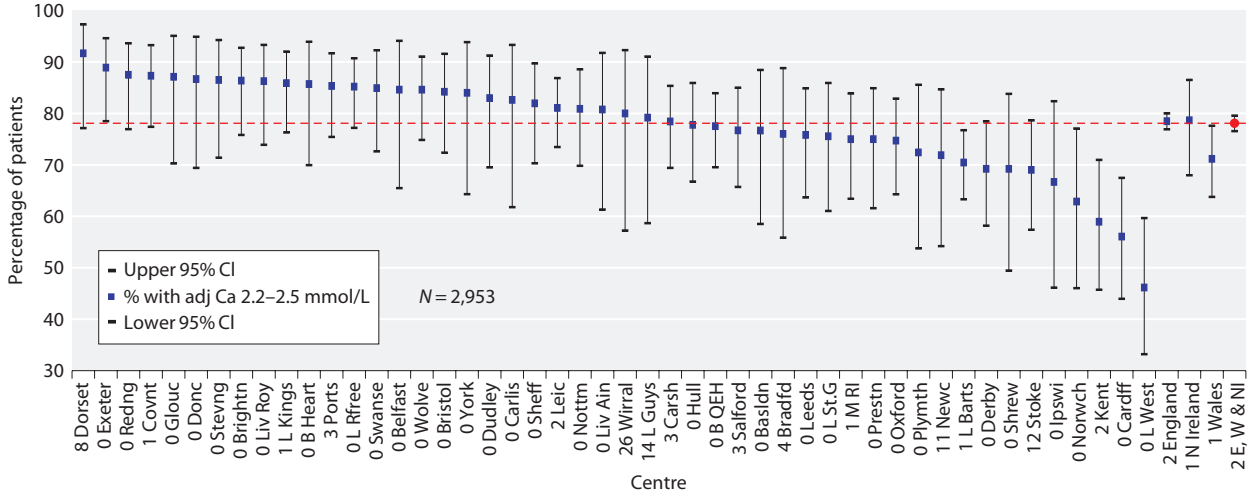

Fig. 8.8. Percentage of peritoneal dialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2013

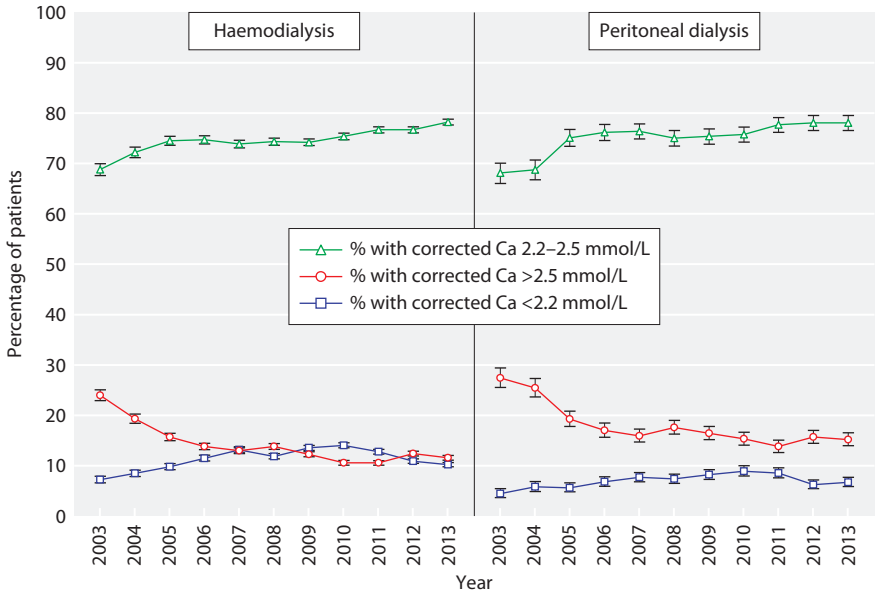

Fig. 8.10. Longitudinal change in percentage of patients with adjusted calcium <2.2 mmol/L, 2.2–2.5 mmol/L and >2.5 mmol/L by dialysis modality 2003–2013

although there was between centre variation (tables 8.11, 8.13). Fifty-seven percent (95% CI 56–58%) of HD patients and 63% (95% CI 61–65%) of PD patients achieved a parathyroid hormone between 16–72 pmol/L (tables 8.12, 8.14).

In 2013, the proportion of HD patients with a parathyroid hormone above the upper limit of the range (>72 pmol/L) was 17% and the proportion with parathyroid hormone below the lower limit of the range was 26%, very similar to aggregate level results in 2012. The proportion of PD patients with parathyroid hormone above the upper limit of the range was 13% and the proportion below the lower limit of the range was 24% (tables 8.12, 8.14, figures 8.11–8.14). Again there was significant between centre variation in unadjusted analyses for the proportion of patients below, within and above the range specified by the clinical performance measure.

There was no substantial variation in attainment of the standard for HD patients but there was deterioration for some PD centres (Birmingham Heartlands, Basildon, Newcastle, Portsmouth) where increases in patients both below and above the audit range were seen.

Table 8.11. Summary statistics for PTH in haemodialysis patients in 2013

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	401	61.8	51.9	49	26	80
B QEH	93.6	828	43.8	51.3	29	15	53
Basldn	98.0	149	38.0	31.9	30	17	49
Bradfd	98.9	184	35.3	37.5	21	12	48
Brightn	81.2	302	39.0	45.8	26	13	49
Bristol	98.6	478	37.7	44.2	26	12	45
Camb	73.9	263	28.1	29.2	23	11	36
Carlis	98.3	57	29.9	30.3	22	12	32
Carsh	74.6	521	60.4	58.2	41	23	77
Chelms	100.0	109	42.0	29.7	33	20	52
Colchr	89.9	98	25.6	28.4	18	9	27
Covnt	98.0	347	43.9	46.0	28	15	56
Derby	99.5	202	30.5	24.4	24	16	39
Donc	100.0	146	49.3	39.9	40	26	63
Dorset	98.8	241	28.3	28.3	19	10	37
Dudley	90.2	147	37.5	40.0	27	13	46
Exeter	98.9	372	22.6	25.3	15	7	28

Table 8.11. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Glouc	99.5	187	34.3	34.1	27	14	45
Hull	97.3	291	49.4	53.9	31	15	65
Ipswi	100.0	112	30.5	38.0	19	12	32
Kent	98.9	372	48.4	40.1	38	19	57
L Barts	99.1	875	51.7	52.9	37	18	67
L Guys	72.8	430	50.8	51.3	36	15	73
L Kings	98.7	460	44.9	45.1	31	13	59
L Rfree	98.4	677	45.7	45.0	34	17	59
L St.G	94.9	242	55.5	53.3	40	20	72
L West	81.4	1,072	64.0	63.5	44	21	83
Leeds	96.8	455	40.4	40.3	27	13	54
Leic	98.6	816	40.9	41.8	27	11	59
Liv Ain	98.0	145	23.4	26.6	14	6	34
Liv Roy	99.7	333	38.0	39.2	25	12	48
M RI	83.7	407	50.1	45.6	38	19	66
Middlbr	94.4	304	50.5	47.4	38	20	64
Newc	99.6	256	41.5	36.4	31	16	55
Norwch	97.7	298	38.2	33.4	30	15	51
Nottm	100.0	354	43.9	51.6	30	15	52
Oxford	99.0	401	44.4	38.4	34	16	60
Plymth	96.7	116	35.4	46.5	24	12	39
Ports	84.8	462	45.9	46.5	32	16	57
Prestn	99.4	505	42.4	42.6	28	15	55
Redng	100.0	260	38.5	35.2	32	16	49
Salford	82.9	300	29.9	28.4	21	10	40
Sheff	99.1	551	44.0	43.7	32	16	56
Shrew	99.4	175	30.5	33.2	19	10	38
Stevng	95.4	411	42.1	31.9	38	19	57
Sthend	90.0	99	44.5	40.7	31	19	56
Stoke	76.7	221	44.0	35.3	35	19	59
Sund	99.4	176	41.0	39.3	29	12	60
Truro	99.3	138	22.4	28.0	14	6	29
Wirral	98.5	195	31.5	28.6	26	14	43
Wolve	93.9	260	45.1	46.9	32	15	57
York	95.4	123	28.0	32.9	18	7	40
N Ireland							
Antrim	100.0	120	28.2	29.6	20	14	35
Belfast	98.5	196	36.1	39.4	23	12	47
Newry	100.0	84	28.6	21.9	22	12	42
Ulster	99.0	102	23.7	22.0	16	8	32
West NI	100.0	107	33.4	22.3	30	18	41
Wales							
Bangor	98.8	83	26.3	20.3	23	14	33
Cardff	98.0	451	43.9	38.0	34	19	56
Clwyd	100.0	72	40.4	39.8	30	13	54
Swanse	74.0	230	39.3	37.5	32	16	53
Wrexm	96.9	93	21.7	18.2	19	10	29
England	**92.9**	**17,324**	**43.9**	**45.7**	**30**	**15**	**57**
N Ireland	**99.4**	**609**	**30.9**	**30.4**	**22**	**12**	**39**
Wales	**90.8**	**929**	**38.7**	**36.0**	**30**	**16**	**51**
E, W & NI	**93.0**	**18,862**	**43.2**	**44.9**	**30**	**15**	**56**

Table 8.12. Percentage of haemodialysis patients within, below and above the range for PTH (16–72 pmol/L) in 2013

Centre	*N*	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% phos >72 pmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
England									
B Heart	401	56.1	51.2	60.9	12.5	31.4	−7.9	−14.7	−1.1
B QEH	828	59.4	56.0	62.7	25.9	14.7			
Basldn	149	67.8	59.9	74.8	22.2	10.1	6.0	−4.9	16.9
Bradfd	184	51.6	44.4	58.8	35.3	13.0	8.2	−2.0	18.3
Brightn	302	56.0	50.3	61.5	31.5	12.6	2.5	−5.7	10.6
Bristol	478	57.3	52.8	61.7	30.8	11.9	−0.1	−6.4	6.3
Camb	263	59.3	53.3	65.1	35.7	4.9	−4.1	−12.8	4.5
Carlis	57	59.7	46.6	71.5	33.3	7.0	1.8	−16.3	19.8
Carsh	521	57.8	53.5	62.0	14.6	27.6			
Chelms	109	67.0	57.6	75.1	16.5	16.5	−1.4	−13.5	10.8
Colchr	98	46.9	37.3	56.8	43.9	9.2	−3.6	−17.4	10.3
Covnt	347	55.6	50.4	60.8	26.5	17.9	−5.8	−13.2	1.6
Derby	202	72.3	65.7	78.0	23.3	4.5	3.7	−5.2	12.5
Donc	146	71.9	64.1	78.6	8.9	19.2	0.6	−9.6	10.7
Dorset	241	50.2	43.9	56.5	41.1	8.7	−1.9	−10.8	7.1
Dudley	147	59.2	51.1	66.8	29.9	10.9	13.7	2.3	25.1
Exeter	372	42.5	37.5	47.6	52.7	4.8	0.7	−6.5	7.9
Glouc	187	64.7	57.6	71.2	27.8	7.5	0.6	−9.0	10.3
Hull	291	53.3	47.5	58.9	26.8	19.9	−4.1	−12.1	3.9
Ipswi	112	49.1	40.0	58.3	41.1	9.8	−10.6	−23.2	2.1
Kent	372	66.7	61.7	71.3	14.3	19.1	−0.6	−7.4	6.3
L Barts	875	57.0	53.7	60.3	20.0	23.0	−2.3	−7.0	2.4
L Guys	430	49.3	44.6	54.0	25.6	25.1	−6.1	−12.7	0.5
L Kings	460	49.8	45.2	54.3	29.1	21.1	−3.7	−10.2	2.8
L Rfree	677	60.6	56.8	64.2	22.0	17.4	0.4	−5.1	6.0
L St.G	242	55.0	48.6	61.1	20.7	24.4	−1.3	−10.1	7.5
L West	1,072	50.9	47.9	53.9	18.4	30.7	0.4	−3.9	4.7
Leeds	455	54.5	49.9	59.0	29.5	16.0	−1.3	−7.8	5.2
Leic	816	47.7	44.3	51.1	33.1	19.2	−2.7	−7.5	2.2
Liv Ain	145	43.5	35.6	51.6	52.4	4.1	−6.9	−18.1	4.4
Liv Roy	333	53.8	48.4	59.1	32.7	13.5	−1.8	−9.4	5.8
M RI	407	58.7	53.9	63.4	19.7	21.6	7.1	0.3	13.8
Middlbr	304	61.8	56.3	67.1	16.8	21.4	−0.2	−8.0	7.6
Newc	256	59.8	53.6	65.6	22.7	17.6	−0.8	−9.2	7.7
Norwch	298	62.8	57.1	68.1	25.2	12.1	1.5	−6.4	9.4
Nottm	354	60.5	55.3	65.4	25.7	13.8	0.4	−6.8	7.6
Oxford	401	56.1	51.2	60.9	24.7	19.2	−2.2	−9.1	4.7
Plymth	116	56.9	47.8	65.6	33.6	9.5	4.7	−8.1	17.6
Ports	462	56.3	51.7	60.7	24.9	18.8	4.1	−2.4	10.6
Prestn	505	56.6	52.3	60.9	26.9	16.4			
Redng	260	67.7	61.8	73.1	21.5	10.8	2.0	−6.2	10.1
Salford	300	55.3	49.7	60.9	37.0	7.7	0.0	−8.0	8.0
Sheff	551	61.0	56.8	65.0	24.0	15.1	−2.6	−8.3	3.2
Shrew	175	49.1	41.8	56.5	41.1	9.7	−0.6	−11.0	9.8
Stevng	411	69.3	64.7	73.6	16.8	13.9	3.4	−3.2	9.9
Sthend	99	63.6	53.8	72.5	18.2	18.2	−1.7	−15.0	11.7
Stoke	221	67.4	61.0	73.3	18.1	14.5	0.2	−8.2	8.7
Sund	176	51.7	44.3	59.0	30.1	18.2	−2.7	−13.1	7.6
Truro	138	42.0	34.1	50.4	54.4	3.6	−3.0	−14.9	8.8
Wirral	195	66.7	59.8	72.9	28.7	4.6	0.6	−9.2	10.4
Wolve	260	56.9	50.8	62.8	25.8	17.3	4.1	−4.4	12.6
York	123	49.6	40.9	58.4	43.9	6.5	0.9	−11.8	13.5

Table 8.12. Continued

Centre	*N*	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% phos >72 pmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
N Ireland									
Antrim	120	62.5	53.5	70.7	34.2	3.3	−4.7	−16.6	7.2
Belfast	196	52.6	45.6	59.5	35.7	11.7	−5.1	−14.8	4.7
Newry	84	59.5	48.8	69.5	34.5	6.0	13.6	−1.3	28.6
Ulster	102	46.1	36.7	55.8	49.0	4.9	−1.4	−15.2	12.3
West NI	107	71.0	61.8	78.8	21.5	7.5	4.4	−7.5	16.2
Wales									
Bangor	83	67.5	56.7	76.7	30.1	2.4	10.7	−4.1	25.4
Cardff	451	65.9	61.4	70.1	18.6	15.5	−5.5	−11.6	0.7
Clwyd	72	54.2	42.6	65.3	27.8	18.1	−7.7	−23.5	8.2
Swanse	230	61.7	55.3	67.8	24.4	13.9	−1.1	−10.0	7.8
Wrexm	93	53.8	43.6	63.6	45.2	1.1	−5.8	−20.4	8.8
England	**17,324**	**56.7**	**56.0**	**57.5**	**26.1**	**17.1**	**−0.4**	**−1.4**	**0.7**
N Ireland	**609**	**57.6**	**53.7**	**61.5**	**35.0**	**7.4**	**−0.5**	**−6.0**	**5.0**
Wales	**929**	**62.9**	**59.7**	**65.9**	**24.4**	**12.7**	**−3.1**	**−7.5**	**1.3**
E, W & NI	**18,862**	**57.1**	**56.4**	**57.8**	**26.3**	**16.6**	**−0.5**	**−1.6**	**0.5**

Blank cells: no data available for 2012

Table 8.13. Summary statistics for PTH in peritoneal dialysis patients in 2013

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	88.6	31	51.8	42.9	38	26	79
B QEH	97.7	126	39.0	40.2	25	14	42
Basldn	100.0	30	39.8	29.3	30	18	57
Bradfd	88.5	23	39.2	49.9	25	4	47
Brightn	97.0	64	32.2	25.2	23	12	49
Bristol	96.5	55	37.1	28.1	32	17	46
Camb	100.0	19					
Carlis	87.0	20	40.6	25.6	28	26	54
Carsh	48.6	51					
Chelms	95.0	19					
Colchr*							
Covnt	91.7	66	22.9	19.9	18	11	28
Derby	97.4	76	29.5	19.6	26	16	35
Donc	96.7	29	54.4	33.7	40	33	63
Dorset	89.7	35	27.7	18.5	24	13	40
Dudley	87.2	41	34.7	40.8	18	10	41
Exeter	100.0	63	24.8	19.3	18	12	35
Glouc	83.9	26	35.7	22.8	26	18	47
Hull	55.6	40	25.5	23.0	22	8	34
Ipswi	91.7	22	56.9	52.1	32	16	87
Kent	96.5	55	41.2	32.4	29	19	57
L Barts	95.5	170	36.0	35.3	27	12	48

Table 8.13. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
L Guys	57.1	16					
L Kings	96.2	76	47.4	41.3	32	17	70
L Rfree	84.3	91	46.1	47.3	35	17	58
L St.G	91.1	41	31.7	27.3	22	16	41
L West	100.0	52	49.5	46.9	34	26	64
Leeds	100.0	62	42.4	34.4	32	18	54
Leic	89.6	121	42.2	35.7	33	16	59
Liv Ain	92.3	24	17.0	12.7	13	10	20
Liv Roy	94.1	48	30.7	23.1	24	13	40
M RI	94.2	65	37.6	22.1	37	21	50
Middlbr	90.9	10					
Newc	83.3	30	30.0	24.9	22	14	38
Norwch	100.0	35	40.0	25.9	33	20	60
Nottm	97.1	66	51.2	54.3	41	19	62
Oxford	95.2	79	44.1	37.6	35	18	57
Plymth	75.9	22	23.6	24.1	18	10	33
Ports	87.0	67	43.6	34.8	33	15	68
Prestn	100.0	52	42.2	28.5	38	24	54
Redng	95.3	61	31.1	18.7	27	17	41
Salford	94.7	71	39.9	39.7	25	13	47
Sheff	86.9	53	34.0	24.0	29	18	46
Shrew	100.0	26	42.6	42.0	24	19	57
Stevng	86.5	32	37.1	21.9	38	19	52
Sthend	60.0	9					
Stoke	87.7	71	52.8	46.0	36	23	67
Sund	100.0	8					
Truro	88.9	16					
Wirral	66.7	18					
Wolve	98.7	77	40.3	29.2	32	19	54
York	100.0	25	33.2	27.5	26	14	52
N Ireland							
Antrim	100.0	15					
Belfast	100.0	26	27.7	20.3	23	10	37
Newry	100.0	17					
Ulster	100.0	4					
West NI	100.0	14					
Wales							
Bangor	91.7	11					
Cardff	92.4	61	49.6	30.9	45	28	71
Clwyd	92.9	13					
Swanse	88.7	47	38.3	28.1	33	17	46
Wrexm	100.0	19					
England	**90.0**	**2,485**	**39.1**	**35.9**	**29**	**16**	**51**
N Ireland	**100.0**	**76**	**25.9**	**19.6**	**22**	**12**	**34**
Wales	**92.1**	**151**	**42.2**	**27.9**	**38**	**19**	**57**
E, W & NI	**90.3**	**2,712**	**38.9**	**35.2**	**29**	**16**	**51**

Blank cells: centres excluded from analyses due to small numbers or poor data completeness
* No PD patients

Table 8.14. Percentage of peritoneal dialysis patients within, below and above the range for PTH (16–72 pmol/L) in 2013

Centre	*N*	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% phos >72 pmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
England									
B Heart	31	61.3	43.5	76.5	12.9	25.8	−13.7	−36.5	9.1
B QEH	126	61.9	53.1	70.0	26.2	11.9	−4.5	−16.0	7.0
Basldn	30	66.7	48.4	81.0	20.0	13.3	−14.8	−37.2	7.5
Bradfd	23	47.8	28.8	67.5	39.1	13.0	−6.7	−35.9	22.4
Brightn	64	59.4	47.0	70.7	34.4	6.3	−4.6	−21.6	12.5
Bristol	55	67.3	53.9	78.3	20.0	12.7	6.9	−11.2	25.0
Carlis	20	80.0	57.2	92.3	5.0	15.0	20.0	−7.7	47.7
Covnt	66	59.1	46.9	70.2	37.9	3.0	−2.0	−18.1	14.2
Derby	76	72.4	61.3	81.2	22.4	5.3	−1.1	−14.9	12.7
Donc	29	72.4	53.8	85.6	6.9	20.7	7.2	−18.2	32.6
Dorset	35	71.4	54.6	83.9	28.6	0.0	4.8	−18.5	28.0
Dudley	41	48.8	34.1	63.7	41.5	9.8	−3.4	−24.4	17.6
Exeter	63	57.1	44.7	68.7	39.7	3.2	7.1	−9.9	24.2
Glouc	26	76.9	57.2	89.3	15.4	7.7	19.2	−5.7	44.2
Hull	40	57.5	42.0	71.7	37.5	5.0	3.2	−16.0	22.5
Ipswi	22	54.6	34.1	73.5	18.2	27.3	−4.1	−31.5	23.4
Kent	55	63.6	50.3	75.2	18.2	18.2	−0.4	−18.8	18.0
L Barts	170	56.5	48.9	63.7	32.4	11.2	−7.0	−17.8	3.7
L Kings	76	56.6	45.3	67.2	19.7	23.7	−1.3	−17.0	14.4
L Rfree	91	61.5	51.2	70.9	22.0	16.5	−6.1	−20.8	8.7
L St.G	41	65.9	50.3	78.6	24.4	9.8	−5.6	−25.5	14.4
L West	52	61.5	47.8	73.7	19.2	19.2	−8.0	−26.8	10.7
Leeds	62	64.5	51.9	75.4	19.4	16.1	−1.7	−17.6	14.2
Leic	121	61.2	52.2	69.4	23.1	15.7	1.3	−10.6	13.3
Liv Ain	24	29.2	14.6	49.8	70.8	0.0			
Liv Roy	48	62.5	48.2	74.9	29.2	8.3	−1.0	−19.9	18.0
M RI	65	73.9	61.9	83.1	15.4	10.8	0.9	−13.8	15.6
Newc	30	53.3	35.8	70.1	36.7	10.0	−21.7	−45.0	1.6
Norwch	35	71.4	54.6	83.9	14.3	14.3	20.3	−0.9	41.4
Nottm	66	66.7	54.5	76.9	15.2	18.2	3.3	−12.7	19.3
Oxford	79	59.5	48.4	69.7	21.5	19.0	−5.6	−21.6	10.4
Plymth	22	50.0	30.2	69.8	45.5	4.6	10.7	−16.9	38.3
Ports	67	49.3	37.6	61.0	28.4	22.4	−18.3	−34.2	−2.4
Prestn	52	69.2	55.5	80.2	17.3	13.5			
Redng	61	75.4	63.1	84.6	19.7	4.9	7.2	−8.6	22.9
Salford	71	54.9	43.3	66.1	26.8	18.3	−6.5	−22.1	9.1
Sheff	53	67.9	54.3	79.0	22.6	9.4	−5.2	−22.6	12.3
Shrew	26	69.2	49.5	83.8	15.4	15.4	1.5	−22.7	25.7
Stevng	32	75.0	57.4	87.0	18.8	6.3	23.0	−1.7	47.7
Stoke	71	70.4	58.9	79.9	9.9	19.7	2.3	−13.0	17.6
Wolve	77	68.8	57.7	78.2	19.5	11.7	−3.2	−17.7	11.3
York	25	64.0	44.0	80.1	32.0	4.0	0.0	−26.6	26.6
N Ireland									
Belfast	26	57.7	38.5	74.8	38.5	3.9	−7.5	−34.7	19.7
Wales									
Cardff	61	60.7	48.0	72.0	16.4	23.0	−5.1	−21.6	11.5
Swanse	47	68.1	53.6	79.8	21.3	10.6	−3.9	−22.1	14.3
England	**2,485**	**62.9**	**60.9**	**64.7**	**24.0**	**13.2**	**−1.7**	**−4.3**	**1.0**
N Ireland	**76**	**60.5**	**49.2**	**70.8**	**36.8**	**2.6**	**−4.2**	**−20.0**	**11.6**
Wales	**151**	**68.9**	**61.1**	**75.7**	**16.6**	**14.6**	**0.6**	**−9.7**	**10.8**
E, W & NI	**2,712**	**63.1**	**61.3**	**64.9**	**23.9**	**12.9**	**−1.6**	**−4.2**	**0.9**

Blank cells: no data available for 2012

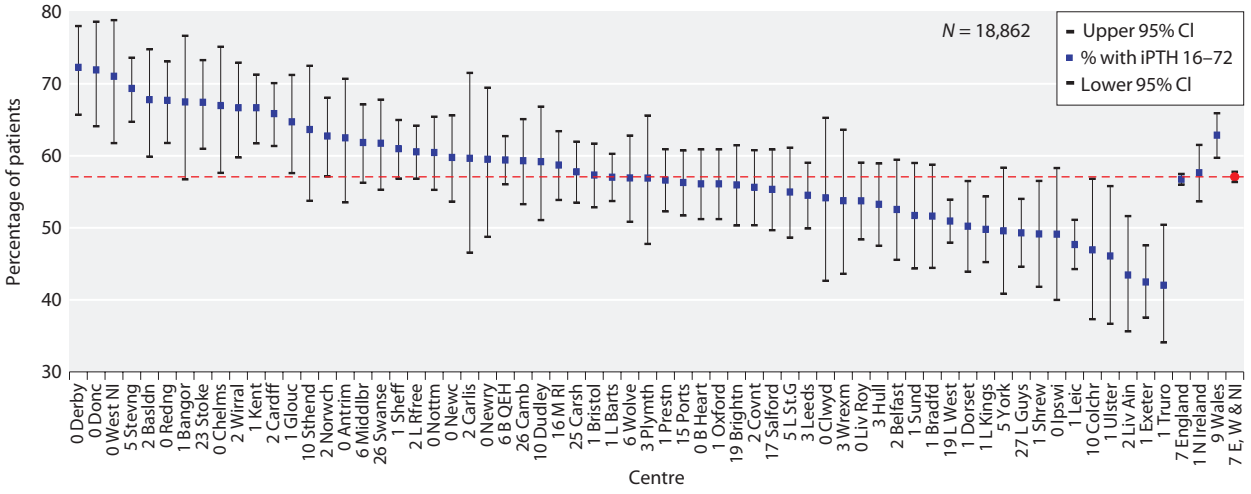

Fig. 8.11. Percentage of haemodialysis patients with PTH within range (16–72 pmol/L) by centre in 2013

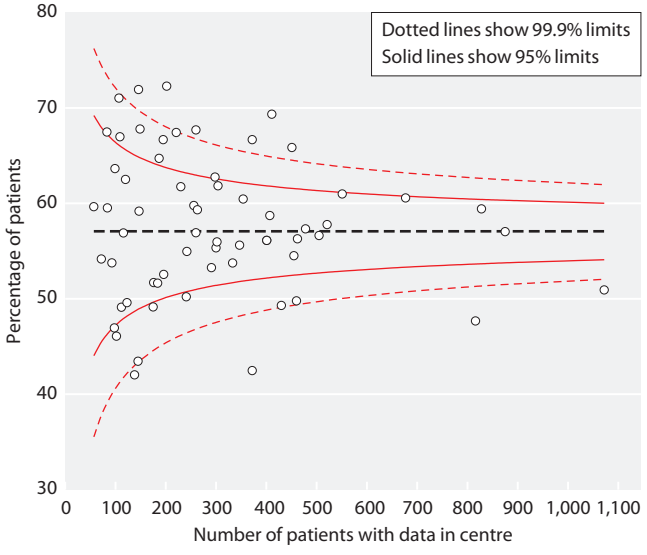

Fig. 8.12. Funnel plot of percentage of haemodialysis patients with PTH within range (16–72 pmol/L) by centre in 2013

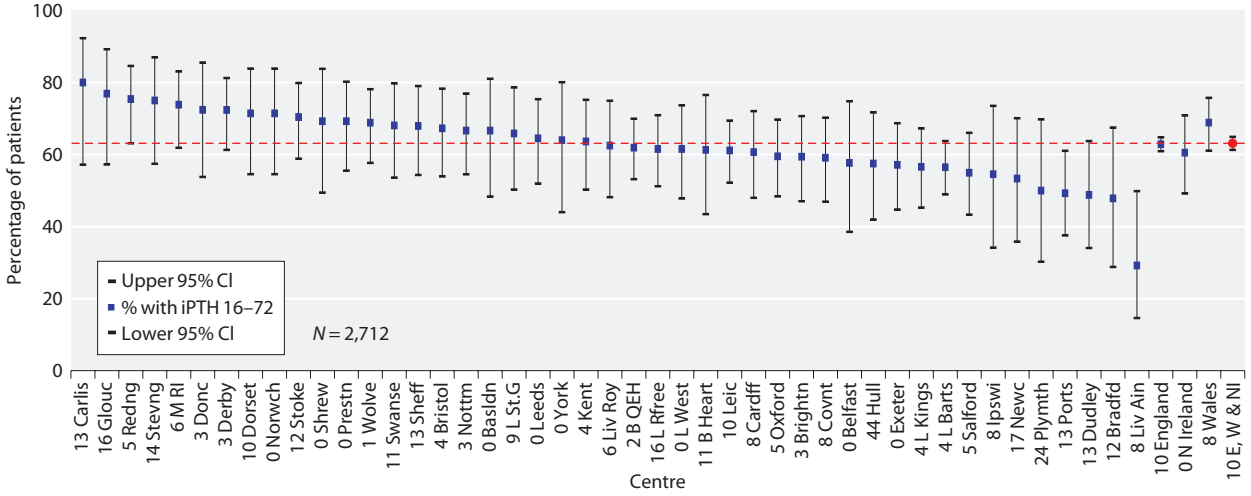

Fig. 8.13. Percentage of peritoneal dialysis patients with PTH within range (16–72 pmol/L) by centre in 2013

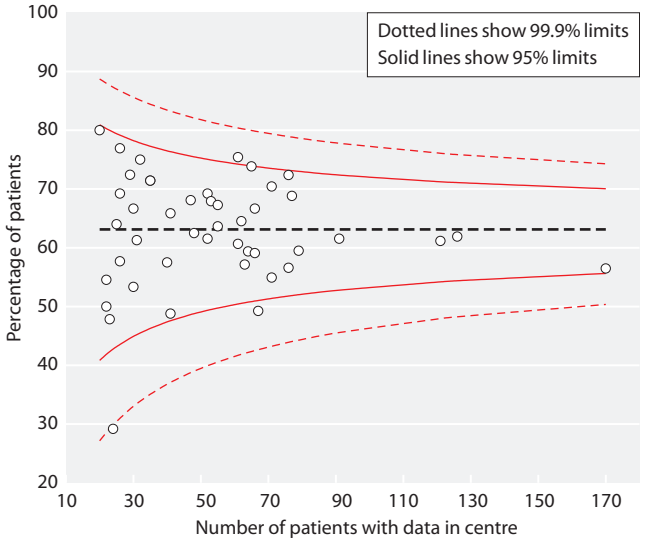

Fig. 8.14. Funnel plot of percentage of peritoneal dialysis patients with PTH within range (16–72 pmol/L) by centre in 2013

Changes in PTH control between 2003 and 2013 stratified by dialysis modality are shown in figure 8.15.

Simultaneous control of corrected calcium, phosphate and PTH in preventing severe hyperparathyroidism

Data points to perform the bone mineral disease (BMD) combination analyses were available from 61 HD and 45 PD centres, covering 18,428 HD and 2,433 PD patients, from England, Wales and Northern Ireland.

Tables 8.15 and 8.16 identify each centre and detail the numbers of patients who had received HD and PD and the results of the BMD combination analyses.

Figures 8.16 and 8.17 demonstrate the caterpillar plots of all centres and the percentage achievement of simultaneous control of all three BMD parameters for HD and PD patients respectively.

Control of none of the parameters of BMD was found in 1.9% of HD patients and 1.6% of PD patients across England, Wales and Northern Ireland cumulatively. Control of one parameter was reported in 13.0% of HD and 12.5% of PD patients; of two parameters in 35.9% of HD and 35.8% of PD patients; and of all three parameters in 49.3% of HD and 50.1% of PD patients (tables 8.15, 8.16).

Figures 8.18 and 8.19 are funnel plots of all centres who contributed data to these analyses based on the size of the centre and the percentage of patients achieving the control of all three BMD parameters. In HD patients, there was a negative trend observed between centre size and the simultaneous control of all three BMD parameters as identified in this analysis. No such trend was observed in PD patients, perhaps because PD centres are all of a small size.

Bicarbonate

In 2013 the following Renal Association clinical practice guidelines regarding bicarbonate management were applicable:

Haemodialysis Guideline 6.3: Pre-dialysis serum bicarbonate concentrations

'We suggest that pre-dialysis serum bicarbonate concentrations, measured with minimum delay after venepuncture, should be between 18 and 24 mmol/l [7].

Peritoneal Dialysis Guideline 6.2 – PD: Metabolic factors

'We recommend that plasma bicarbonate should be maintained within the normal range' [8].

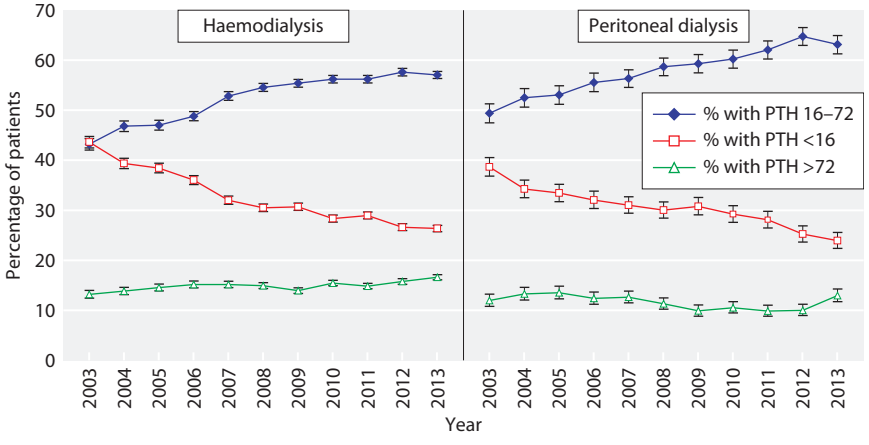

Fig. 8.15. Longitudinal change in percentage of patients with PTH within range (16–72 pmol/L) by dialysis modality 2003–2013

Table 8.15. Percentage of haemodialysis patients within the ranges specified for the simultaneous combinations of control of bone and mineral disorder parameters in preventing severe hyper parathyroidism in 2013

		Number of parameters			
Centre	*N*	None	One	Two	Three
England					
B Heart	401	5.2	24.7	35.9	34.2
B QEH	806	1.7	12.3	35.9	50.1
Basldn	149	0.0	8.7	32.9	58.4
Bradfd	184	1.1	13.0	28.3	57.6
Brightn	241	0.8	14.9	38.2	46.1
Bristol	478	1.3	9.0	33.3	56.5
Camb	248	0.0	8.1	37.5	54.4
Carlis	57	0.0	15.8	50.9	33.3
Carsh	521	3.5	14.4	38.0	44.1
Chelms	109	0.9	5.5	31.2	62.4
Colchr	96	0.0	9.4	19.8	70.8
Covnt	347	1.7	16.7	36.0	45.5
Derby	202	1.0	7.4	37.1	54.5
Donc	146	0.0	7.5	34.2	58.2
Dorset	241	1.2	10.4	26.6	61.8
Dudley	146	3.4	10.3	33.6	52.7
Exeter	372	0.5	6.2	30.1	63.2
Glouc	187	0.0	9.1	34.2	56.7
Hull	291	2.1	11.3	36.4	50.2
Ipswi	112	0.0	5.4	39.3	55.4
Kent	366	2.7	18.3	41.0	38.0
L Barts	875	3.0	18.9	38.6	39.5
L Guys	418	2.4	14.8	38.3	44.5
L Kings	460	0.9	9.1	31.7	58.3
L Rfree	677	0.7	11.7	33.2	54.4
L St.G	242	1.7	14.5	37.2	46.7
L West	988	3.5	19.6	41.9	34.9
Leeds	455	2.0	13.6	35.6	48.8
Leic	816	2.3	15.4	38.7	43.5
Liv Ain	145	0.0	4.8	32.4	62.8
Liv Roy	332	0.6	8.4	39.8	51.2
M RI	407	2.2	16.5	37.3	44.0
Middlbr	304	1.3	17.8	43.4	37.5
Newc	256	1.2	10.5	31.3	57.0
Norwch	296	2.7	12.8	36.1	48.3
Nottm	354	2.5	12.1	33.1	52.3
Oxford	401	2.0	15.2	34.9	47.9
Plymth	115	1.7	12.2	33.0	53.0
Ports	461	2.6	14.5	38.0	44.9
Prestn	483	2.5	14.1	37.1	46.4
Redng	260	0.0	11.5	27.7	60.8
Salford	300	0.7	8.0	35.7	55.7
Sheff	551	2.0	11.6	36.3	50.1
Shrew	173	2.3	9.2	37.6	50.9
Stevng	403	2.0	12.2	35.7	50.1
Sthend	99	1.0	11.1	48.5	39.4
Stoke	208	2.9	8.2	33.7	55.3
Truro	138	0.7	4.3	35.5	59.4
Wirral	194	0.5	7.7	33.5	58.2
Wolve	260	1.9	12.3	35.4	50.4
York	123	0.8	2.4	26.8	69.9

Table 8.15. Continued

Centre	*N*	Number of parameters			
		None	One	Two	Three
N Ireland					
Antrim	120	0.0	5.0	33.3	61.7
Belfast	194	2.6	11.9	30.9	54.6
Newry	82	1.2	7.3	35.4	56.1
Ulster	102	2.0	4.9	34.3	58.8
West NI	107	0.9	7.5	37.4	54.2
Wales					
Bangor	83	1.2	3.6	32.5	62.7
Cardff	451	3.3	18.2	33.0	45.5
Clwyd	72	1.4	12.5	38.9	47.2
Swanse	230	0.9	13.9	36.1	49.1
Wrexm	93	0.0	6.5	34.4	59.1
England	**16,894**	**1.9**	**13.1**	**36.1**	**49.0**
N Ireland	**605**	**1.5**	**7.9**	**33.7**	**56.9**
Wales	**929**	**2.0**	**14.2**	**34.3**	**49.4**
E, W & NI	**18,428**	**1.9**	**13.0**	**35.9**	**49.3**

Table 8.16. Percentage of peritoneal dialysis patients within the ranges specified for the simultaneous combinations of control of bone and mineral disorder parameters in preventing severe hyperparathyroidism in 2013

Centre	*N*	Number of parameters			
		None	One	Two	Three
England					
B Heart	31	3.2	22.6	32.3	41.9
B QEH	126	2.4	12.7	34.9	50.0
Basldn	30	3.3	13.3	20.0	63.3
Bradfd	22	0.0	18.2	45.5	36.4
Brightn	64	0.0	6.3	45.3	48.4
Bristol	55	0.0	10.9	52.7	36.4
Covnt	64	0.0	3.1	26.6	70.3
Derby	76	0.0	11.8	38.2	50.0
Donc	29	3.4	6.9	41.4	48.3
Dorset	30	0.0	3.3	23.3	73.3
Dudley	41	0.0	12.2	46.3	41.5
Exeter	63	0.0	7.9	25.4	66.7
Glouc	26	0.0	7.7	38.5	53.8
Hull	40	2.5	2.5	40.0	55.0
Ipswi	22	4.5	27.3	18.2	50.0
Kent	54	0.0	22.2	44.4	33.3
L Barts	169	1.8	12.4	39.1	46.7
L Kings	76	0.0	10.5	39.5	50.0
L Rfree	91	0.0	12.1	38.5	49.5
L St.G	40	2.5	5.0	42.5	50.0
L West	52	3.8	17.3	53.8	25.0
Leeds	62	3.2	21.0	35.5	40.3
Leic	121	0.8	9.9	41.3	47.9
Liv Ain	24	0.0	8.3	29.2	62.5
Liv Roy	48	0.0	2.1	41.7	56.3
M RI	64	1.6	12.5	32.8	53.1
Newc	30	0.0	13.3	46.7	40.0

Table 8.16. Continued

Centre	*N*	Number of parameters			
		None	One	Two	Three
Norwch	35	5.7	8.6	34.3	51.4
Nottm	66	0.0	16.7	28.8	54.5
Oxford	79	2.5	21.5	31.6	44.3
Plymth	22	4.5	9.1	27.3	59.1
Ports	67	1.5	16.4	34.3	47.8
Prestn	52	5.8	9.6	34.6	50.0
Redng	61	1.6	6.6	23.0	68.9
Salford	71	2.8	16.9	31.0	49.3
Sheff	53	0.0	13.2	34.0	52.8
Shrew	26	7.7	7.7	30.8	53.8
Stevng	32	0.0	12.5	18.8	68.8
Stoke	63	6.3	17.5	33.3	42.9
Wolve	77	1.3	20.8	20.8	57.1
York	25	0.0	4.0	28.0	68.0
N Ireland					
Belfast	26	0.0	7.7	42.3	50.0
Wales					
Cardff	61	4.9	18.0	45.9	31.1
Swanse	47	0.0	6.4	44.7	48.9
England	**2,299**	**1.6**	**12.5**	**35.3**	**50.6**
N Ireland	**26**	**0.0**	**7.7**	**42.3**	**50.0**
Wales	**108**	**2.8**	**13.0**	**45.4**	**38.9**
E, W & NI	**2,433**	**1.6**	**12.5**	**35.8**	**50.1**

Bicarbonate data were 93% complete for HD patients and 92% complete for PD patients (tables 8.17, 8.19). The proportion of HD patients with a serum bicarbonate within the audit measure range was 59% in 2013 (95% CI 59–60%) (table 8.18); the mean bicarbonate in HD patients was 23 mmol/L (table 8.17).

The proportion with a serum bicarbonate within the audit standard in PD patients was 79% (CI 77–80%) (table 8.20). The mean bicarbonate level in PD patients was 25 mmol/L (table 8.19).

As in previous years, between centre variation was observed in attainment of the audit standard for both

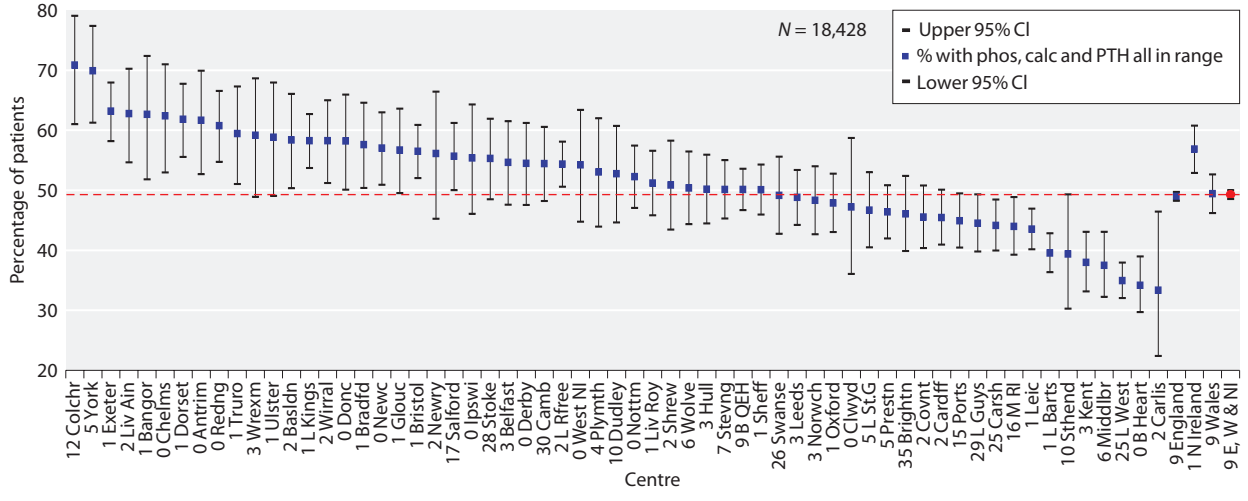

Fig. 8.16. Percentage of HD patients achieving simultaneous control of all three BMD parameters in preventing severe hyperparathyroidism by centre in 2013

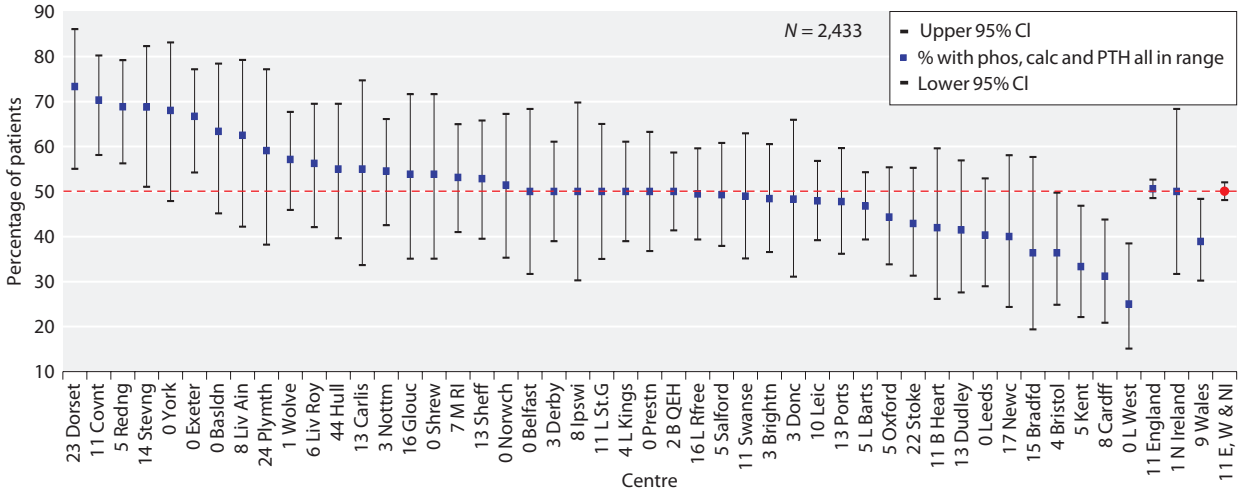

Fig. 8.17. Percentage of PD patients achieving simultaneous control of all three BMD parameters in preventing severe hyperparathyroidism by centre in 2013

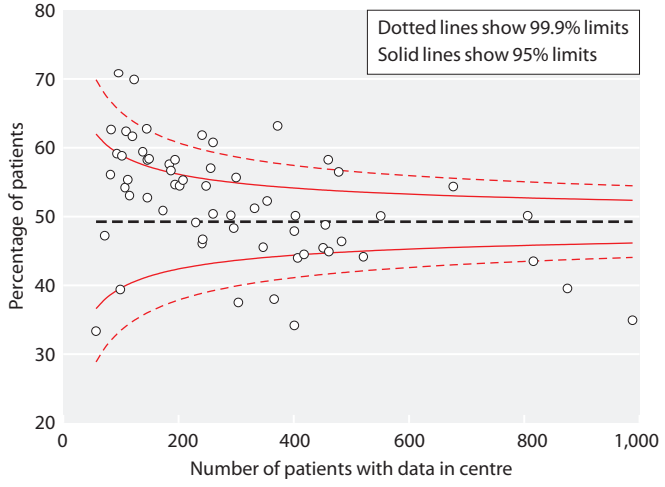

Fig. 8.18. Funnel plot for percentage of HD patients achieving simultaneous control of all three BMD parameters in preventing severe hyperparathyroidism by centre in 2013

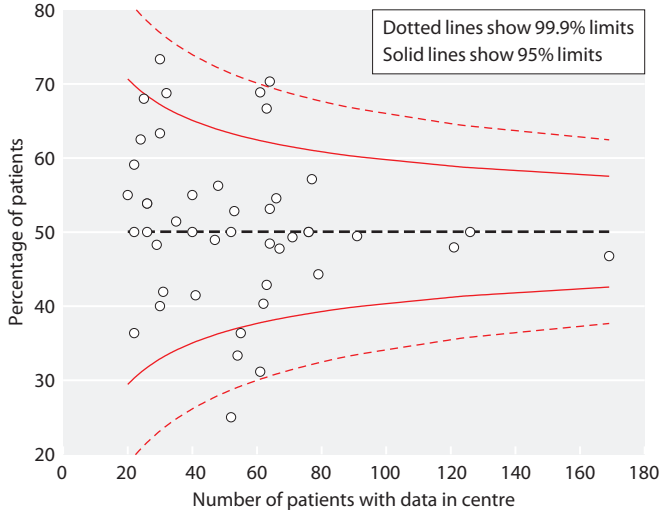

Fig. 8.19. Funnel plot for percentage of PD patients achieving simultaneous control of all three BMD parameters in preventing severe hyperparathyroidism by centre in 2013

Table 8.17. Summary statistics for serum bicarbonate in haemodialysis patients by centre in 2013

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	68.6	275	21.1	2.9	21	19	23
B QEH	98.6	873	23.9	2.5	24	22	26
Basldn	99.3	151	22.2	2.7	22	20	24
Bradfd	100.0	186	24.0	2.7	24	22	26
Brightn	95.2	354	23.0	3.0	23	21	25
Bristol	100.0	485	23.5	2.6	24	22	25
Camb	94.4	336	24.1	2.7	24	22	26
Carlis	100.0	58	21.4	2.6	21	19	24
Carsh	93.6	653	24.9	3.8	25	22	28
Chelms	100.0	109	22.4	2.1	22	21	24
Colchr	92.7	101	25.1	1.4	25	24	26
Covnt	89.3	316	23.0	2.8	23	21	25
Derby	99.5	202	22.8	2.6	23	21	24
Donc	100.0	146	25.2	2.8	25	24	27
Dorset	98.8	241	22.8	2.5	23	21	24
Dudley	94.5	154	23.1	3.1	23	21	25
Exeter	100.0	376	22.7	2.7	23	21	24
Glouc	100.0	188	23.5	2.5	24	22	25
Hull	100.0	299	23.4	2.5	24	22	25
Ipswi	98.2	110	22.7	2.9	23	21	24
Kent	99.5	374	21.1	2.6	21	20	23
L Barts	99.7	880	20.5	2.5	21	19	22
L Guys	66.7	394	22.9	2.9	23	21	25
L Kings	99.8	465	25.8	2.1	26	25	27
L Rfree	98.4	677	23.0	2.8	23	21	25
L St.G	98.8	252	27.8	3.1	28	26	30
L West	64.8	853	19.5	2.7	19	18	21
Leeds	99.4	467	21.7	3.0	22	20	24
Leic	99.3	822	24.5	3.4	24	22	26
Liv Ain	99.3	147	24.8	3.1	25	23	26
Liv Roy	99.7	333	24.5	3.4	24	22	27
M RI	93.6	455	23.9	3.1	24	22	26
Middlbr	99.1	319	27.1	3.4	27	25	29
Newc	100.0	257	26.3	3.0	27	25	28
Norwch	99.7	304	24.4	3.1	25	22	26
Nottm	94.4	334	25.4	3.0	25	24	27
Oxford	99.8	404	24.3	3.3	25	22	26
Plymth	98.3	118	24.8	1.9	25	23	26
Ports	98.0	534	23.7	3.3	24	22	26
Prestn	99.4	505	23.8	2.9	24	22	26
Redng	100.0	260	24.8	3.0	25	23	27
Salford	9.9	36					
Sheff	99.8	555	23.7	3.0	24	22	26
Shrew	100.0	176	23.4	3.2	24	22	26
Stevng	97.5	420	23.1	3.0	23	21	25
Sthend	100.0	110	24.9	3.9	25	23	27
Stoke	76.0	219	24.5	2.8	25	22	26
Sund	100.0	177	27.9	2.8	28	26	30
Truro	100.0	139	23.0	2.4	23	22	24
Wirral	93.4	185	23.9	2.7	24	22	26
Wolve	99.6	276	19.0	2.3	19	18	20
York	100.0	129	24.1	2.7	24	22	26

Table 8.17. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
N Ireland							
Antrim	98.3	118	23.8	2.8	24	22	26
Belfast	99.5	198	22.6	2.8	23	21	24
Newry	100.0	84	22.3	2.2	22	21	24
Ulster	100.0	103	24.3	2.4	24	23	26
West NI	100.0	107	23.2	2.6	23	22	25
Wales							
Bangor	100.0	84	26.1	3.2	26	24	28
Cardff	99.1	456	23.3	3.3	24	21	26
Clwyd	100.0	72	22.3	2.5	22	21	24
Swanse	99.7	310	23.0	3.4	23	20	25
Wrexm	100.0	96	22.6	2.3	23	21	24
England	**92.1**	**17,189**	**23.4**	**3.4**	**23**	**21**	**26**
N Ireland	**99.5**	**610**	**23.2**	**2.7**	**23**	**22**	**25**
Wales	**99.5**	**1,018**	**23.3**	**3.3**	**23**	**21**	**26**
E, W & NI	**92.7**	**18,817**	**23.4**	**3.4**	**23**	**21**	**26**

Blank cells: centres excluded from analyses due to poor data completeness

Table 8.18. Percentage of haemodialysis patients within, below and above the range for bicarbonate (18–24 mmol/L) by centre in 2013

Centre	*N*	% bicarb 18–24 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <18 mmol/L	% bicarb >24 mmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
England									
B Heart	275	81.5	76.4	85.6	8.7	9.8	3.3	−2.9	9.5
B QEH	873	58.2	54.9	61.4	0.8	41.0	−3.9	−8.5	0.8
Basldn	151	76.2	68.7	82.3	4.0	19.9	6.7	−3.4	16.9
Bradfd	186	57.0	49.8	63.9	0.5	42.5	6.2	−3.9	16.3
Brightn	354	65.5	60.4	70.3	4.2	30.2	1.4	−5.9	8.7
Bristol	485	63.9	59.5	68.1	2.5	33.6	−11.6	−17.4	−5.8
Camb	336	58.0	52.7	63.2	0.6	41.4	−7.1	−14.6	0.4
Carlis	58	77.6	65.1	86.5	6.9	15.5	14.4	−2.1	30.9
Carsh	653	42.4	38.7	46.3	2.3	55.3	−10.6	−16.0	−5.2
Chelms	109	83.5	75.3	89.3	0.9	15.6	−3.3	−12.5	5.9
Colchr	101	33.7	25.1	43.4	0.0	66.3	−8.3	−21.7	5.0
Covnt	316	64.6	59.1	69.6	3.2	32.3	11.4	3.9	18.9
Derby	202	73.3	66.7	78.9	3.5	23.3	−3.3	−11.7	5.1
Donc	146	38.4	30.8	46.5	0.0	61.6	−29.4	−40.1	−18.6
Dorset	241	77.6	71.9	82.4	2.1	20.3	3.5	−4.1	11.1
Dudley	154	69.5	61.8	76.2	2.6	27.9	10.3	−0.4	20.9
Exeter	376	77.7	73.2	81.6	3.5	18.9	−4.1	−9.9	1.8
Glouc	188	64.9	57.8	71.4	1.6	33.5	6.6	−3.1	16.4
Hull	299	64.9	59.3	70.1	2.0	33.1	−21.9	−28.5	−15.2
Ipswi	110	73.6	64.6	81.0	1.8	24.6	3.5	−8.0	15.0
Kent	374	82.4	78.2	85.9	8.3	9.4	0.5	−5.0	6.1

Table 8.18. Continued

Centre	*N*	% bicarb 18–24 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <18 mmol/L	% bicarb >24 mmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
L Barts	880	83.6	81.0	85.9	10.9	5.5	11.8	7.4	16.3
L Guys	394	71.3	66.7	75.6	2.5	26.1	−3.6	−9.7	2.5
L Kings	465	24.5	20.8	28.6	0.0	75.5	7.4	2.1	12.6
L Rfree	677	68.4	64.8	71.8	2.4	29.3	−1.5	−6.7	3.7
L St.G	252	16.3	12.2	21.4	0.4	83.3	−3.9	−10.5	2.8
L West	853	73.6	70.6	76.5	23.1	3.3	1.9	−2.3	6.1
Leeds	467	75.8	71.7	79.5	7.3	16.9	−0.4	−5.9	5.1
Leic	822	51.2	47.8	54.6	2.0	46.8	3.4	−1.4	8.3
Liv Ain	147	44.9	37.1	53.0	0.7	54.4	−11.9	−23.0	−0.8
Liv Roy	333	48.7	43.3	54.0	1.5	49.9	35.5	29.0	41.9
M RI	455	54.7	50.1	59.3	1.3	44.0	−0.3	−6.9	6.2
Middlbr	319	21.9	17.7	26.8	0.6	77.4	1.7	−4.6	8.1
Newc	257	21.0	16.5	26.4	0.8	78.2	−11.1	−18.6	−3.5
Norwch	304	47.4	41.8	53.0	1.0	51.6	−9.9	−17.8	−2.0
Nottm	334	35.9	31.0	41.2	0.6	63.5	−3.2	−10.5	4.2
Oxford	404	47.3	42.5	52.2	2.2	50.5	−14.3	−21.1	−7.4
Plymth	118	43.2	34.6	52.3	0.0	56.8	14.7	2.6	26.7
Ports	534	58.4	54.2	62.5	2.6	39.0	−12.5	−18.2	−6.7
Prestn	505	59.4	55.1	63.6	1.6	39.0	−1.4	−7.5	4.7
Redng	260	43.5	37.6	49.6	1.2	55.4	−6.3	−15.0	2.3
Sheff	555	58.2	54.1	62.2	2.3	39.5	11.8	5.9	17.6
Shrew	176	56.3	48.8	63.4	4.6	39.2	5.7	−4.6	16.0
Stevng	420	69.8	65.2	74.0	2.1	28.1	0.9	−5.5	7.4
Sthend	110	43.6	34.7	53.0	2.7	53.6	7.5	−5.4	20.5
Stoke	219	48.9	42.3	55.5	0.5	50.7			
Sund	177	10.7	7.0	16.2	0.0	89.3	−9.5	−16.9	−2.1
Truro	139	76.3	68.5	82.6	1.4	22.3	−6.4	−16.0	3.1
Wirral	185	60.0	52.8	66.8	1.1	38.9	12.1	1.7	22.5
Wolve	276	74.6	69.2	79.4	23.6	1.8	−3.1	−10.3	4.0
York	129	52.7	44.1	61.2	1.6	45.7	−9.3	−21.5	2.9
N Ireland									
Antrim	118	59.3	50.3	67.8	0.9	39.8	−4.6	−16.9	7.7
Belfast	198	75.8	69.3	81.2	3.5	20.7	12.8	3.9	21.7
Newry	84	84.5	75.2	90.8	1.2	14.3	11.6	−0.6	23.8
Ulster	103	59.2	49.5	68.3	1.0	39.8	−12.1	−25.0	0.9
West NI	107	69.2	59.8	77.2	1.9	29.0	15.7	3.4	27.9
Wales									
Bangor	84	32.1	23.1	42.8	0.0	67.9	−15.4	−30.1	−0.7
Cardff	456	57.7	53.1	62.1	2.6	39.7	−6.2	−12.6	0.2
Clwyd	72	73.6	62.3	82.5	4.2	22.2	−4.0	−17.9	9.8
Swanse	310	63.9	58.4	69.0	3.6	32.6	13.2	5.5	20.9
Wrexm	96	80.2	71.0	87.0	0.0	19.8	−9.5	−19.7	0.8
England	**17,189**	**58.8**	**58.0**	**59.5**	**4.1**	**37.2**	**−0.1**	**−1.2**	**0.9**
N Ireland	**610**	**69.8**	**66.1**	**73.4**	**2.0**	**28.2**	**6.0**	**0.8**	**11.2**
Wales	**1,018**	**60.7**	**57.7**	**63.7**	**2.6**	**36.7**	**−1.0**	**−5.2**	**3.3**
E, W & NI	**18,817**	**59.2**	**58.5**	**59.9**	**3.9**	**36.8**	**0.0**	**−1.0**	**1.0**

Blank cells: no data available for 2012

Table 8.19. Summary statistics for serum bicarbonate in peritoneal dialysis patients by centre in 2013

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	35	21.4	3.0	22	19	23
B QEH	94.6	122	23.7	3.1	24	22	26
Basldn	80.0	24	25.5	2.6	26	24	28
Bradfd	96.2	25	26.5	2.2	27	25	28
Brightn	10.0	66	24.2	3.0	24	22	27
Bristol	98.3	56	22.9	2.6	23	21	25
Camb	89.5	17					
Carlis	100.0	23	22.7	2.4	23	22	24
Carsh	77.1	81	23.1	3.0	23	21	25
Chelms	95.0	19					
Colchr*							
Covnt	86.1	62	25.2	2.7	25	23	27
Derby	97.4	76	24.7	2.7	25	23	27
Donc	100.0	30	26.8	3.2	27	25	28
Dorset	89.7	35	22.5	2.2	23	21	24
Dudley	97.9	46	24.6	4.0	24	22	27
Exeter	100.0	63	24.5	2.6	25	23	26
Glouc	100.0	31	24.5	3.0	25	22	27
Hull	100.0	72	25.3	3.2	26	23	28
Ipswi	100.0	24	27.1	2.9	28	25	29
Kent	100.0	57	22.9	2.5	23	21	25
L Barts	98.9	176	22.3	2.8	22	21	24
L Guys	85.7	24	23.0	3.5	23	20	27
L Kings	98.7	78	25.6	2.6	26	24	27
L Rfree	74.1	80	24.6	3.3	25	23	27
L St.G	100.0	45	28.4	2.9	29	27	30
L West	100.0	52	23.0	2.9	24	21	25
Leeds	100.0	62	26.3	3.0	26	25	27
Leic	93.3	126	26.2	3.6	26	24	29
Liv Ain	100.0	26	26.4	2.1	27	24	28
Liv Roy	100.0	51	24.7	2.5	25	23	26
M RI	98.6	68	25.8	4.0	26	24	28
Middlbr	100.0	11					
Newc	88.9	32	25.7	3.2	26	24	28
Norwch	97.1	34	24.3	2.3	24	23	26
Nottm	50.0	34	27.8	3.3	28	27	30
Oxford	80.7	67	25.2	3.1	25	23	27
Plymth	93.1	27	23.7	3.4	25	21	26
Ports	96.1	74	26.4	3.6	27	24	29
Prestn	100.0	52	26.2	3.4	27	24	29
Redng	100.0	64	26.8	3.3	26	24	29
Salford	9.3	7					
Sheff	100.0	61	24.7	3.3	25	23	27
Shrew	100.0	26	25.4	3.2	25	23	28
Stevng	89.2	33	26.4	3.1	27	25	28
Sthend	100.0	15					
Stoke	98.8	80	25.5	3.0	25	24	27
Sund	100.0	8					
Truro	94.4	17					
Wirral	74.1	20	25.8	3.4	26	24	28
Wolve	98.7	77	21.3	2.3	21	20	23
York	100.0	25	26.7	2.8	26	24	29

Table 8.19. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
N Ireland							
Antrim	73.3	11					
Belfast	100.0	26	23.8	3.2	24	21	26
Newry	100.0	17					
Ulster	100.0	4					
West NI	92.9	13					
Wales							
Bangor	100.0	12					
Cardff	100.0	66	25.4	3.1	26	23	27
Clwyd	100.0	14					
Swanse	100.0	53	24.7	2.6	25	23	27
Wrexm	100.0	19					
England	**91.1**	**2,516**	**24.8**	**3.4**	**25**	**23**	**27**
N Ireland	**93.4**	**71**	**24.4**	**3.3**	**24**	**22**	**27**
Wales	**100.0**	**164**	**25.0**	**3.0**	**25**	**23**	**27**
E, W & NI	**91.6**	**2,751**	**24.8**	**3.4**	**25**	**23**	**27**

Blank cells: low patient numbers or poor data completeness
*No PD patients

Table 8.20. Percentage of peritoneal dialysis patients within, below and above the range for bicarbonate (22–30 mmol/L) by centre in 2013

Centre	*N*	% bicarb 22–30 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <22 mmol/L	% bicarb >30 mmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
England									
B Heart	35	57.1	40.6	72.3	42.9	0.0	15.7	−6.6	38.0
B QEH	122	75.4	67.0	82.2	23.8	0.8	3.1	−7.6	13.9
Basldn	24	91.7	72.1	97.9	8.3	0.0	17.6	−2.3	37.5
Bradfd	25	96.0	76.5	99.4	0.0	4.0	−4.0	−11.7	3.7
Brightn	66	75.8	64.0	84.6	24.2	0.0	−4.2	−19.0	10.5
Bristol	56	73.2	60.2	83.2	26.8	0.0	10.7	−6.5	27.9
Carlis	23	78.3	57.2	90.7	21.7	0.0	21.1	−5.9	48.2
Carsh	81	66.7	55.8	76.0	33.3	0.0	−14.0	−27.2	−0.8
Covnt	62	91.9	82.1	96.6	6.5	1.6	5.5	−4.9	15.8
Derby	76	89.5	80.3	94.7	10.5	0.0	7.3	−3.4	18.0
Donc	30	83.3	65.7	92.9	6.7	10.0	5.1	−16.4	26.6
Dorset	35	68.6	51.7	81.7	31.4	0.0	−3.4	−26.8	19.9
Dudley	46	67.4	52.7	79.3	23.9	8.7	−17.2	−34.0	−0.5
Exeter	63	85.7	74.8	92.4	14.3	0.0	30.6	16.1	45.2
Glouc	31	87.1	70.3	95.1	9.7	3.2	0.4	−16.5	17.4
Hull	72	83.3	72.9	90.3	12.5	4.2	−7.3	−18.2	3.5
Ipswi	24	91.7	72.1	97.9	4.2	4.2	18.3	−1.0	37.6
Kent	57	66.7	53.6	77.6	33.3	0.0	−13.0	−29.2	3.3
L Barts	176	61.4	54.0	68.3	38.6	0.0	−17.8	−27.3	−8.3
L Guys	24	62.5	42.2	79.2	37.5	0.0	−14.4	−39.7	10.8
L Kings	78	91.0	82.4	95.7	5.1	3.9	9.5	−1.3	20.2
L Rfree	80	80.0	69.8	87.4	17.5	2.5	−3.1	−15.0	8.8
L St.G	45	77.8	63.4	87.6	0.0	22.2	−11.4	−26.5	3.8
L West	52	73.1	59.5	83.4	26.9	0.0	19.9	1.2	38.6
Leeds	62	90.3	80.1	95.6	3.2	6.5	8.5	−2.8	19.8
Leic	126	77.8	69.7	84.2	10.3	11.9	−1.2	−11.2	8.7
Liv Ain	26	96.2	77.2	99.5	0.0	3.9			
Liv Roy	51	94.1	83.3	98.1	5.9	0.0	11.1	−0.9	23.1

Table 8.20. Continued

Centre	*N*	% bicarb 22–30 mmol/L	Lower 95% CI	Upper 95% CI	% bicarb <22 mmol/L	% bicarb >30 mmol/L	Change in % within range from 2012	95% LCL change	95% UCL change
M RI	68	85.3	74.8	91.9	8.8	5.9	−1.4	−12.8	10.0
Newc	32	81.3	64.1	91.3	12.5	6.3	0.0	−19.1	19.1
Norwch	34	91.2	76.0	97.1	8.8	0.0	22.4	6.2	38.6
Nottm	34	79.4	62.7	89.9	5.9	14.7	4.4	−14.7	23.5
Oxford	67	88.1	77.9	93.9	9.0	3.0	1.8	−10.4	14.0
Plymth	27	66.7	47.3	81.7	33.3	0.0	−23.0	−43.9	−2.0
Ports	74	81.1	70.6	88.5	9.5	9.5	−12.4	−22.9	−1.9
Prestn	52	82.7	70.0	90.7	9.6	7.7	1.7	−12.7	16.1
Redng	64	78.1	66.4	86.6	3.1	18.8	−5.0	−18.6	8.7
Sheff	61	75.4	63.1	84.6	18.0	6.6	−4.9	−19.3	9.6
Shrew	26	84.6	65.5	94.1	11.5	3.9	3.4	−16.0	22.7
Stevng	33	81.8	65.0	91.6	12.1	6.1	−10.5	−27.2	6.2
Stoke	80	87.5	78.3	93.1	8.8	3.8	13.9	1.4	26.4
Wirral	20	75.0	52.2	89.2	15.0	10.0	−20.5	−41.3	0.4
Wolve	77	49.4	38.4	60.4	50.7	0.0	−37.8	−51.2	−24.4
York	25	92.0	73.1	98.0	0.0	8.0	−4.3	−17.1	8.5
N Ireland									
Belfast	26	73.1	53.3	86.6	26.9	0.0	−8.7	−32.2	14.7
Wales									
Cardff	66	81.8	70.7	89.4	13.6	4.6	7.6	−6.5	21.6
Swanse	53	90.6	79.3	96.0	9.4	0.0	7.2	−5.4	19.9
England	**2,516**	**78.5**	**76.8**	**80.0**	**17.1**	**4.4**	**−0.7**	**−3.0**	**1.5**
N Ireland	**71**	**78.9**	**67.9**	**86.8**	**18.3**	**2.8**	**−7.7**	**−20.9**	**5.6**
Wales	**164**	**84.2**	**77.7**	**89.0**	**12.2**	**3.7**	**3.2**	**−5.0**	**11.4**
E, W & NI	**2,751**	**78.8**	**77.2**	**80.3**	**16.9**	**4.3**	**−0.6**	**−2.8**	**1.5**

Blank cells: no data available for 2012

HD and PD groups (tables 8.18, 8.20, figures 8.20–8.23).

There was a notable deterioration in the achievement of bicarbonate within range compared with 2012 at a number of centres (tables 8.18, 8.20). For these HD centres there was a uniform shift to higher bicarbonate concentrations (Doncaster, Hull, Oxford, Bangor) whereas for PD centres there was a downward shift in

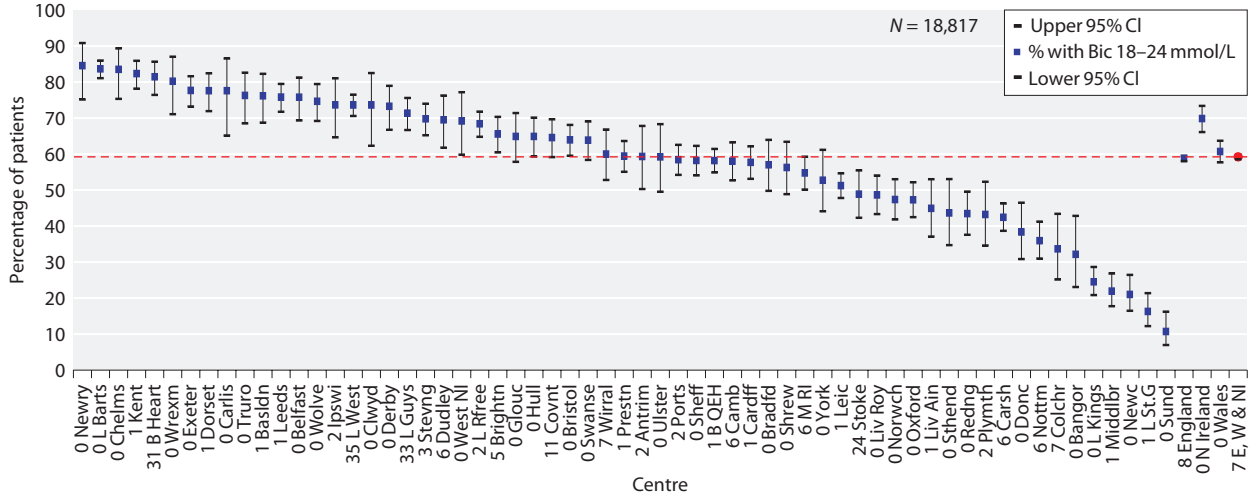

Fig. 8.20. Percentage of haemodialysis patients with serum bicarbonate within range (18–24 mmol/L) by centre in 2013

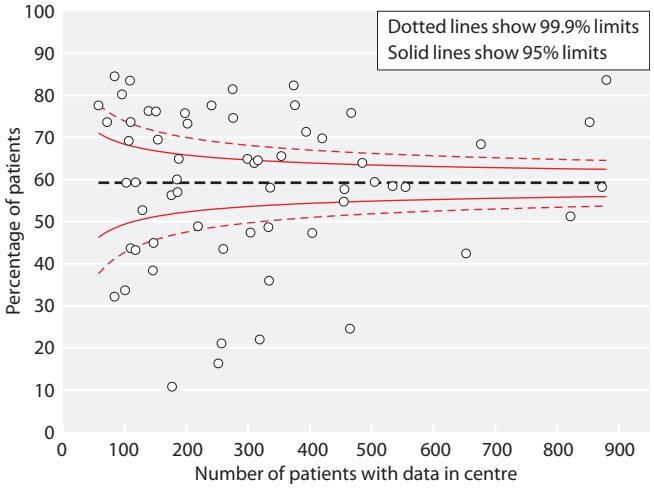

Fig. 8.21. Funnel plot for percentage of haemodialysis patients within the range for bicarbonate (18–24 mmol/L) by centre in 2013

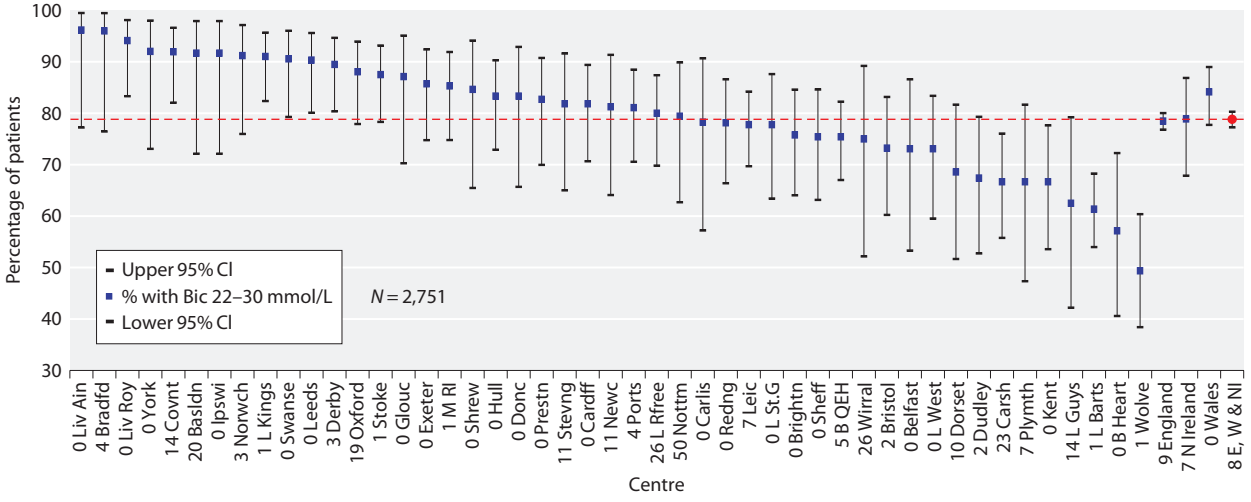

Fig. 8.22. Percentage of peritoneal dialysis patients with serum bicarbonate within range (22–30 mmol/L) by centre in 2013

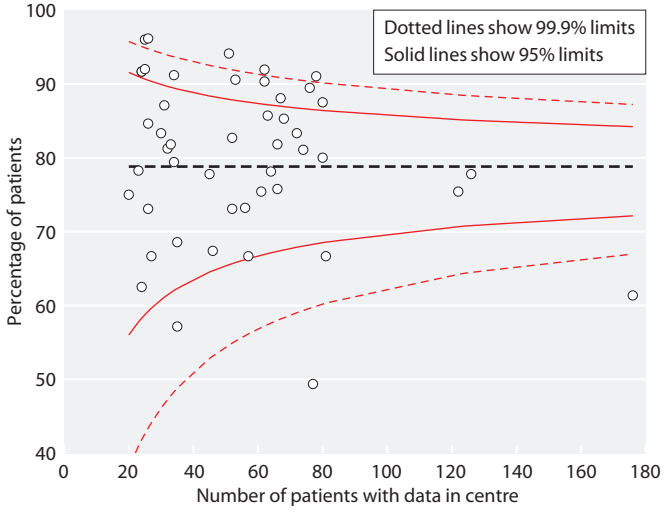

Fig. 8.23. Funnel plot for percentage of peritoneal dialysis patients within the range for bicarbonate (22–30 mmol/L) by centre in 2013

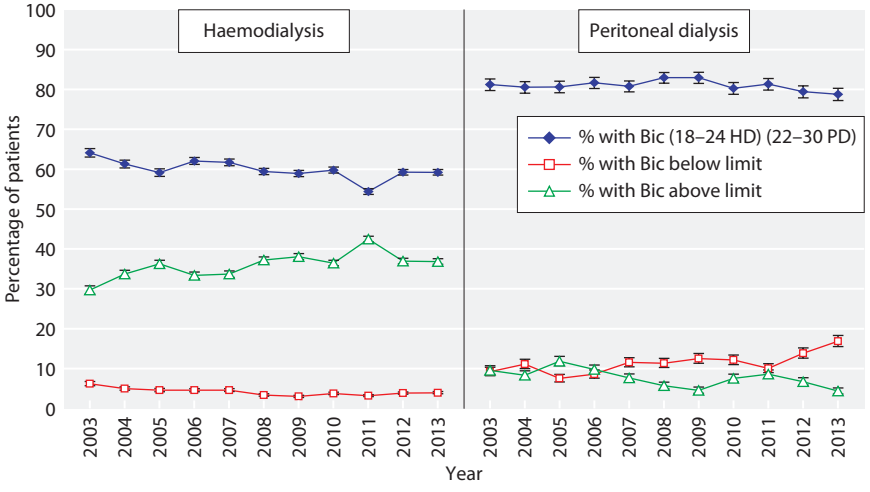

Fig. 8.24. Longitudinal change in percentage of patients within the range for bicarbonate (18–24 mmol/L for HD and 22–30 mmol/L for PD) by dialysis modality 2003–2013

bicarbonate concentrations (Carshalton, Dudley, Kent, London St Bartholemew's, London Guy's, Plymouth, Wirral, Wolverhampton).

Serial trends in serum bicarbonate measures between 2003 and 2013 by dialysis modality are presented in figure 8.24. Sample processing, case-mix, differences in dialysis, residual renal function and oral bicarbonate prescriptions may all contribute to the variation observed.

Conclusions

The UKRR has consistently demonstrated between centre variation in achievement of audit measures for bone and mineral parameters but little is understood about the causes of this 'centre effect'. The complexity of the clinical processes required to manage mineral and bone disorders is probably further confounded by case-mix. In the future, with centres moving to newer IT systems, medications used in the management of bone and mineral diseases may become available to aid in better analyses of these parameters.

Additionally, it is important to consider data quality and the potential for measurement error particularly in light of the variability in assay methods, for example for parathyroid hormone. However, detecting these centre level differences is an important step in understanding the factors associated with variation in performance. Some specifics for consideration are highlighted below.

Bone Mineral Variables

Observational data support that hyperphosphataemia is associated with increased mortality in dialysis patients but the data linking calcium and parathyroid hormone to patient survival are less clear [9–13]. A cohort study has however suggested that simultaneous achievement of all three audit measures does appear to be associated with better patient outcomes [14].

Possible issues relating to calcium measures

The current RA guidelines are based upon measures of adjusted serum calcium [3]. A variety of formulae have been proposed to permit calculation of the 'adjusted' total calcium (i.e. an estimation of the expected total calcium were the serum albumin normal) from the total calcium and albumin concentration, but there are no data to support the use of mathematical corrections of serum calcium amongst patients with ERF. This topic was discussed in detail in the 2009 annual report and most of the shortcomings remain [15]. However, the ongoing restructuring of pathology into a smaller number of services together with harmonisation should increase measurement uniformity across laboratories and hence renal centres. UK laboratories are still in the process of adopting the guidelines to harmonise albumin-adjusted calcium reference ranges to 2.2–2.6 mmol/L using method-specific adjustment equations normalised to a mean calcium of 2.4 mmol/L. Until this process is complete, differences between laboratories in the reported adjusted calcium are likely to continue. Meanwhile, centres must work with their laboratories to ensure that

the calcium results are adjusted correctly for the methods in use. These problems must be borne in mind when trying to interpret the figures that compare serum adjusted calcium achieved in different renal centres.

Centres should also be aware that achievement of the audit standard can however mask population shifts in concentration. This can be illustrated by data from the Royal Free for HD patients: in 2011 30% had an adjusted calcium <2.2 mmol/L, 65% were within range, and 5% were >2.5 mmol/L; in 2012 4% had an adjusted calcium <2.2 mmol/L, 77% were within range and 19% were >2.5 mmol/L. A similar pattern was observed in PD patients. However, the figures for unadjusted calcium remained stable. This shift can be attributed to a change in the equation used to adjust calcium that was introduced on July 6th 2012 before the UKRR collection of data in the last two quarters. The new equation increased adjusted calcium values by approximately 0.2 mmol/L. It was subsequently recognised that the new equation was over-adjusting calcium results and a revised equation was introduced from October 2013 that conformed to current harmonisation guidelines. Accordingly for 2013, the Royal Free show a decline from 19% (2012) to 5% >2.5 mmol/L, an increase from 4% (2012) to 10% <2.2 mmol/L and an increase from 77% (2012) to 86% within range. Mean and median adjusted calcium fell from 2.4 mmol/L (2012) to 2.3 mmol/L in 2013. These shifts were mirrored in the PD population at the Royal Free. A similar change was observed in Newcastle's HD data following a change in the equation to conform with harmonisation guidelines in April 2013 that increased the adjusted calcium – compared with 2012, the 2013 data show a decrease in results <2.2 mmol/L (from 22% to 8%).

Centres showing significant shifts in any biochemical parameter should consider whether there have been any changes in laboratory methodology that may account for the apparent deterioration or whether it is truly treatment-related.

Possible issues relating to PTH measures

A significant contributor to centre variation will be the assay used to measure PTH. This has been demonstrated by a study undertaken by the Scottish Clinical Biochemistry Managed Diagnostic Network in association with the Scottish Renal Registry [16]. Analysis of samples from 106 haemodialysis patients by six different PTH immunoassays in common use showed a 1.2- to 2.7-fold variation in results in spite of similar reference ranges for each method. Since current guidelines refer to multiples of the upper reference limit, 53% of patients were classified differently by different methods with implications for treatment e.g. with Cinacalcet. In an accompanying editorial, Garrett and Goldsmith also highlighted the high biological variability of PTH and its poor ability to predict skeletal or patient outcomes [17]. Whether more accurate and specific assays would improve this or whether PTH will be supplanted by other markers such as bone specific alkaline phosphatase that also have greater pre-analytical stability remains to be determined.

Improvement of PTH assays to achieve consensus results within CKD patients requires manufacturers to consider two principal factors: adoption of a common reference preparation for standardisation, such as the WHO international standard 95/646, and selection of pairs of antibodies that do not detect PTH fragments such as 7–84 that accumulate in CKD. Meanwhile Almond et al and a further editorial review urge adoption of assay-specific action limits for PTH in CKD patients [16, 18]. However, this approach raises a number of difficult governance issues. There is already evidence that the manufacturers of the major diagnostic platforms used throughout the world have started to respond. The Roche assay used by Almond et al was PTH (intact) that was not standardised and cross-reacted with PTH 7–84 [16].

Conflicts of interest: none

References

1 Renal Association: Clinical Practice Guidelines. 5th Edition. http://www.renal.org/Clinical/GuidelinesSection/Guidelines.aspx

2 Ansell D, Tomson CRV: Chapter 15 UK Renal Registry Annual Report: UK Renal Registry, UKRR database, validation and methodology. Nephron Clin Pract. 2009;111(Suppl 1):c277–85

3 Steddon S, Sharpes E: Renal Association Clinical Practice Guideline. CKD-Mineral and Bone Disorders, 2010. http://www.renal.org/guidelines/modules/ckd-mineral-and-bone-disorders

4 Morton AR, Garland JS, Holden RM: Is the calcium correct? Measuring serum calcium in dialysis patients. Semin Dial. 2010;23(3):283–289

5 Kidney Disease: Improving Global Outcomes (KDIGO) CKD–MBD Work Group: KDIGO clinical practice guideline for the diagnosis, evaluation, prevention, and treatment of chronic kidney disease–mineral and bone disorder (CKD–MBD). Kidney International 2009; 76(Suppl 113):S1–S130

6 Spiegelhalter DJ: Funnel plots for comparing institutional performance. Statistics in Medicine 2005;24:1185–1202
7 Mactier R, Hoenich N, Breen C: Renal Association Clinical Practice Guideline Haemodialysis, 2009. http://www.renal.org/Clinical/GuidelinesSection/Haemodialysis.aspx
8 Woodrow G, Davies S: Renal Association Clinical Practice Guideline Peritoneal Dialysis, 2010. http://www.renal.org/Clinical/GuidelinesSection/PeritonealDialysis.aspx
9 Kalantar-Zadeh K, Kuwae N, Regidor DL, Kovesdy CP, Kilpatrick RD, Shinaberger CS, McAllister CJ, Budoff MJ, Salusky IB, Kopple JD: Survival predictability of time-varying indicators of bone disease in maintenance hemodialysis patients. Kidney Int 2006;70:771–780
10 Melamed ML, Eustace JA, Plantinga L, Jaar BG, Fink NE, Coresh J, Klag MJ, Powe NR: Changes in serum calcium, phosphate, and pth and the risk of death in incident dialysis patients: A longitudinal study. Kidney Int 2006;70:351–357
11 Noordzij M, Korevaar JC, Boeschoten EW, Dekker FW, Bos WJ, Krediet RT: The kidney disease outcomes quality initiative (k/doqi) guideline for bone metabolism and disease in ckd: Association with mortality in dialysis patients. Am J Kidney Dis 2005;46:925–932
12 Stevens LA, Djurdjev O, Cardew S, Cameron EC, Levin A: Calcium, phosphate, and parathyroid hormone levels in combination and as a function of dialysis duration predict mortality: Evidence for the complexity of the association between mineral metabolism and outcomes. J Am Soc Nephrol 2004;15:770–779
13 Block GA, Klassen PS, Lazarus JM, Ofsthun N, Lowrie EG, Chertow GM: Mineral metabolism, mortality, and morbidity in maintenance hemodialysis. J Am Soc Nephrol 2004;15:2208–2218
14 Danese MD, Belozeroff V, Smirnakis K, Rothman KJ: Consistent control of mineral and bone disorder in incident hemodialysis patients. Clin J Am Soc Nephrol 2008;2:2
15 Ansell D, Tomson CRV: Twelfth Annual Report: Chapter 10 Biochemistry Profile of Patients Receiving Dialysis in the UK in 2008: national and centre-specific analyses. Bristol, UK Renal Registry, 2009
16 Almond A, Ellis AR, Walker SW: Current parathyroid hormone immunoassays do not adequately meet the needs of patients with chronic kidney disease. Ann Clin Biochem 2011;49:63–67
17 Garrett G, Goldsmith DJA: Parathyroid hormone measurements, guidelines statements and clinical treatments: a real world cautionary tale. Ann Clin Biochem 2011;49:4–6
18 Sturgeon CM, Sprague SM, Metcalfe W: Variation in parathyroid hormone immunoassay results – a critical governance issue in the management of chronic kidney disease. Nephrol Dial Transplant 2011;26:3440–3445

UK Renal Registry 17th Annual Report: Chapter 9 Clinical, Haematological and Biochemical Parameters in Patients Receiving Renal Replacement Therapy in Paediatric Centres in the UK in 2013: National and Centre-specific Analyses

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Key Words
Biochemical variables · Blood pressure · BMI · Children · Dialysis · ERF · Growth · Haemoglobin · Height · Paediatric · Quality improvement · Transplant · Weight

Summary

- The median height z-score for children on dialysis was −2.0 and for children with a functioning transplant −1.3. Children transplanted before the age of 11 years improved their height z-score over the subsequent three years, whereas those older than 11 maintained their height z-score, with all transplanted patients having a similar height z-score after three years of starting renal replacement therapy (RRT).
- The median weight z-score for children on dialysis was −1.2 whereas children with a functioning transplant had a near normal weight with a median z-score of −0.2.
- Of those with data, 75% of the prevalent paediatric RRT population had one or more risk factors for cardiovascular disease, with 1 in 10 having all three risk factors evaluated.
- For transplant patients, 76% achieved the systolic blood pressure (SBP) standard and 91% achieved the haemoglobin standard.
- For haemodialysis patients, 53% achieved the SBP standard, 66% achieved the haemoglobin standard, 84% achieved the calcium standard, 43% achieved the phosphate standard and 43% achieved the parathyroid hormone (PTH) standard.
- For peritoneal dialysis patients, 61% achieved the SBP standard, 83% achieved the haemoglobin standard, 71% achieved the calcium standard, 56% achieved the phosphate standard and 36% achieved the PTH standard.

Introduction

This report focuses on the following variables for the prevalent paediatric dialysis and transplantation cohort on the 31st December 2013:

1. The completeness of data returns to the UK Renal Registry (UKRR)
2. Anthropometric characteristics and growth in children with established renal failure (ERF)
3. Cardiovascular risk factors (CVRFs) in children with ERF
4. Laboratory and clinical indices including anaemia control and biochemical findings in children with ERF

Analyses of prevalent paediatric patients aged <16 years receiving renal replacement therapy (RRT) for the year 2013 and for the period 2002 to 2013 inclusive are reported. A single dataset was collected for each patient per year during this time period. Where possible, analysis of incident cohorts has been undertaken with centre specific data for each paediatric nephrology centre in the UK also being provided.

Methods

There were 13 paediatric nephrology centres managing children on RRT in the UK in 2013. Ten of these centres provided surgical renal transplant services, and all centres offered outpatient and inpatient follow up for children who had received kidney transplants. Centres and abbreviations are listed in appendix K.

Data collection

The data presented in this report relate to the annual census date of 31st December 2013. Data submission to the UKRR in previous years has been electronic in most cases and paper-based in a minority. These data items are then checked, validated and manually entered into the current paediatric UKRR database.

Standards and standardisation

Standards are in bold text and are from the 'Treatment of adults and children with renal failure', Renal Association standards third edition (2002) [1] unless otherwise stated.

Where the value of clinical parameters in childhood varies with age and size, data are presented as z-scores.

Anthropometry

'Measures of supine length or standing height and weight should be monitored at each clinic visit. All measurements should be plotted on European reference growth charts for healthy children.'

The reference range for height (Ht), weight (Wt) and body mass index (BMI) in childhood varies with gender and age. BMI was calculated using the formula BMI = Wt (kg)/Ht^2 (m). Height and weight were adjusted for age. To account for discrepancies in linear growth secondary to renal disease, BMI was expressed according to height-age, rather than chronological age. The International Obesity Taskforce definition [2] was used to define overweight and obesity; z-scores were calculated based on the British 1990 reference data for height and weight [3].

Blood pressure

'Blood pressure varies throughout childhood and should be maintained within two standard deviations of the mean for normal children of the same height and sex. The systolic blood pressure during peritoneal dialysis or after haemodialysis should be maintained at <90th centile for age, gender and height.'

'In paediatric renal transplant patients, the systolic blood pressure should be maintained at <90th percentile for age, gender and height.'

The analyses of systolic blood pressure (SBP) in this report present the achievement of SBPs at or below the 90th percentile. Guidance for blood pressure in paediatric renal transplant patients was based on 2011 British Association for Paediatric Nephrology (BAPN) recommendations [4].

The reference range for SBP varies with gender, age and height. The data is therefore presented as z-scores based on data from the fourth report of the National High Blood Pressure Education Programme working group in the United States [5].

Cholesterol

The National Heart Lung and Blood Institute recommends screening for dyslipidaemias in children with chronic renal disease/end-stage renal disease/post renal transplant (deemed high risk) between the ages of 2 and 17, and defines high total cholesterol as $\geqslant$5.2 mmol/L [6]. This cut-off has been adopted for this report.

Haemoglobin and Ferritin

Guidance on the management of anaemia in adults and children with chronic kidney disease was updated and published by the National Institute for Health and Care Excellence (NICE) in February 2011 (Clinical Guideline 114) [7].

'Typically maintain the aspirational Hb range between 100 and 120 g/L for young people and children aged 2 years and older, and between 95 and 115 g/L for children younger than 2 years of age, reflecting the lower normal range in that age group.'

Haemoglobin and ferritin were analysed using age related laboratory reference ranges as in table 9.1.

Calcium, phosphate and parathyroid hormone (PTH)

'Serum phosphate and calcium should be kept within the normal range. PTH levels should be maintained within twice the upper limit of the normal range but, contrary to adult standards, may be kept within the normal range if growth is normal.'

Table 9.1. Summary of relevant biochemical clinical audit measures

Parameter	Age			
	<1 year	1–<5 years	6–12 years	>12 years
Haemoglobin (g/L), NICE guideline CG 114	Maintain 95–115 for <2 years	Maintain 100–120 for >2 years	100–120	100–120
Ferritin (μg/L)	200–500	200–500	200–500	200–500
Corrected calcium (mmol/L)	2.24–2.74	2.19–2.69	2.19–2.69	2.15–2.55
Phosphate (mmol/L)	1.10–1.95	1.05–1.75	1.05–1.75	1.05–1.75
Parathyroid hormone (individual centre units)	Within twice the normal range Levels may be maintained within normal range if growing appropriately			
Bicarbonate (mmol/L)	Reported as either within or outside centre reference range			

Calcium, phosphate and PTH were analysed using age related laboratory reference ranges as in table 9.1. Individual variable data analysis has been performed per centre and nationally. It should be noted that 'normal' growth is difficult to determine in the setting of paediatric RRT.

Bicarbonate

'Serum bicarbonate concentrations should be between 20 and 26 mmol/l.'

Bicarbonate reference ranges vary by centre, and are reported as within or outside the reference range as given in table 9.1.

Cardiovascular risk factors

This year a cross-sectional evaluation of the prevalence of traditional risk factors for cardiovascular disease, including hypertension, overweight/obesity and hypercholesterolaemia in children with ERF was undertaken. In this initial analysis, the prevalence of one or more CVRFs in children with ERF in the UK is shown. Evidence for the use of total cholesterol and the relationship of childhood CVRFs with adult CVRFs is available from The National Heart Lung and Blood Institute [6].

Statistical analyses

Data were analysed to calculate summary statistics (maximum, minimum, mean and median values in addition to standard deviation and quartile ranges). Where applicable, the percentage achieving the audit standard was also calculated. If a patient had missing data, they were excluded from the relevant analyses.

Longitudinal analyses of attainment of standards were also performed. These were based on a single data point per ERF patient per year collected as described previously. Caution should be exercised in the interpretation of analyses based on data items from a single annual measurement per patient. This is due to changing audit standards over time and variable data returns for previous years. Furthermore, for biochemical variables there are not only differences between assays used at different centres, but also differences in the timing of the result between modalities to take into account. All analyses were performed using SAS 9.3.

Results

Data completeness

Tables 9.2 and 9.3 show the completeness of data returns for transplant and dialysis patients for 2013.

Overall, completeness was excellent for height, weight, SBP, haemoglobin, creatinine, bicarbonate, calcium and phosphate in both groups. Variability in the use of certain parameters limits the completeness of these items. In 2013 completeness remained similar to the previous year [8]. For the first time this year total cholesterol data is presented in the cardiovascular risk section. Inter-centre reporting of this remained inconsistent, with completeness from five centres less than 50% for transplant patients. It is hoped that reporting this data will encourage improved data returns for this item in subsequent years.

Growth

Height

Figures 9.1 and 9.2 show that children receiving RRT were short for their age; those on dialysis were significantly shorter that those with renal transplants. The overall median z-score was −1.3 in the transplanted group and −2.0 in the dialysis group, $p < 0.0001$. Figure 9.3 demonstrates that by the time of RRT start, children are already short for their age with an overall median height z-score of −1.4 (shown by the dotted line) with younger children aged 2–8 most affected. Figure 9.4 shows that the subset of children who improved height z-scores were those transplanted before the age of 11 years. In contrast, all those commencing RRT over the age of 11 started at the same z-score of

Table 9.2. Percentage data completeness for transplant patients <16 years old by centre for each variable and total number of patients per centre in 2013

Centre	Transplant patients *N*	Height	Weight	BMI	SBP	Hb	Creat	Ferr	ESA	IV iron	Chol	Bicarb	PTH	Ca	Phos
Bham_P	63	98.4	98.4	98.4	98.4	93.7	98.4	52.5			93.6	98.4	91.9	98.4	98.4
Blfst_P[a]	16	93.8	100.0	93.8	100.0	100.0	100.0	25.0	100.0	87.5	43.8	100.0	6.3	93.8	93.8
Brstl_P	32	93.8	96.9	93.8	93.8	100.0	100.0	59.4	100.0	100.0	62.5	100.0	65.6	100.0	100.0
Cardf_P[b]	16	94.1	100.0	94.1	100.0	100.0	100.0	93.8	93.8	93.8	100.0	100.0	100.0	100.0	100.0
Glasg_P	29	100.0	100.0	100.0	100.0	100.0	100.0	44.8	100.0	100.0	34.5	96.6	86.2	96.6	100.0
L Eve_P	62	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	85.5	100.0	100.0	100.0	100.0
L GOSH_P	119	96.6	96.6	96.6	93.3	96.6	96.6	96.6	42.9	28.6	5.0	96.6	96.6	96.6	96.6
Leeds_P	53	90.6	90.6	88.7	90.6	100.0	100.0	79.3	100.0	100.0	94.3	98.1	83.0	100.0	96.2
Livpl_P[b]	27	84.6	84.6	84.6	80.8	84.6	84.6	73.1	80.8	61.5	69.2	84.6	40.0	80.8	84.6
Manch_P	36	97.2	97.2	97.2	97.2	100.0	100.0	80.6	100.0	100.0	47.2	100.0	100.0	100.0	100.0
Newc_P	21	90.5	90.5	90.5	90.5	85.7	76.2	76.2	100.0	100.0	66.7	81.0	52.4	85.7	85.7
Nottm_P	58	94.8	96.6	94.8	94.8	98.3	98.3	41.4	98.3	96.6	1.7	98.3	44.8	100.0	100.0
Soton_P[b]	18	88.2	94.1	88.2	94.1	100.0	100.0	93.8	94.1	94.1	100.0	100.0	93.8	100.0	100.0
UK	**550**	**95.3**	**96.2**	**95.1**	**94.9**	**97.1**	**97.3**	**74.3**	**70.3**	**65.7**	**52.6**	**97.1**	**80.6**	**97.3**	**97.3**

Abbreviations: BMI – body mass index; SBP – systolic blood pressure; Hb – haemoglobin; Creat – creatinine; Ferr – ferritin; ESA – erythropoietin stimulating agent; IV – intravenous; Chol – cholesterol; Bicarb – bicarbonate; PTH – parathyroid hormone; Ca – calcium; Phos – phosphate
Blank cells represent data items that could not be submitted due to technical reasons
[a]Belfast does not measure PTH in transplanted patients
[b]Non-transplant surgery centre

approximately −1.1, but whilst those who were transplanted maintained their height, the height z-score continued to worsen for those who received dialysis. For dialysis patients across all age groups their height z-score tended to worsen over time. It should be noted that due to changes in modality, groups are not strictly sequential in this analysis.

The proportion of patients aged 2–16 years with a height less than two standard deviations in 2013 was much higher for those on dialysis (46.8% for

Table 9.3. Percentage data completeness for dialysis patients <16 years old by centre for each variable and total number of patients per centre in 2013

Centre	Dialysis patients *N*	Height	Weight	BMI	SBP	Hb	Ferr	ESA	IV iron	Chol	Bicarb	PTH	Ca	Phos
Bham_P	20	90.0	95.0	90.0	95.0	95.0	95.5			95.2	90.0	95.2	95.0	95.0
Blfst_P	5	60.0	100.0	60.0	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0
Brstl_P	7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	85.7	100.0	100.0	100.0	100.0
Cardf_P	3	100.0	100.0	100.0	100.0	100.0	100.0		100.0	33.3	100.0	100.0	100.0	100.0
Glasg_P	12	91.7	100.0	91.7	100.0	100.0	91.7	100.0	100.0	58.3	100.0	100.0	100.0	100.0
L Eve_P	14	57.1	64.3	57.1	64.3	100.0	100.0	92.9	92.9	7.1	100.0	100.0	100.0	100.0
L GOSH_P	30	100.0	100.0	100.0	96.7	100.0	96.7	86.7	80.0	72.0	100.0	100.0	100.0	100.0
Leeds_P	12	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Livpl_P	5	66.7	100.0	66.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Manch_P	25	92.0	92.0	92.0	92.0	100.0	100.0	100.0	96.0	4.0	100.0	100.0	100.0	100.0
Newc_P	2	50.0	50.0	50.0	50.0	100.0	100.0	100.0	100.0	50.0	100.0	100.0	100.0	100.0
Nottm_P	12	83.3	91.7	91.7	50.0	100.0	91.7	91.7	91.7		100.0	91.7	100.0	100.0
Soton_P	5	100.0	100.0	100.0	100.0	80.0	85.7	100.0	100.0	80.0	80.0	71.4	80.0	80.0
UK	**152**	**88.2**	**93.5**	**88.9**	**89.5**	**98.7**	**96.8**	**76.6**	**74.7**	**50.0**	**98.0**	**97.5**	**98.7**	**98.7**

Abbreviations: BMI – body mass index; SBP – systolic blood pressure; Hb – haemoglobin; Ferr – ferritin; ESA – erythropoietin stimulating agent; IV – intravenous; Chol – cholesterol; Bicarb – bicarbonate; PTH – parathyroid hormone; Ca – calcium; Phos – phosphate
Blank cells represent data items that could not be submitted due to technical reasons

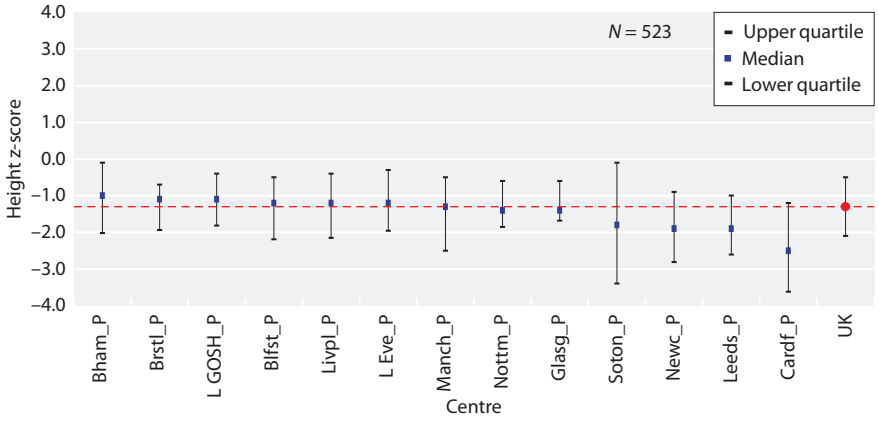

Fig. 9.1. Median height z-scores for transplant patients <16 years old in 2013, centre specific and national averages.

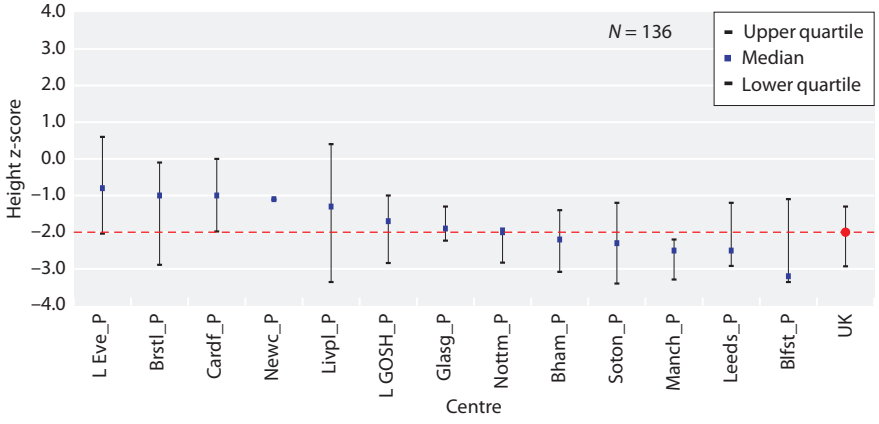

Fig. 9.2. Median height z-scores for dialysis patients <16 years old in 2013, centre specific and national averages.

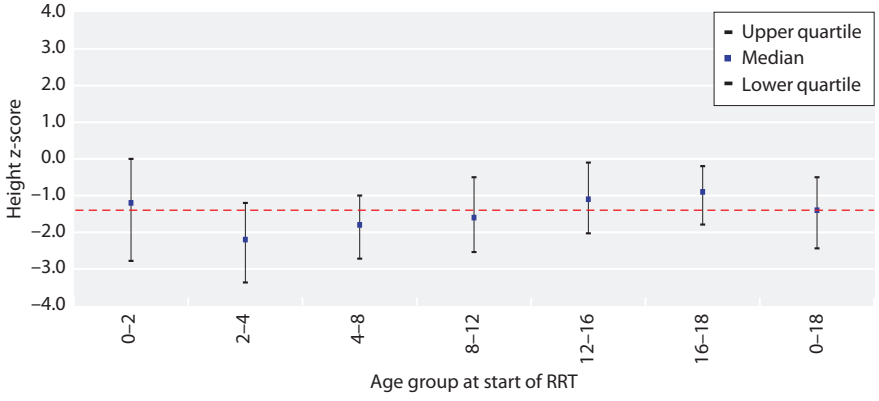

Fig. 9.3. Median height z-scores at start of RRT for patients <18 years old between 2002 and 2013, by age of start

haemodialysis (HD) and 43.2% for peritoneal dialysis (PD)) compared to those with a functioning transplant (25.7%), excluding situations where growth might be compromised (patients with syndromes and those born prematurely). Individual centre data has not been shown due to very small numbers per modality per centre. Figure 9.5 displays temporal fluctuations in use of growth hormone in those with a height less than two standard deviations; whilst it appears use of growth hormone was falling, reporting of this has been poor over the last three years. Average use of growth hormone for under 16s with a height less than two standard deviations since 2002 is 27.2% for dialysis patients and 10.3% for transplant patients.

Weight

Figures 9.6 and 9.7 show that children receiving dialysis were significantly more underweight than those

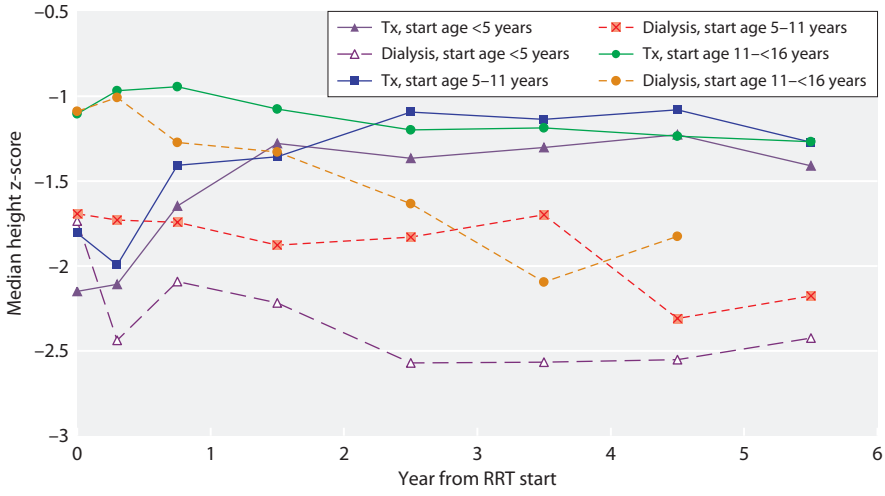

Fig. 9.4. Median height z-scores for patients <16 years old by time on RRT and treatment modality

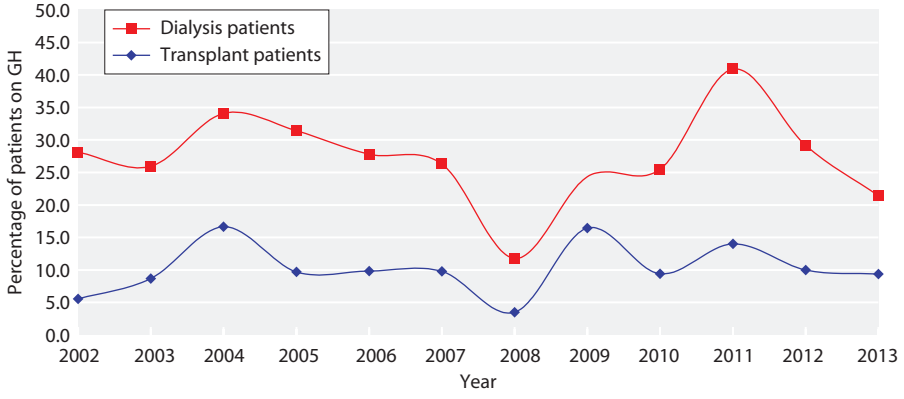

Fig. 9.5. Use of growth hormone in children <16 years old with a height under 2SD between 2002 and 2013

with renal transplants. The overall median z-score was −0.2 in the transplanted group and −1.2 in the dialysis group, $p < 0.0001$.

Cardiovascular risk factor evaluation

Obesity

Figures 9.8 and 9.9 show that children with renal transplants had a significantly higher body mass index than those receiving dialysis. The overall median z-score was 0.9 in the transplanted group and 0.2 in the dialysis group, $p < 0.0001$.

Figure 9.10 demonstrates higher proportions of overweight and obese children (41.4%) in those with renal transplants compared to those receiving dialysis (25.9%). There was a higher proportion of underweight children in the dialysis group (8.9%) compared to those with renal transplants (0.6%). There was a highly significant difference in proportions of those underweight or with a normal BMI and those overweight/obese between age groups; older children aged 12 to <16 years had a higher body mass index than younger children aged under five years, $p < 0.0001$. Of those aged 12 to <16 years, 44.2% were overweight or obese compared to 40.0% of those aged 5 to <12 years and only 17.2% of those aged 0 to <5 years. Looking only at the proportions of those underweight, just 0.8% of those aged 12 to <16 years were underweight compared to 1.3% of those aged 5 to <12 years and 9.1% of those aged 0 to <5 years. There were no statistically significant differences between proportions of those underweight, normal, overweight or obese in terms of sex, ethnicity or donor source (deceased or living).

Hypertension

Figures 9.11 and 9.12 show children receiving RRT are hypertensive compared to the healthy population, and those receiving dialysis had a significantly higher median SBP than those with renal transplants. There was wide inter-centre variability in median SBP z-score. The median SBP z-score was maintained at or below the 90th centile by all centres for children with transplants

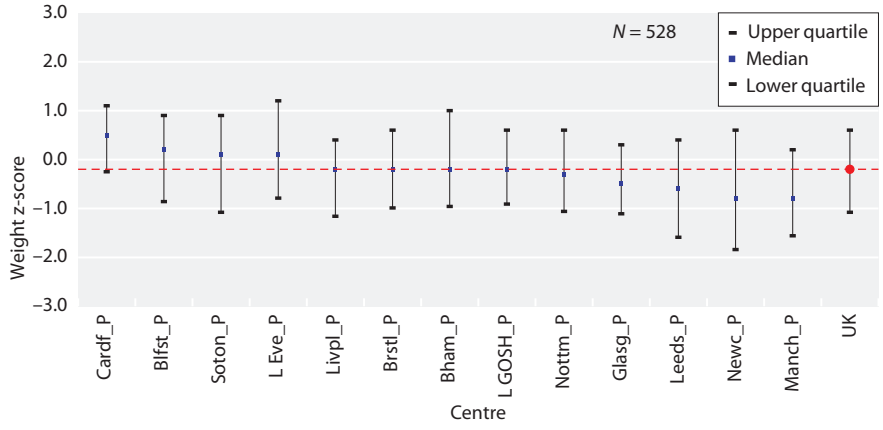

Fig. 9.6. Median weight z-scores for transplant patients <16 years old in 2013, centre specific and national averages

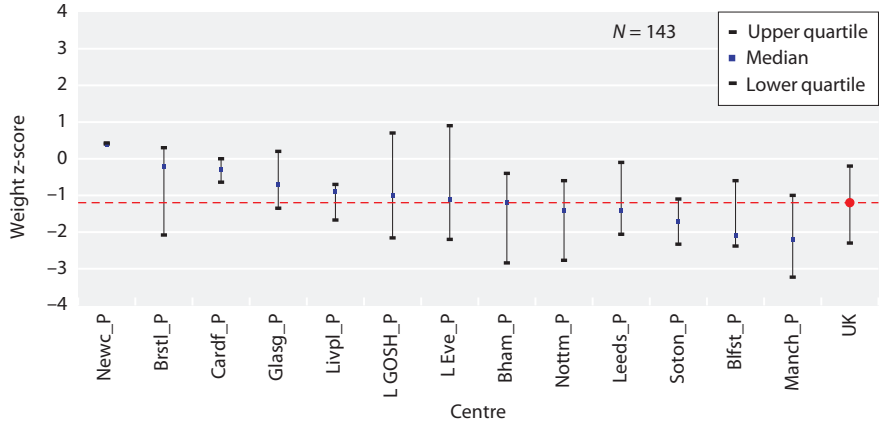

Fig. 9.7. Median weight z-scores for dialysis patients <16 years old in 2013, centre specific and national averages

whereas six centres were above the 90th centile for median SBP z-score for children receiving dialysis. The overall median z-score was 0.6 in the transplanted group and 1.0 in the dialysis group, $p = 0.002$. Of those aged <16, 76.1% of children with a functioning kidney transplant, 53.4% of those receiving HD, and 60.7% of those receiving PD had a SBP <90th percentile in 2013. Individual centre data showing percentages achieving the SBP standard by modality has not been shown due to very small numbers per modality per centre. Table 9.4 shows that there was a highly significant difference in the percentage <90th percentile for SBP between RRT modalities, whereas there was no difference with age, gender or ethnicity. Nor was there any statistically significant difference in SBP between living and deceased donor transplants.

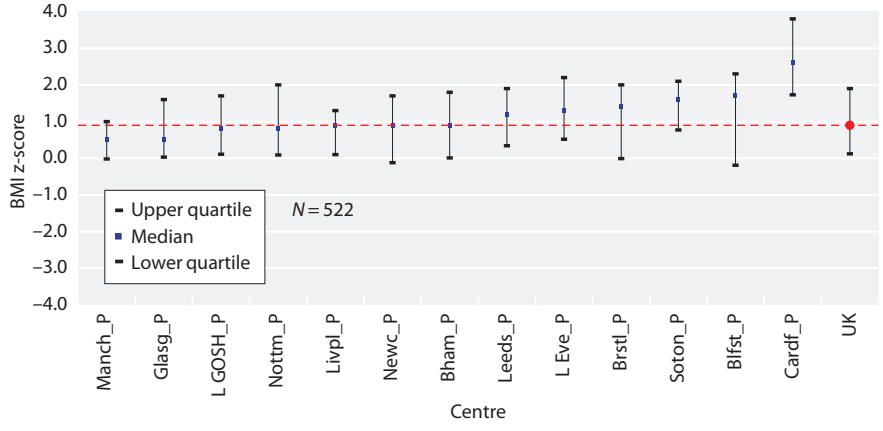

Fig. 9.8. Median BMI z-scores for transplant patients <16 years old in 2013, centre specific and national averages

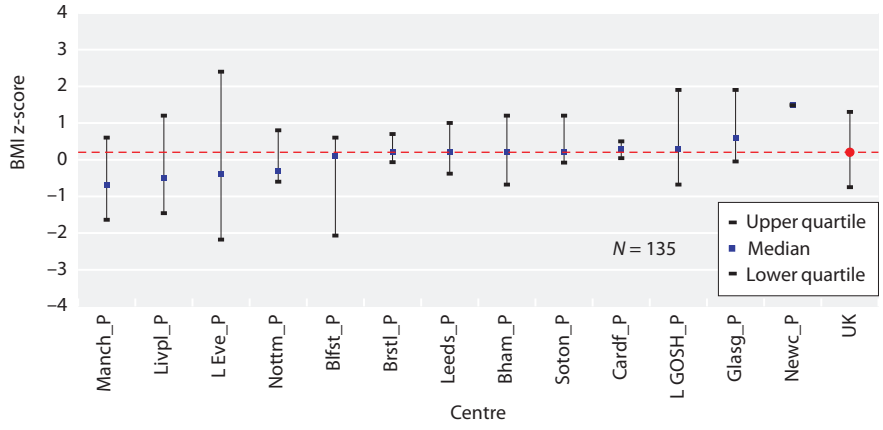

Fig. 9.9. Median BMI z-scores for dialysis patients <16 years old in 2013, centre specific and national averages

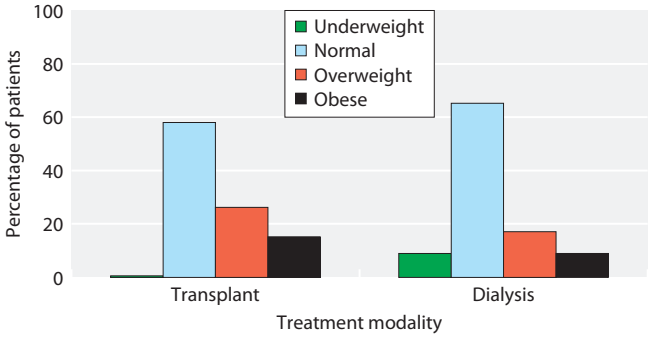

Fig. 9.10. BMI categorisation in children <16 years old by modality in 2013

Cardiovascular risk factor prevalence

Table 9.5 shows that the percentage of patients with no CVRFs was 26%, one CVRF was 35%, two CVRFs was 27% and the percentage of those with all evaluated CVRFs was 12%. This analysis is restricted to the 353 of 702 (50.3%) patients with complete data for all three items. Thus of the included prevalent paediatric RRT population, 75% had one or more risk factors for cardiovascular disease, with 1 in 10 having all three risk factors evaluated. Of those included in this analyses, 170 (48%) had hypertension, 150 (43%) were overweight/obese and 125 (35%) had hypercholesterolaemia. Treatment modality influenced the number of CVRFs, with transplants being associated with more CVRFs ($p = 0.007$). There were no statistically significant differences in number of CVRFs according to age, gender or ethnicity.

Laboratory and clinical indices

Haemoglobin and ferritin

The percentage of patients aged <16 on dialysis achieving the haemoglobin standard in 2013 was 65.5% for those on HD and 82.5% for those on PD, compared to 91.2% for those with a renal transplant. Individual centre data has not been shown due to very small numbers per modality per centre. During 2011–2013, 73.2% of dialysis patients and 91.8% of transplant patients achieved the standard for haemoglobin, which has remained consistent since 2002–2004. The proportion of patients with a ferritin in range during 2011–2013

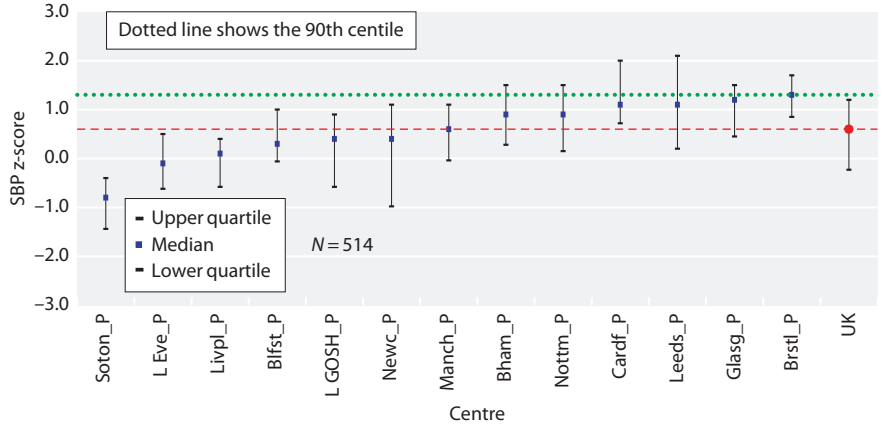

Fig. 9.11. Median systolic blood pressure z-scores for transplant patients <16 years in 2013, centre specific and national averages

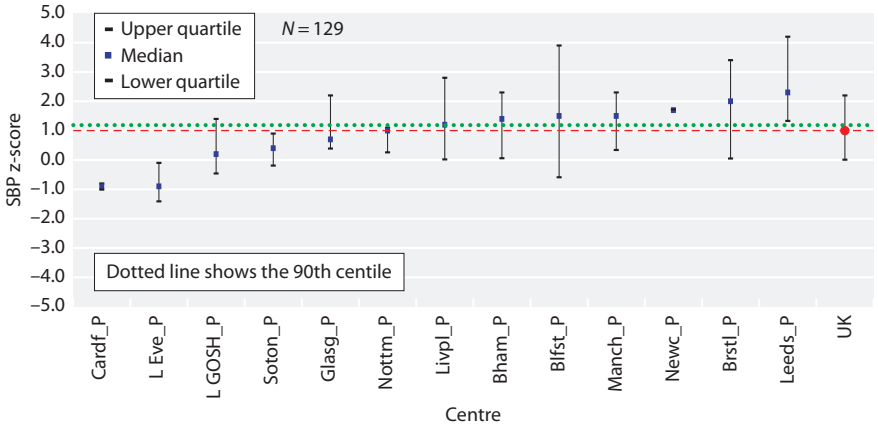

Fig. 9.12. Median systolic blood pressure z-scores for dialysis patients <16 years in 2013, centre specific and national averages

Table 9.4. Percentage of patients <16 years old achieving the standards for systolic blood pressure in 2013

	N	% below 90th percentile	*p* value
Total	643	72.2	
Age group			0.13
0–<5 years	94	66.0	
5–<12 years	301	70.8	
12–16 years	248	76.2	
Gender			0.06
Male	393	74.8	
Female	250	68.0	
Ethnicity			0.3
Black	23	60.9	
Other	44	75.0	
South Asian	101	66.3	
White	446	73.5	
RRT modality			<0.0001
Dialysis	129	56.6	
Transplant	514	76.1	

was 33.3% for dialysis patients and 14.8% for transplant patients. It is not possible to comment on trends for ferritin due to historical missing data, although this has substantially improved more recently.

Whilst table 9.6 suggests that fewer anaemic dialysis patients were receiving erythropoietin stimulating agents (ESAs) in the 2011–2013 period, it must be considered that the data completeness of ESA usage has fallen considerably in the last five years, and therefore reliability of the data is questionable.

Figure 9.13 demonstrates fluctuations in usage of ESAs for dialysis patients according to haemoglobin standard, with an erratic picture largely since 2009 when data completeness reduced. Prior to 2009, trends were more stable. Usage appears smoother for the transplant groups, where completeness is marginally better. Figure 9.14 shows that similar to figure 9.13, attainment of the haemoglobin standard and use of intravenous iron was also subject to alterations, with completeness also being inconsistent. More meaningful conclusions might be evident from these graphs if this data could be better provided by centres.

Table 9.5. Frequency of number of cardiovascular risk factors in prevalent RRT patients <16 years in 2013

Number of CV risk factors	Hypertensive	OW/Obese	Hypercholesterolaemic	*N*	%	Total %
0	No	No	No	90	25.5	**25.5**
1	Yes	No	No	55	15.6	
	No	Yes	No	45	12.7	**35.1**
	No	No	Yes	24	6.8	
2	Yes	Yes	No	38	10.8	
	Yes	No	Yes	34	9.6	**27.2**
	No	Yes	Yes	24	6.8	
3	Yes	Yes	Yes	43	12.2	**12.2**
N	**170**	**150**	**125**			
Total %	**48.2**	**42.5**	**35.4**			

Table 9.6. Proportion of paediatric RRT patients on ESA, by haemoglobin attainment, across time

Time period	Haemoglobin below standard % on ESA	Haemoglobin above standard % on ESA
Transplant patients		
2002–2004	17.5	4.2
2005–2007	22.5	4.1
2008–2010	24.7	8.1
2011–2013	20.0	5.8
Dialysis patients		
2002–2004	95.5	90.6
2005–2007	95.8	96.3
2008–2010	93.9	88.1
2011–2013	78.3	88.8

Calcium

The percentage of patients aged <16 on HD ($n = 88$) achieving the calcium standard in 2013 was 84.1%, with 5.7% of patients being hypocalcaemic, and 10.2% being hypercalcaemic. The percentage of patients aged <16 on PD ($n = 63$) achieving the calcium standard in 2013 was 71.4%, with 4.8% of patients being hypocalcaemic, and 23.8% being hypercalcaemic. Individual centre data has not been shown due to very small numbers per modality per centre.

Analysis by age demonstrated that for HD in the 0 to <5 group ($n = 27$), 22.2% were hypercalcaemic and 3.7% hypocalcaemic, with the remainder (74.1%) being within the age related reference range. In the 5 to <12 group ($n = 32$), 0% were hypercalcaemic, 3.1% were hypocalcaemic and the vast majority (96.9%) were within the age related reference range. In the 12 to <16 group ($n = 29$), 10.3% were hypercalcaemic, 10.3% were hypocalcaemic and the remainder (79.3%) were within the age related reference range. For PD, analysis by age was less reliable due to small group numbers; the majority of the hypercalcaemia came from 13 patients in the 12 to <16 year group, where 46.2% were hypercalcaemic.

Phosphate

The percentage of patients aged <16 on HD ($n = 88$) achieving the phosphate standard in 2013 was 43.2%, with 27.3% of patients being hypophosphataemic, and 29.6% being hyperphosphataemic. The percentage of patients aged <16 on PD ($n = 63$) achieving the phosphate standard in 2013 was 55.6%, with 4.8% of patients being hypophosphataemic, and 39.7% being hyperphosphataemic. Individual centre data has not been shown due to very small numbers per modality per centre.

Analysis by age for both HD and PD demonstrated no particular differences between age groups of proportions within, above or below the age related reference range.

Parathyroid hormone

The percentage of patients aged <16 with a renal transplant ($n = 439$) achieving the PTH standard in 2013 was 80.2%, with 19.8% having hyperparathyroidism. The percentage of patients aged <16 on HD ($n = 87$) achieving the PTH standard in 2013 was 42.5%, with 57.5% having hyperparathyroidism. The percentage of patients aged <16 on PD ($n = 66$) achieving the PTH standard in 2013 was 36.4%, with 63.6% having hyperparathyroidism.

Individual centre data has not been shown due to very small numbers per modality per unit, and low

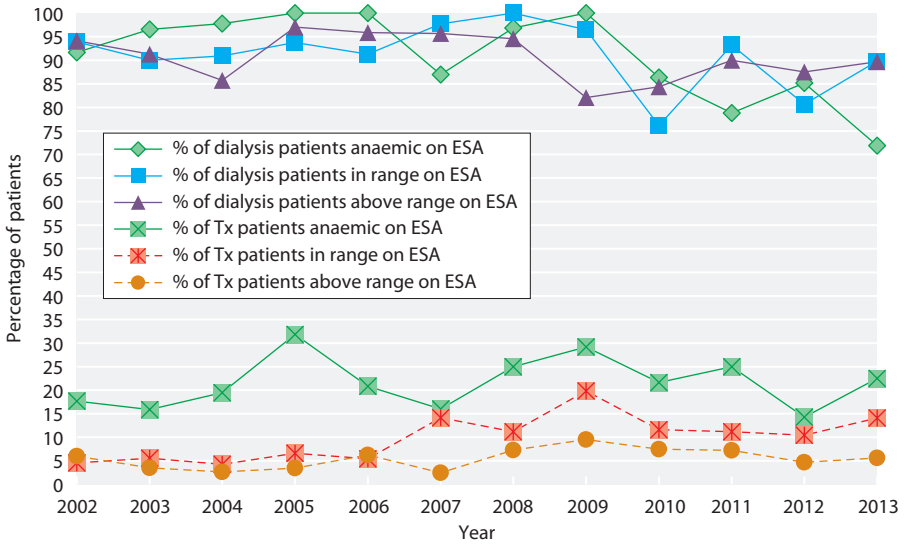

Fig. 9.13. The use of ESA by haemoglobin standard and treatment modality between 2002 and 2013 in prevalent RRT patients <16 years old

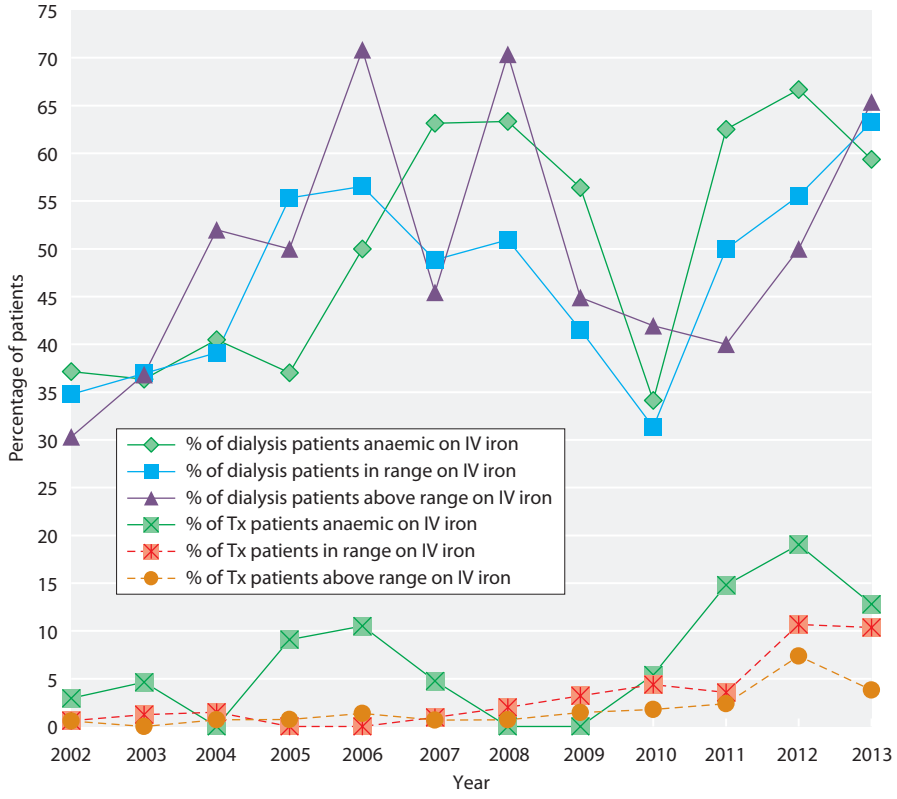

Fig. 9.14. The use of intravenous iron by haemoglobin standard and treatment modality between 2002 and 2013 in prevalent RRT patients <16 years old

completeness for some centres for transplant patients. Analysis by age for all groups demonstrated no particular differences between age groups of proportions within or above the standard.

Bicarbonate

Table 9.7 demonstrates that more than 80% of both transplant and dialysis patients achieved the bicarbonate standard in 2013, with reasonably similar proportions

Table 9.7. Centre analysis of bicarbonate levels (mmol/L) in patients under 16 years old by treatment modality, in 2013

	Transplant patients				Dialysis patients			
Centre	*N*	% below standard	% within standard	% above standard	*N*	% below standard	% within standard	% above standard
Bham_P	62	1.6	82.3	16.1	18	0.0	77.8	22.2
Blfst_P	16	68.8	31.3	0.0	5	0.0	100.0	0.0
Brstl_P	32	18.8	81.3	0.0	7	10.0	90.0	0.0
Cardf_P	16	6.3	93.8	0.0	3	33.3	66.7	0.0
Glasg_P	28	14.3	82.1	3.6	12	17.1	82.9	0.0
L Eve_P	62	24.2	75.8	0.0	14	25.0	75.0	0.0
L GOSH_P	115	0.9	98.3	0.9	30	7.1	88.1	4.8
Leeds_P	52	3.9	90.4	5.8	12	0.0	83.3	16.7
Livpl_P	22	27.3	72.7	0.0	6	0.0	100.0	0.0
Manch_P	36	8.3	88.9	2.8	25	22.2	71.5	6.3
Newc_P	17	17.7	82.4	0.0	2	0.0	100.0	0.0
Nottm_P	57	3.5	87.7	8.8	12	0.0	58.6	41.4
Soton_P	18	5.6	94.4	0.0	4	0.0	100.0	0.0
UK	**533**	**10.5**	**85.6**	**3.9**	**150**	**8.8**	**80.4**	**10.8**
Age group								
0–<5 years	50	16.0	82.0	2.0	58	11.2	75.6	13.2
5–<12 years	267	12.4	84.3	3.4	50	6.3	83.5	10.2
12–<16 years	216	6.9	88.0	5.1	42	8.6	83.7	7.7

between modalities. Here individual centre data has been combined for HD and PD in order to provide limited comparison, but despite this, numbers remain small. There were no statistical differences between age groups on the achievement of the bicarbonate standard.

Conclusions

Registry data

The Paediatric Renal Registry is a valuable resource for describing the paediatric ERF population and assessing how outcome data compares against national standards. It provides a means of benchmarking and improving the quality of the care provided to children on RRT in the UK.

There are some important limitations to the data provided to the Registry. Unlike the adult Registry, data collection is only performed once per year; one must be wary of over analysing items where a single annual measurement is submitted to the Registry, especially if the variable can vary widely from day to day. The Paediatric Registry also includes far fewer patients. These limitations restrict the quality of the analysis and ability to make comparisons between centres. In order to address these restrictions, patients are grouped into cohorts by time period to ameliorate the problem of reduced numbers. Moving to a quarterly data return would greatly improve the accuracy of the report, as well as resolve some of the issues with completeness. The lack of completeness of certain data items described in this report such as the use of growth hormone, ESAs and intravenous iron and transplant immunosuppression do provide a challenge in drawing meaningful conclusions from the data. A concerted effort from all centres to regularly provide this information could lead to a much more accurate assessment of how paediatric ERF patients are managed. In addition, more cohesiveness between centres with the items reported to the Registry would be valuable, however it is accepted that information technology, practice and services differ.

Changes to the chapter

This year the paediatric biochemistry chapter has been restructured, with the objective to provide new ways of looking at the data and to improve reporting. Insights from the literature and from other national registries are welcomed to provide novel data presentation and processing to aid better management of children on RRT. For the first time, cholesterol data which has now passed 50% completeness is reported and has enabled the presentation of the prevalence of some of the commonest CVRFs in children on RRT. It is hoped that by reporting on items with lower completeness, clinicians will be inspired to improve their returns to fully realise the potential of the Registry.

Standards

The Renal Association guidelines that are reported against are now over ten years old with guidelines in development or being updated by the BAPN. These new standards are welcomed in order to ensure that the report is current and relevant.

Growth

Previous Registry reports [8] and data from the ESPN/ERA-EDTA [9] have established that the UK ERF population are shorter than healthy children. UK paediatric transplant patients had a near normal z-score for weight, whereas dialysis patients are underweight. The BMI findings in this report are influenced by the reduced height of RRT patients, so although transplant patients' weights were comparable to the healthy population, they were overweight for their height.

A new analysis in this report suggests that there were important differences in growth trends between cohorts of children according to age of commencement of RRT. Children transplanted under 11 years of age improved their height z-score, and children transplanted over 11 years maintain height z-scores, with all transplanted patients having a similar height z-score after three years of starting RRT. As a healthy child with a normal pubertal growth spurt will have a static height z-score and the Registry dataset does not collect information regarding puberty, it is difficult to comment on growth patterns any further. This new analysis thus shows patterns of growth trend over the first few years following commencement of RRT by modality and adds to the recent European Registry data where an older age at RRT start, the cumulative time with a functioning graft, more recent RRT vintage and greater height z-score at RRT start were associated with higher final height z-score [9]. Although the proportion of those receiving growth hormone in those under 16 with a height z-score <2 standard deviations is reported, it is accepted that growth hormone use would not be recommended in newly transplanted patients and in those demonstrating catch up growth.

Work is being undertaken to investigate the number of patients with a final adult height recorded at age 18. Difficulties in such an analysis include the representation of patients who may be managed in paediatric or adult

centres and the low data completeness of height reporting to the adult Registry, as well as continued growth past the age of 18 years. More detailed analyses of the effect of different steroid regimes on growth were not possible for inclusion in this report due to a lack of power.

Cardiovascular risk factor evaluation

Novel analyses in this report highlight that of those with data, 75% of paediatric RRT patients had one or more risk factors, and that 1 in 10 had three risk factors for cardiovascular disease including hypertension, obesity and hypercholesterolaemia. As the assessment of all three risk factors only used data from half the population, the proportions of hypertension and obesity without cholesterol data were also tested and found to be the same as when taking into account all three variables. It is accepted that using total cholesterol alone may have limitations in the assessment of dyslipidaemia, but Registry data for other lipid measures is sub-optimal and thus this makes best use of the data available. An annual full lipid screen for children on RRT would enhance the Registry's ability to assess dyslipidaemia in the paediatric ERF population.

The analyses highlight that hypertension remained the most prevalent 'traditional' CVRF in this paediatric RRT cohort. These findings are similar to previous reports including pre-dialysis CKD cohorts [10]. These data should encourage clinicians to develop strategies to reduce current rates of hypertension and excess weight in childhood populations on RRT in the UK.

Laboratory and clinical indices

Haemoglobin standard achievement was broadly similar to previous years. Completeness for ferritin has improved in recent years but unfortunately reduced for ESA data. Improving data returns on usage of ESAs and intravenous iron would help more comprehensive commentary regarding anaemia management. The results of the national audit on anaemia in the UK paediatric ERF population may provide further insights.

This year comparison between centres has not been reported for bone biochemistry parameters. The small numbers per modality at each centre allow for limited comparison, and therefore data for all patients and by age groups are instead provided.

Bicarbonate data, an important aspect in the growing child, has been merged for the dialysis groups in order to compare with children with renal transplants. Standard achievement remained stable for this variable.

Future work

A strategy under discussion is a move to consider 'double counting' patients. If a patient changes modality half way through the year, their results currently can only be reported against one modality. Double counting would correct for potential data lost in a modality. This may provide a suitable stopgap until quarterly data returns are in place for children receiving RRT.

The ongoing work to merge the paediatric and adult registries will allow the reporting of data for 16–18 year olds, who may be managed in either care setting. Uniting the registries will also allow the linkage of longer term outcomes such as graft lifespan and cardiovascular comorbidity.

The full integration of the NEW paediatric dataset (version 10.0) should provide more uniformity in the data items collected which may aid completeness.

An exciting development for nephrology in general is the formation of the UK Renal Data Collaboration (of which the BAPN is a member) and the creation of a data warehouse [11]. Such an advance has the possibility to revolutionise future reporting by facilitating the collection of data and allowing increased frequency of data collection. Potentially this will also allow the expansion of range of electronic data items that are reported. This could remove many of the current limitations associated with the Paediatric Renal Registry.

Conflicts of interest: none

References

1 Renal Association standards, 3rd edition, 2002: http://www.renal.org/docs/default-source/guidelines-resources/Renal_Association_Standards_3rd_Edition_2002-2007.pdf?sfvrsn=0 (last accessed 20th October 2014)

2 Cole TJ, Flegal KM, Nicholls D, Jackson AA: Body Mass Index cut offs to define thinness in children and adolescents: international study. BMJ 2007;335(7612):194

3 Freeman JV CT, Chinn S et al.: Cross sectional stature and weight reference curves for the UK, 1990. Arch Dis Child 1995;73:17–24

4 BAPN Standards for Hypertension in Paediatric Renal Transplant Recipients, 2011: http://www.renal.org/docs/default-source/special-interest-groups/bapn/clinical-standards/bapn-standards-for-hypertension-in-renal-transplant-recipients.pdf?sfvrsn=2 (last accessed 10th November 2014)

5 National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents: The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. Pediatrics 2004;114(2):555–76
6 Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents: summary report. Pediatrics 2011 Dec;128(suppl 5):S213–56. doi: 10.1542/peds.2009–2107C
7 NICE clinical guideline 114: Anaemia management in people with chronic kidney disease. London: National Institute for Health and Clinical Excellence, 2011
8 Pruthi R, Maxwell H, Casula A, Braddon F, Lewis M, O'Brien C, Stojanovic J, Tse Y, Inward C, Sinha MD: UK Renal Registry 16th Annual Report: Chapter 13 Clinical, Haematological and Biochemical Parameters in Patients receiving Renal Replacement Therapy in Paediatric Centres in the UK in 2012: National and Centre-specific Analyses. Nephron Clin Prac 2013;125(1–4):259–73. doi: 10.1159/000360032
9 Harambat J, Bonthius M, van Stralen KJ, Ariceta G, Battelino N, Bjerre A, Jahnukainen T, Leroy V, Reusz G, Sandes AR, Sinha MD, Groothoff JW. Combe C, Jager KJ, Verrina E, Schaefer F: ESPN/ERA-EDTA Registry. Adult Height in Patients with Advanced CKD requiring Renal Replacement Therapy during Childhood. Clin J Am Soc Nephrol 2014 Jan;9(1):92–9. doi:10.2215/CJN.00890113
10 Wilson AC, Schneider MF, Cox C, Greenbaum LA, Saland J, White CT, Furth S, Warady BA, Mitsnefes MM: Prevalence and Correlates of Multiple Cardiovascular Risk Factors in Children with Chronic Kidney Disease. Clin J Am Soc Nephrol. 2011 Dec;6(12):2759–65. doi: 10.2215/CJN.03010311
11 https://www.renalreg.org/projects/the-uk-renal-data-collaboration-ukrdc/ (last accessed 20th October 2014)

UK Renal Registry 17th Annual Report: Chapter 10 2013 Multisite Dialysis Access Audit in England, Northern Ireland and Wales and 2012 PD One Year Follow-up: National and Centre-specific Analyses

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Key Words

Chronic kidney disease · Diabetes · Dialysis · End stage renal disease · Established renal failure · Haemodialysis · Peritoneal dialysis · Prevalence · Renal replacement therapy · Transplantation · Treatment modality · Vascular access

Summary

- Data are presented from the second combined vascular and peritoneal dialysis access audit.
- In 2013, 57 centres in England, Wales and Northern Ireland (out of a total of 62) returned data on first access from 3,663 incident haemodialysis (HD) patients and 1,022 incident peritoneal dialysis (PD) patients.
- Of the incident HD patients, 40.7% started therapy on an arteriovenous fistula (AVF), 37.2% on a tunnelled line (TL), 21.3% on non-tunnelled line (NTL) and 0.9% by means of arteriovenous graft (AVG).
- Older patients ($\geqslant$75 years) were more likely to start dialysis using AVF compared to their younger counterparts (43.5 vs. 39.6%).
- There continues to be a strong tendency for many centres to rely on one single approach to PD catheter placement, with 13 centres reporting use of a single technique for all of their patients.
- Wide variations were apparent between centres for use of AVF as the first dialysis access ranging from 10–50%.
- Twenty-four centres were 2 or 3 standard deviations below the 65% target for incident patients commencing haemodialysis on an AV fistula.
- Length of time known to nephrology services and likelihood of commencing dialysis using either an AVF or a PD catheter are strongly associated. Patients who were known to a nephrologist over one year had a greater proportion of patients starting with an AVF as compared to those who were referred between 90–365 days (42.5% vs. 25.3%). By comparison, amongst the late presenters only 4.8% had first access documented as an AVF and 83.4% started dialysis on either a tunnelled line or a non-tunnelled line.
- Initial surgical assessment was a key determinant of the likelihood of AVF formation. Of the incident patients assessed by a surgeon at least three months prior to starting dialysis, 73% started dialysis on an AVF whereas of those who were not seen by a surgeon only 10% did.
- 31 of the 39 centres were 2 or 3 standard deviations below the 85% target, for prevalent haemodialysis patients on an AV fistula.
- For centres returning data on one year peritoneal dialysis outcomes, the majority of centres maintained $>$50% of patients on PD at one year, however only four centres maintained $>$80% on PD at one year.
- Further enhancement of data fields, improved data completeness and accuracy of returns will be essential to improve the quality of future audits.
- Further work is required to determine if the variations that exist between centres for type of haemodialysis access translates to outcomes.

Introduction

The second combined vascular and peritoneal dialysis access audit in England, Wales and Northern Ireland represents the findings from the 2013 data collection period for patients starting dialysis between 1st January 2013 and 31st December 2013. Previously, vascular and peritoneal dialysis access audits have been published separately [1, 2]. The combined access audit provides information on timely and appropriate access interventions in order to achieve permanent access based on the recommendations and quality requirements stated in Renal Association clinical practice guidelines and Vascular Access guidelines for Haemodialysis and Peritoneal access [3, 4]. The core principal of these audits has been to highlight the performance variation of renal centres across England, Wales and Northern Ireland and explore factors that may contribute to the provision of excellent quality vascular and peritoneal access.

The term established renal failure used within this chapter is synonymous with the terms end stage renal failure and end stage kidney disease, which are in more widespread international usage. Patients have disliked the term 'end stage' which reflects the inevitable outcome of this disease.

Methods

All adult renal centres in England, Wales and Northern Ireland were contacted regarding vascular and peritoneal access for all incident and prevalent dialysis patients (centre level only) in 2013. Data were collected using Microsoft Excel spreadsheets circulated by the UK Renal Registry (UKRR). Of 62 centres contacted, data were received from 57 centres. Definitions were refined from the previous audit performed in 2013 based on the quality of the returned questionnaires and the feedback received from centres.

Patients who were identified by the renal centres as having acute kidney injury (AKI) in the free text fields or patients who were reported to have recovered renal function within three months were categorised as having AKI for the purposes of this audit and excluded ($n = 367/5{,}105$). The remaining records received were validated against the UKRR database to confirm that the population collected at each centre for the audit was the same as, or representative of, the incident population at that centre as collected via the usual UKRR quarterly return. Data checks were made by cross-referencing with the UKRR database. Any patients identified from the UKRR as not incident to dialysis between 1st January 2013 and 31st December 2013 were excluded. Similarly, where the reported prevalent numbers from the audit did not match those in the UKRR database, those centres were excluded. The cross-referencing also enabled ascertainment of information on mortality within three months of commencing dialysis.

Centres who reported data on peritoneal dialysis (PD) patients in the 2012 vascular and peritoneal access audit were asked to complete a one year follow up of their PD patients. Additional information was requested on the date of PD catheter failure, the reason for catheter failure, the number of catheters used during the year, and the modality in use at one year after starting PD.

Table 10.1 lists the summary of audit measures as stated in the Renal Association clinical practice guidelines, with explanation for why some of the audit measures were not reported.

Patients starting haemodialysis (HD) were grouped by type of first vascular access: arteriovenous fistula (AVF), arteriovenous graft (AVG), tunnelled dialysis line (TL), non-tunnelled dialysis line (NTL). Patients starting PD were categorised by the insertion technique: laparoscopic, peritoneoscopic, open surgery, percutaneous. Access at three months was defined as the type of access in use at three months after starting dialysis. If a patient was no longer receiving dialysis at three months then the reason was recorded instead, for example died or transplanted. Referral time was defined as the number of days between the date of first being seen by a renal physician and the date of commencing dialysis. Patients were classified as presenting late if they had a referral time of less than 90 days. In the analyses involving whether or not a patient had received surgical assessment at least three months before starting dialysis, patients were excluded if they were categorised as a late presenter.

Access failure was defined as the access no longer being usable for dialysis. Data about the date and cause of access failure were collected. Access failure was censored for death, transplantation, withdrawal from renal replacement therapy (RRT) and elective switching of access type. It was the intention to only capture access failures relating to the first type of access. If the reason recorded for access failure was incompatible with the first type of access recorded then the data was not included in this analysis.

Separate or combined analyses have been performed for incident HD patients and incident PD patients as appropriate. Due to the exploratory nature of the audit the analyses have been limited to descriptive statistics of frequencies, percentages and unadjusted associations between variables. If a centre had more than 50% missing returns for a particular data field, then all patients from the centre were excluded from analyses involving that data field. The data were analysed using SAS 9.3.

Results

Data completeness

Fifty-seven centres returned data on first dialysis access for 3,663 incident HD patients and 1,022 incident PD patients. The UKRR incident patient data for the same year were 4,030 HD and 1,108 PD, thus there were access returns on 91% of HD and 92% of PD patients.

Seventeen patients were excluded from all analyses due to missing RRT start date or first access type. Figure 10.1 illustrates the data completeness for key variables.

Table 10.1. Summary of audit measures stated in Renal Association clinical practice guidelines for dialysis access

	RA audit measure	Reported	Reason for non-inclusion
HD Access			
1	Proportion of patients whose first haemodialysis treatment is with an arteriovenous fistula	Yes	
1a	Stratified by new patients with established renal failure and known to the nephrology team for >90 days	Yes	
1b	Stratified by new patients with established renal failure and known to the nephrology team for ≤90 days	Yes	
1c	Patients with a failed renal transplant	No	Not captured by the audit
1d	Patients transferred permanently from PD to haemodialysis	No	Not captured by the audit
2	65% of all patients commencing haemodialysis should commence with an AV fistula	Yes	
3	A centre should measure the proportion of prevalent long term haemodialysis patients receiving dialysis via a fistula, an arteriovenous graft and a tunnelled or a non-tunnelled line	Yes	
4	85% of all prevalent patients on haemodialysis should receive dialysis via a functioning arteriovenous fistula	Yes	
5	Complications related to vascular access	Yes	
5a	Rupture of vascular access (fistula and graft)	Partly	Incident patients only
PD access			
1	Catheter patency – more than 80% of catheters should be patent at 1 year (censoring for death and elective modality change)	Yes	
2	Complications following PD catheter insertion	Yes	
2a	Bowel perforation <1%	No	Not captured by the audit
2b	Significant haemorrhage <1%	No	Not captured by the audit
2c	Exit site infection within 2 weeks of catheter insertion <5%	No	Not captured by the audit
2d	Peritonitis within 2 weeks of catheter insertion <5%	Yes	
2e	Functional catheter problem requiring manipulation or replacement or leading to technique failure <20%	No	Not captured by the audit

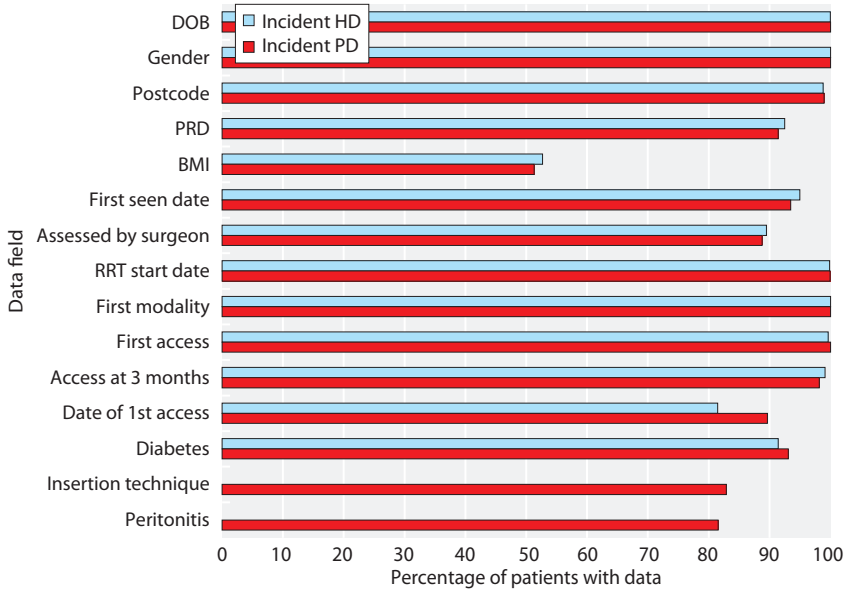

Fig. 10.1. Data completeness for key variables, stratified by first modality DOB = date of birth; PRD = primary renal diagnosis; BMI = body mass index

Table 10.2. Patient demographics

Variable		Total $N = 4,668$	HD $N = 3,647$	PD $N = 1,021$
Age	Median (IQR)	66 (53, 76)	67 (55, 76)	60 (47, 71)
BMI	Median (IQR)	27 (24, 32)	28 (24, 32)	27 (24, 31)
		***N* (%)**	***N* (%)**	***N* (%)**
Gender	Female	1,663 (35.6)	1,306 (35.8)	357 (35)
	Male	3,005 (64.4)	2,341 (64.2)	664 (65)
Diabetes	Missing	372 (8)	301 (8.3)	71 (7)
	Yes	2,677 (57.3)	2,031 (55.7)	646 (63.3)
	No	1,619 (34.7)	1,315 (36.1)	304 (29.8)
PRD	Missing	353 (7.6)	265 (7.3)	88 (8.6)
	Diabetes	1,218 (26.1)	980 (26.9)	238 (23.3)
	Glomerulonephritis	598 (12.8)	430 (11.8)	168 (16.5)
	Hypertension	368 (7.9)	291 (8)	77 (7.5)
	Other	673 (14.4)	572 (15.7)	101 (9.9)
	Polycystic kidney	286 (6.1)	184 (5)	102 (10)
	Pyelonephritis	247 (5.3)	183 (5)	64 (6.3)
	Renal vascular disease	264 (5.7)	225 (6.2)	39 (3.8)
	Uncert	661 (14.2)	517 (14.2)	144 (14.1)

IQR = interquartile range; BMI = body mass index; PRD = primary renal diagnosis; HD = haemodialysis; PD = peritoneal dialysis

Variations in first dialysis access

Patient demographics

The median patient age when starting RRT was 67 years in the HD cohort and 60 years for patients commencing PD. Overall, 64.4% of the patients were male, 35.6% female; the proportional distribution of the sexes was similar for both the HD and PD subgroups.

A significant proportion of patients starting dialysis had diabetes (57.3%), however, diabetes associated nephropathy was the primary renal disease (PRD) in only 26.1% (table 10.2).

Table 10.3 presents HD and PD patient subgroups stratified by age, dichotomised body mass index (BMI) ($\leqslant 30$ or >30), PRD, referral time (<90 or $\geqslant 90$ days) and surgical assessment status.

There was an association between the access modality (HD vs. PD), referral time (<90 days vs. $\geqslant 90$ days) and surgical assessment status in excess of three months prior to dialysis start. The following observations can be made:

For HD:

- AVF was the initial access for 40.7% of patients, with 0.9% on an AVG, 37.2% on a tunnelled line and 21.3% on a non-tunnelled line. The percentage of patients starting with an AVF has been stable for the last three years with the majority of centres failing to achieve the target as stated in the Renal Association guidelines (65% of all patients commencing haemodialysis should commence with an AVF).
- Patients aged 75 or over were more likely to initiate RRT on an AVF (43.5%) when compared to patients <75 years (39.6%). Similarly, older patients were less likely to start on a tunnelled line (31.5% vs. 39.6%).
- Patients with polycystic kidney disease (PKD) as primary renal diagnosis were most likely to start on an AVF (67.4%).
- Patients, who were referred at least 90 days prior to commencing dialysis, were more likely to start on an AVF compared to those starting more acutely (52.3% vs. 5.5%).
- A high proportion of patients (33.6%) who were referred at least 90 days prior to commencing dialysis, start dialysis on a tunnelled line.
- Patients who had been seen by a surgeon at least three months before starting dialysis were more likely to start on an AVF than those not assessed (72.4% vs. 6.1%).

For PD:

- For a total of 1,021 first PD catheters, the insertion techniques were 38.3% open surgical, 13.3% laparoscopic, 3.2% peritoneoscopic and 28.0%

Table 10.3. Patient characteristics stratified by type of first dialysis access

Variable	HD *N*	HD patients: AVF	AVG	TL	NTL	PD *N*	PD patients: Open surgery	Laparo-scopic	Peritoneo-scopic	Percuta-neous	Missing
Total patients	**3,647**	1,485	31	1,356	775	**1,021**	391	136	33	286	175
%		40.7	0.9	37.2	21.3		38.3	13.3	3.2	28.0	17.1
Age at first dialysis		%					%				
<75	2,579	39.6	0.9	39.6	20.0	840	38.6	13.6	3.7	28.0	16.2
⩾75	1,068	43.5	0.7	31.5	24.3	181	37.0	12.2	1.1	28.2	21.5
BMI (kg/m^2)											
⩽30	1,193	42.6	0.9	37.6	18.9	332	43.4	16.0	6.9	27.7	6.0
>30	625	54.9	0.8	28.3	16.0	126	48.4	14.3	7.9	23.8	5.6
No BMI	467	28.7	0.6	38.8	31.9	156	24.4	14.1	0.0	39.7	21.8
PRD											
Diabetes	980	43.3	1.0	39.3	16.4	238	34.5	12.2	2.9	31.9	18.5
GN	430	42.6	0.2	38.1	19.1	168	41.7	12.5	5.4	26.2	14.3
Hypertension	291	46.4	1.4	32.6	19.6	77	31.2	24.7	6.5	20.8	16.9
PKD	184	67.4	1.1	23.9	7.6	102	52.0	14.7	2.0	18.6	12.7
Pyelo	183	48.1	2.7	32.2	16.9	64	43.8	23.4	1.6	12.5	18.8
RVD	225	43.6	0.4	30.2	25.8	39	48.7	12.8	7.7	15.4	15.4
Uncertain	517	41.6	0.8	36.9	20.7	144	41.7	11.1	0.7	30.6	16.0
Other	572	23.3	0.3	45.8	30.6	101	37.6	13.9	5.0	24.8	18.2
No PRD	175	28.0	1.1	31.4	39.4	79	21.5	2.5	0.0	60.8	15.2
Referral time (days)											
<90	797	5.5	0.1	51.4	42.9	106	28.3	8.5	6.6	37.7	18.9
⩾90	2,663	52.3	1.0	33.6	13.1	843	41.6	14.7	3.1	25.0	15.5
No ref	120	24.2	1.7	30.0	44.2	58	17.2	3.4	0.0	60.3	19.0
Assessed by surgeon											
Missing	165	9.1	0.0	61.8	29.1	102	34.3	2.9	0.0	59.8	2.9
No	1,373	6.1	0.1	58.0	35.8	321	34.6	16.8	0.6	36.4	11.5
Yes	1,654	72.4	1.5	20.3	5.8	505	45.1	14.1	6.1	20.2	14.5

Patients from centres with more than 50% missing data for a variable are excluded from the table for that variable
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; GN = glomerulonephritis; BMI = body mass index; PKD = polycystic kidney disease; PRD = primary renal diagnosis; Pyelo = pyelonephritis; RVD = reno-vascular disease

percutaneous. Insertion technique was not reported for the remaining 17.1%.

- Referral time had an influence on PD catheter insertion technique; 37.7% of patients referred less than 90 days before starting dialysis underwent percutaneous insertion compared to 25.0% of patients known longer to the service. These data were reversed for general surgical insertion: 28.3% of patients who presented late versus 41.6% of patients who did not present late.
- Patients who were assessed by a surgeon at least three months before starting dialysis were more likely to undergo open surgical placement (45.1% vs. 34.6% for non-surgical assessment) and understandably less likely to undergo percutaneous catheter placement (20.2% vs. 36.4%).

Figure 10.2 shows types of haemodialysis access stratified by age group. Patients aged less than 75 at the point of commencing RRT were less likely than older patients (⩾75) to start dialysis using an AVF (39.6% vs. 43.5%) and more likely to start with a tunnelled line (39.6% vs. 31.5%). The reason for this is unknown but may reflect patient engagement with renal services or varying progression of chronic kidney disease in the older population.

Figure 10.3 shows haemodialysis access stratified by PRD. The proportional distribution of HD access modality was similar for different primary renal disease diagnoses. Of note, patients with polycystic kidney disease were more likely to start HD on an AVF. This likely results from the opportunity for timely access preparation as these patients are often known to renal

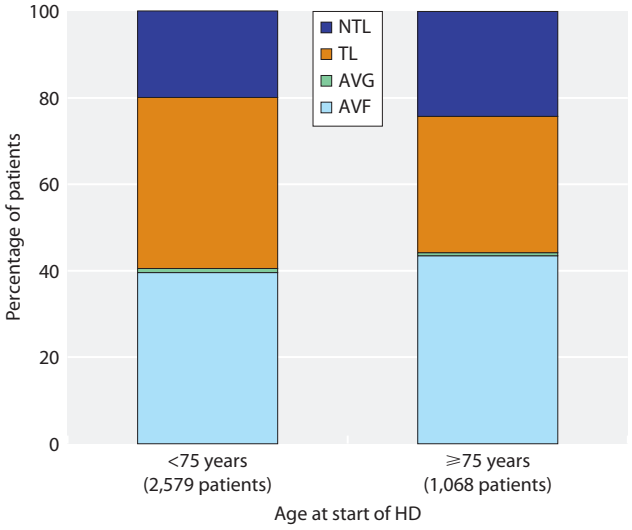

Fig. 10.2. Type of haemodialysis access stratified by age group
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line

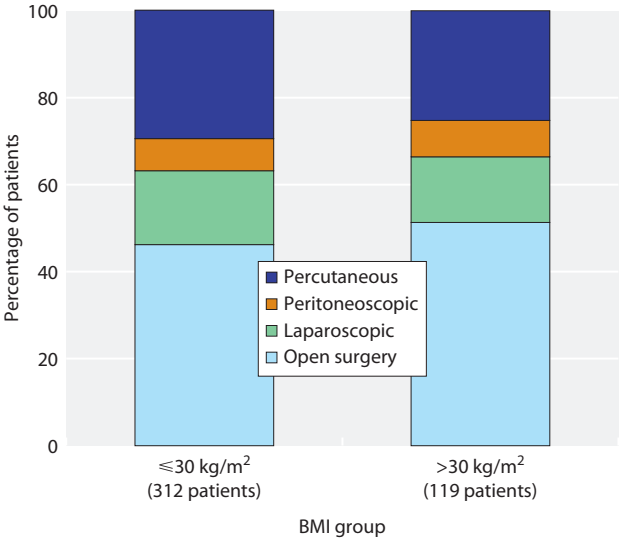

Fig. 10.4. Method of PD catheter insertion stratified by body mass index
BMI = body mass index
All patients from centres with more than 50% missing data for BMI were excluded

services for many years before dialysis is required. Where no primary renal diagnosis was available, the numbers of patients starting dialysis with a tunnelled or non-tunnelled dialysis venous catheter were higher, suggesting that this may represent a cohort of patients who present late to renal services or whose renal function declines more rapidly than predicted.

Figure 10.4 shows PD catheter insertion methods stratified by BMI. Patients with body mass index (BMI) $>30\ kg/m^2$ were more likely to undergo open surgical placement (51.3%) than those with BMI $\leqslant 30\ kg/m^2$ (46.2%). The percutaneous approach was less likely to be used in patients in the higher BMI category (25.2%) compared with those with a lower BMI (29.5%). The peritoneoscopic or laparoscopic approach was used in a similar proportion of patients in both BMI groups. It should be noted that the analysis was limited due to a high proportion of missing data for BMI.

Figure 10.5 shows PD catheter insertion technique by centre. Centres reporting less than five patients on PD were not considered for analysis ($n = 7$). Eleven centres

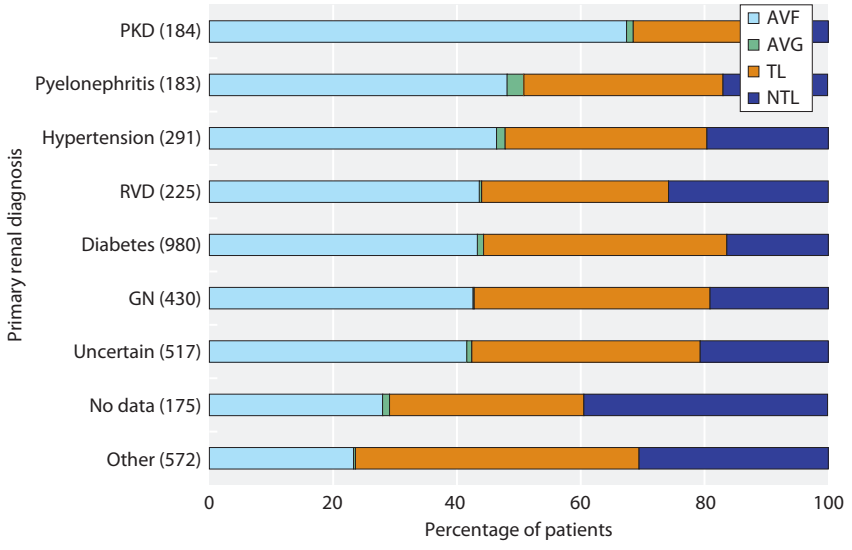

Fig. 10.3. Type of haemodialysis access stratified by primary renal disease
Number of patients in each primary renal diagnosis group in brackets
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; GN = glomerulonephritis; RVD = reno-vascular disease; PKD = polycystic kidney disease

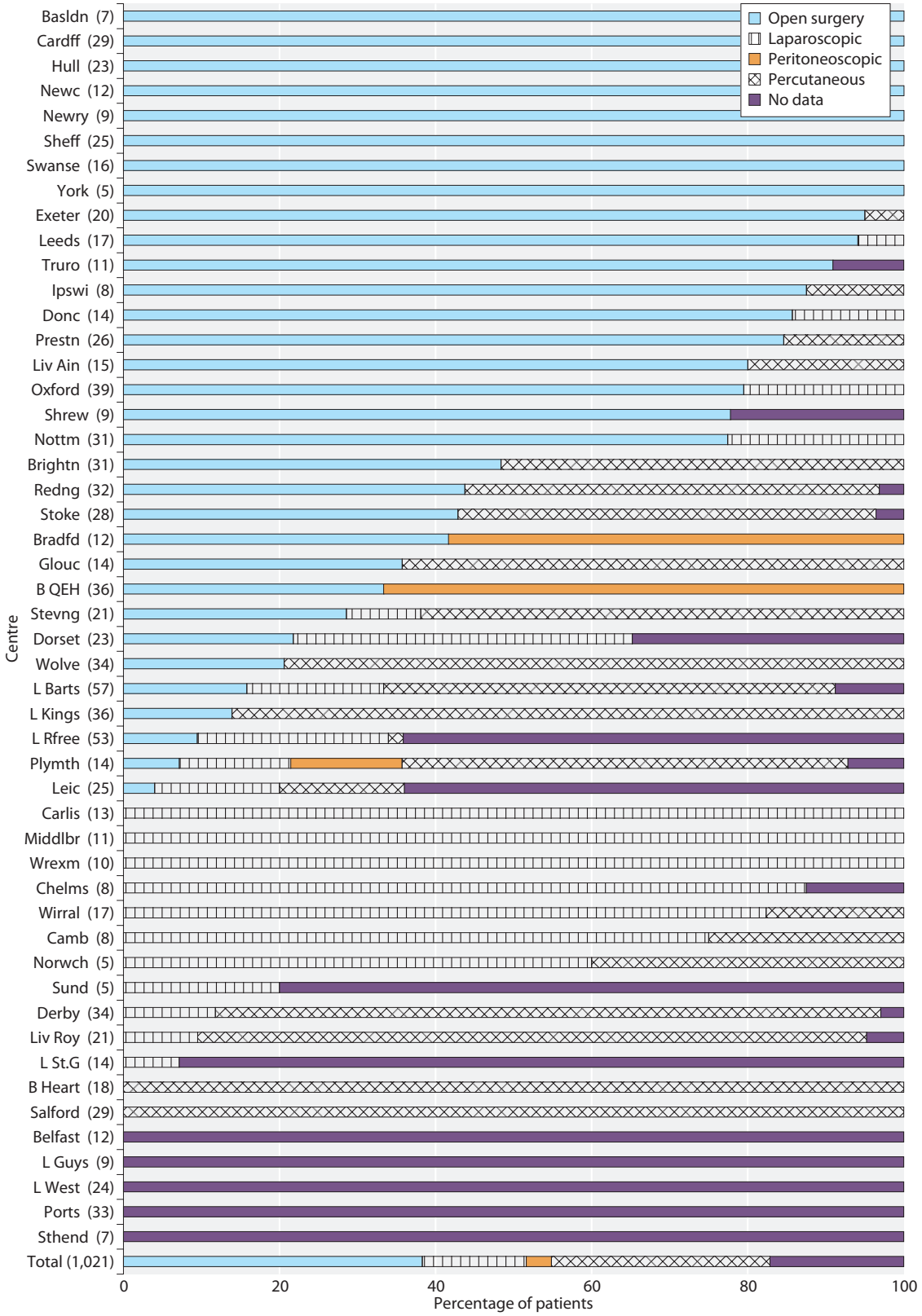

Fig. 10.5. PD catheter insertion technique stratified by centre

reported less than 10 patients using PD catheters for first dialysis in 2013. There continues to be a strong tendency for many centres to rely on one single approach to PD catheter placement, with 13 centres reporting use of a single technique for all of their patients. Twenty-two centres reported using the percutaneous technique. Amongst these centres were some of those with the highest proportion of patients using a PD catheter as first access (Derby 45.9%, London St Bartholemew's 39.5%, Wolverhampton 37.3%, Liverpool Roy 36.2%, to name a few).

First dialysis access and renal centre

Figure 10.6 shows type of first dialysis access by centre. Variations were apparent between centres when considering patients commencing dialysis via an AVF, ranging from 10% (London West, London St Bartholemew's, Wrexham) to 50% (Birmingham Heartlands, Cambridge, Colchester, Liverpool Aintree). Some centres had over 60% of patients starting dialysis on a tunnelled line (London West, Sunderland, Dudley). The use of arteriovenous graft as the first dialysis access was between 0–5% with only 17 of the 57 centres opting to use this.

Use of a PD catheter as first access varied between 45% (Derby) and 0% (Colchester, Clwyd, Dudley). In last year's audit there was some evidence that centres that had high usage of AVFs as starting access were also more likely to start patients on a PD catheter. Based on this year's audit, there is no evidence of this association.

The Renal Association guidelines on vascular access for Haemodialysis recommends 65% of all patients commencing haemodialysis should commence with an AV fistula. This is depicted in figure 10.7 with patients who presented late excluded for this analysis. There were 14 centres below 2 standard deviations and a further 10 centres below 3 standard deviations. There were two centres above 2 standard deviations (Derby, Liverpool Aintree). The results have to be cautiously interpreted due to non-adjustment for any patient related factors. This may indicate variation in local processes for access planning and delivery and needs further investigation.

First dialysis access and referral time

Figure 10.8 shows a clear association between time known to a nephrologist and patient starting haemodialysis with an AVF. A greater proportion of patients who were known to a nephrologist for over one year started dialysis with an AVF, as compared to those who were referred between 90–365 days (42.5% vs. 25.3%). Similarly, patients who were known to a nephrologist between 90 days to over one year were more likely to start on PD when compared to patients who were referred <90 days prior to dialysis start.

Figure 10.9 shows PD catheter insertion technique by referral time. Patients who were first seen by a nephrologist <90 days before starting RRT were more likely to undergo percutaneous insertion when compared to patients who were known between 90–365 days and >365 days. Open surgical technique was less likely to be used in the patients presenting late when compared to the patients who were known over three months, probably because of having a lesser likelihood of seeing a surgeon.

Figure 10.10 shows first access for centres providing data for patients presenting late (known to renal services for <90 days). Amongst the 913 patients for whom data were reported, 45.3% started dialysis on a tunnelled line, 38.1% on a non-tunnelled line, 11.6% using a PD catheter with only 4.8% having first access documented as an AVF. There was however, wide variation amongst centres and clearly an understanding of practice patterns could lead to potential improvements in access service provision. There may also be reporting differences which need to be explored.

In 13 centres, more than 15% of patients presenting late had a peritoneal dialysis catheter inserted for use as first dialysis access and as a result had a lower requirement for tunnelled or non-tunnelled lines. However, the number of patients presenting late reported in some centres was extremely small and it is difficult to make firm observations about clinical pathways for the development of dialysis access in this cohort.

Figure 10.11 shows the type of haemodialysis access in patients known to the renal service for longer than three months. There was significant variation for patients starting haemodialysis on AVF, with Derby on one end of the spectrum at 91.6% and London West at the other end at 15%. The centres with highest tunnelled line use were London West (76%), Carlisle (73%), London St Bartholemew's (67%). There were five centres who reported over 30% of patients as starting on non-tunnelled lines despite being known to the centre for at least 90 days (Antrim 44.4%, Shrewsbury 41.6%, London Kings 37.7%, London St Georges 50.0%, Portsmouth 32.9%). It will be important to understand the variations in practice patterns that lie behind these statistics which were not provided by current data.

First dialysis access and surgical assessment

Figure 10.12 highlights the proportion of patients who had been referred for surgical assessment at least three months prior to starting dialysis. There was considerable

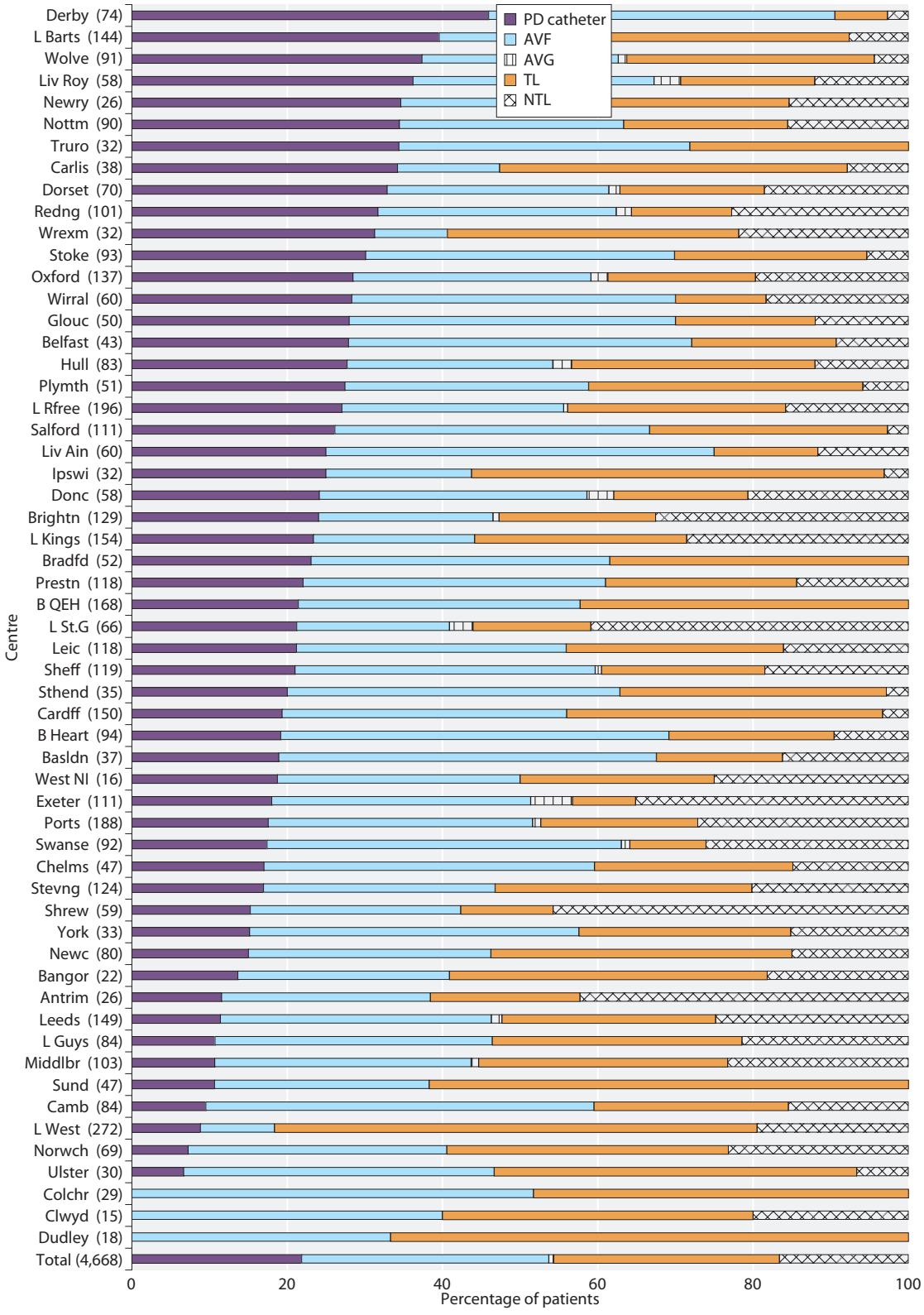

Fig. 10.6. Type of first dialysis access stratified by centre
PD = peritoneal dialysis; AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line

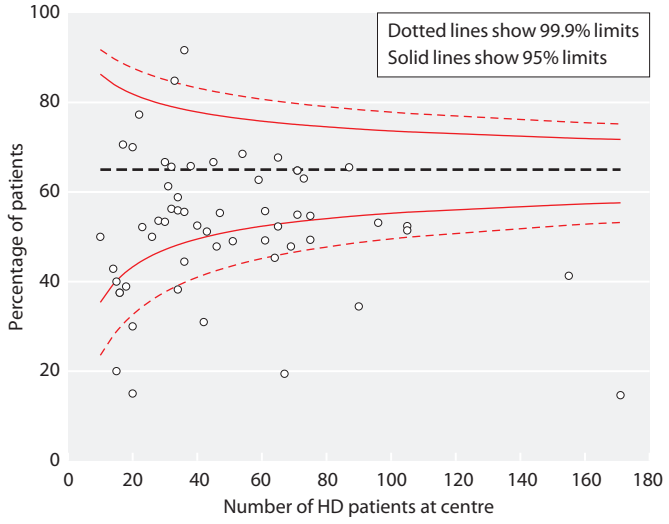

Fig. 10.7. Funnel plot of the percentage of HD patients who commenced dialysis using an AVF

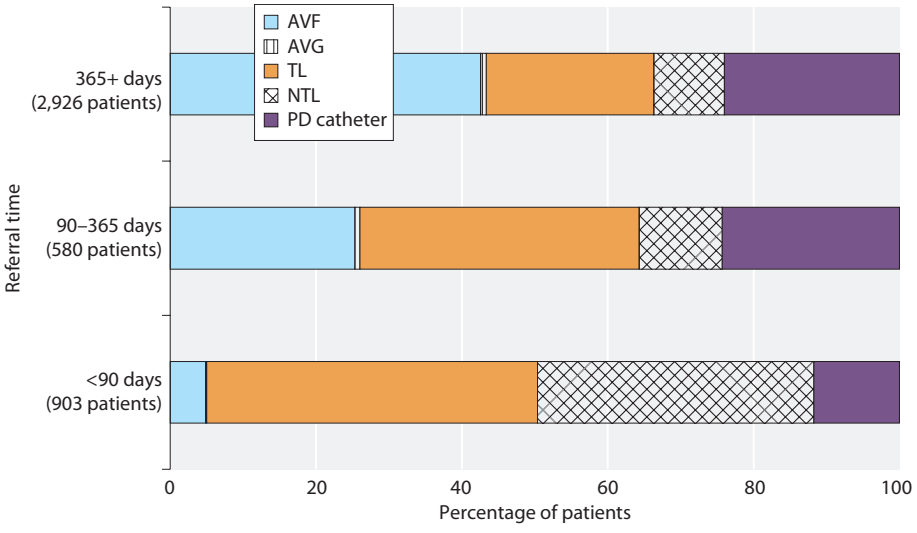

Fig. 10.8. Type of first dialysis access by referral time

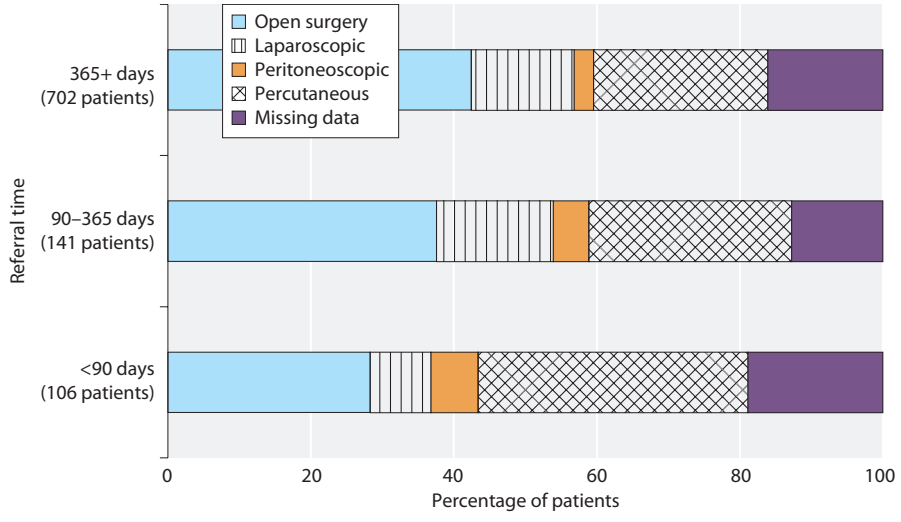

Fig. 10.9. PD catheter insertion technique by referral time

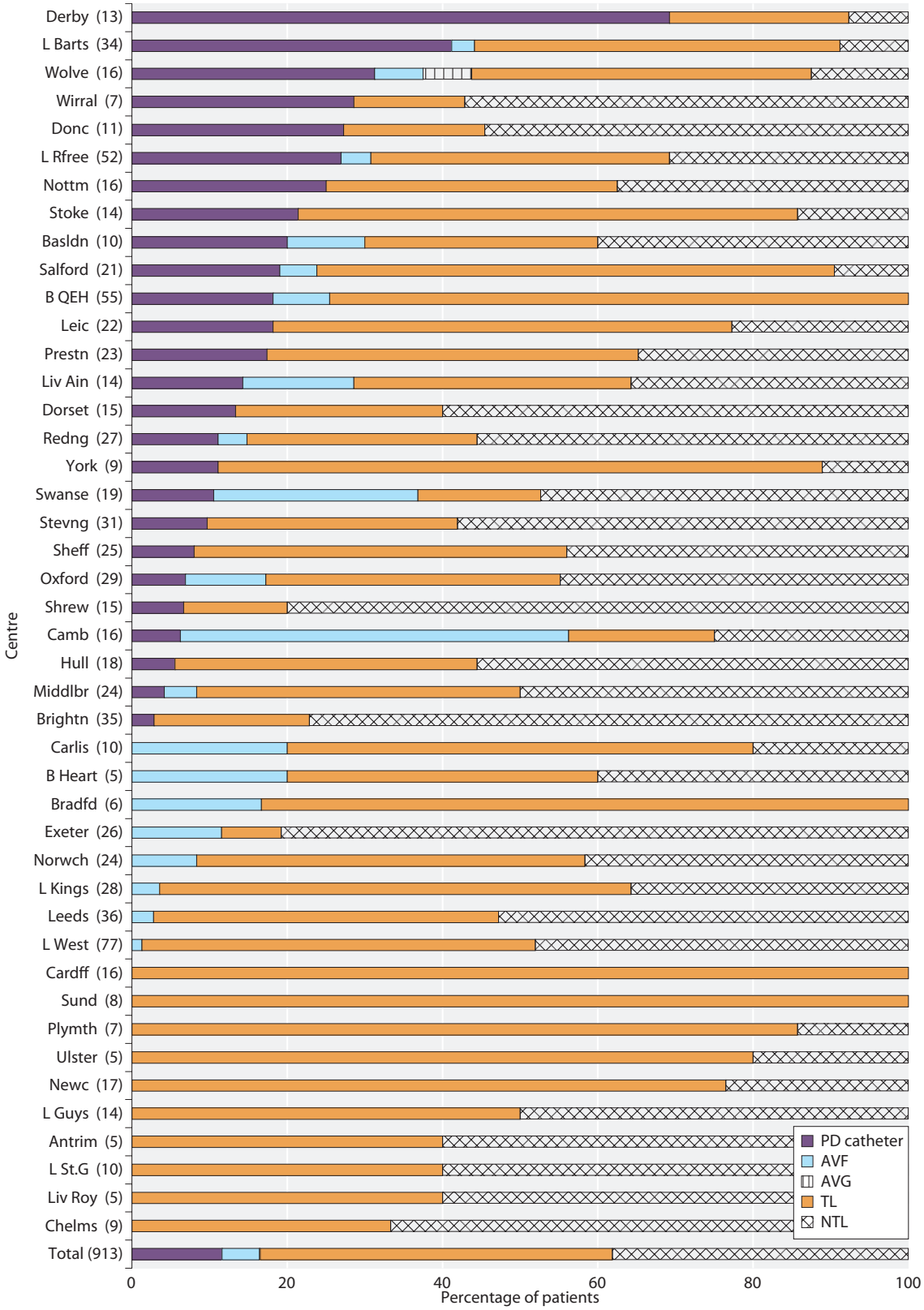

Fig. 10.10. Type of access used for first dialysis in patients presenting to a nephrologist <90 days prior to dialysis start
PD = peritoneal dialysis; AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line

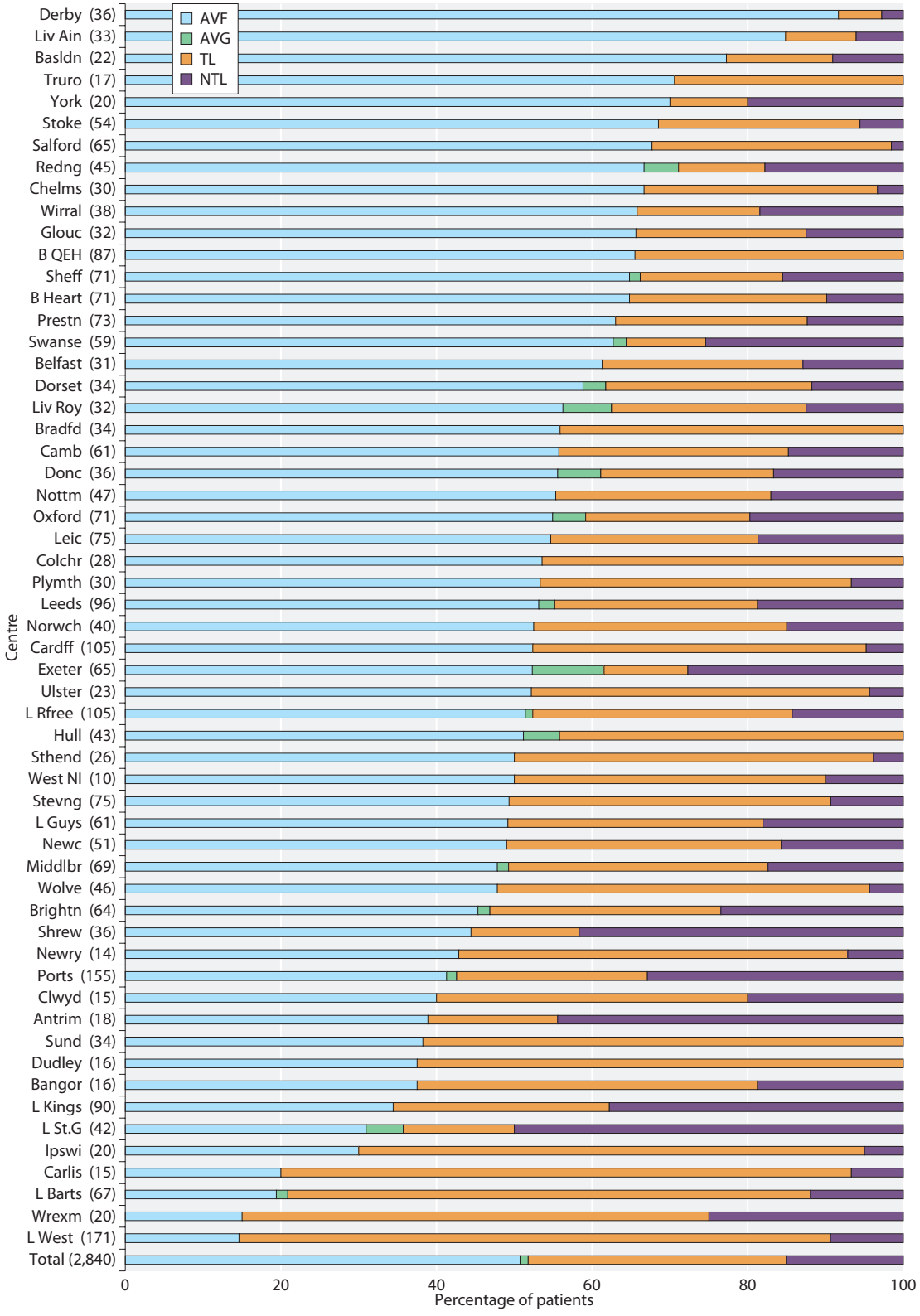

Fig. 10.11. Type of first access for haemodialysis stratified by centre restricted to patients presenting to a nephrologist ⩾90 days prior to start
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line

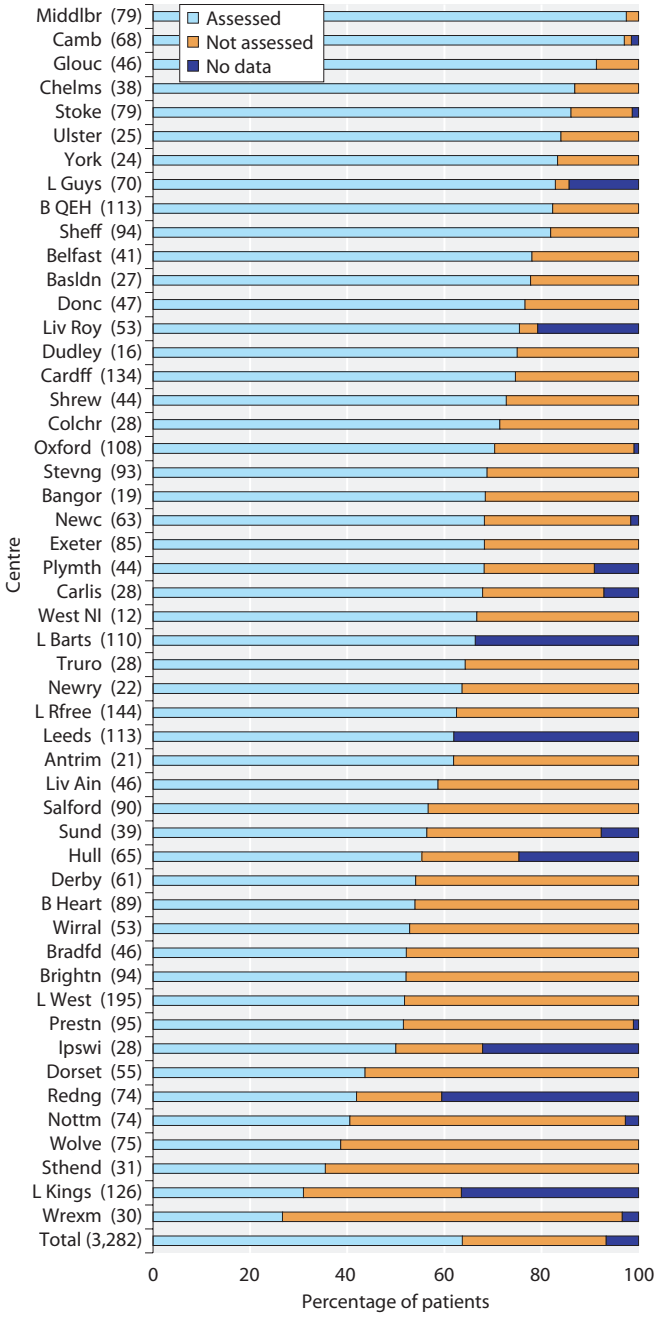

Fig. 10.12. Frequency of surgical assessment more than three months prior to starting dialysis

variation between the renal centres. Overall, the proportion referred to a surgeon was highest in Middlesbrough (97.5%), Cambridge (97%) and Gloucester (91.3%). A detailed understanding of factors that prevent patients from being assessed for access in a timely fashion is required. These may reflect organisational factors or clinical uncertainty around the need for dialysis.

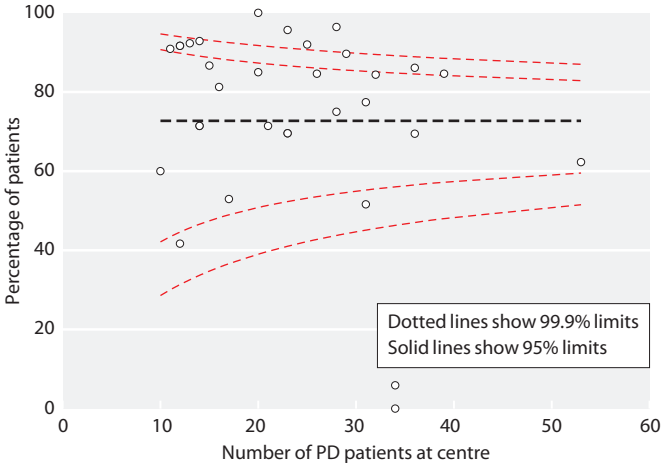

Fig. 10.13. Funnel plot of the percentage of patients with PD catheter insertion >2 weeks before starting dialysis

Renal Association Peritoneal Access Clinical Guidelines state that [4]:

'Whenever possible, catheter insertion should be performed at least 2 weeks before starting peritoneal dialysis. Small dialysate volumes in the supine position can be used if dialysis is required earlier.'

Figure 10.13 shows the variation in centres according to whether PD catheters were inserted at least two weeks prior to commencing dialysis. Thirty of the 32 centres had over 40% of patients with their PD catheters inserted at least two weeks prior to commencement of dialysis. Nottingham, Belfast, Derby and Wolverhampton were 2 standard deviations below the mean, probably because these centres carry out PD catheter insertion in late presenters. This guideline was intended to reduce the risk of dialysate leakage following catheter insertion, however it may actually have resulted in patients being less likely to use the PD catheter for early start PD and therefore possibly be exposed to the hazards of a central venous line. It is quite possible that this guideline has been a disincentive to using PD for patients presenting late or for acute kidney injury and revision should be considered in the next iteration of the guideline.

In the 2013 audit returns a greater proportion of patients who received surgical assessment at least three months prior to commencing dialysis underwent open surgical insertion (53.3% vs. 39.2%) compared to those who did not (figure 10.14).

Figure 10.15 demonstrates a strong relationship between being assessed by a surgeon at least three months before starting dialysis and the likelihood of starting on an AVF. This relationship was much stronger than that

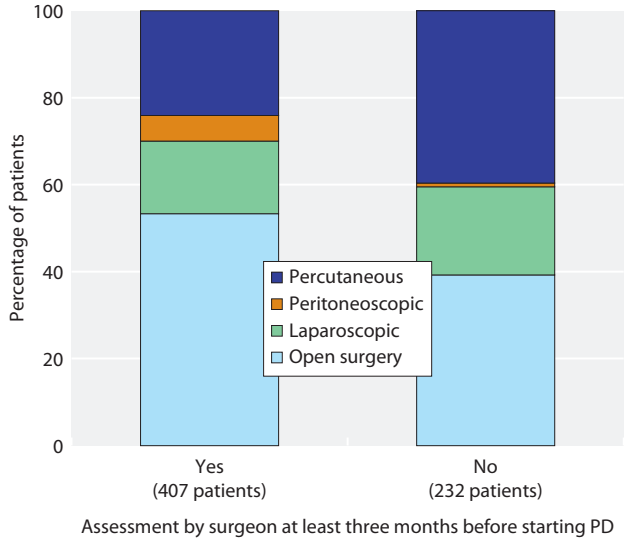

Fig. 10.14. PD catheter insertion technique stratified by surgical assessment

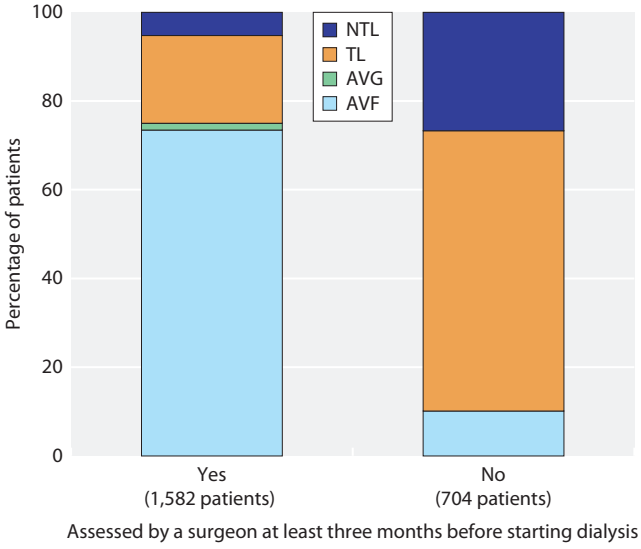

Fig. 10.15. Type of haemodialysis access stratified by surgical assessment
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line

between surgical assessment and method of PD catheter placement. This suggests that the role of surgical assessment was more important in relation to AVF placement. Of those assessed by a surgeon at least three months prior to starting dialysis, 73.5% started dialysis on an AVF whereas of those who were not seen by a surgeon only 10.1% did. Clearly, timely surgical assessment is a key component of the clinical pathway to fistula placement and without such assessment, patients are more likely to require temporary haemodialysis access such as a tunnelled or non-tunnelled dialysis catheter.

The relationship between surgical assessment and AVF formation was very different from that of PD catheter placement. It is quite possible that the time required to plan PD catheter placement is less than that required for AVF formation where vein mapping may be necessary.

Dialysis access at three months after starting RRT

The type of access used three months after starting dialysis gives an important insight into the responsiveness of the access formation pathway. Table 10.4 expresses the proportion of patients still dialysing using a particular form of access as a percentage of the access they originally started dialysis with. For example, 90.3% of patients starting dialysis with an AVF were still using this at three months and 88.4% of patients starting on PD remained on this modality at three months. Of patients starting dialysis via a tunnelled line, the majority continued to use this form of access at three months (76.4%) and of 775 patients who commenced dialysis via a non-tunnelled line, 492 (63.6%) were dialysing through a tunnelled line at three months. This may suggest that obtaining definitive access for HD within three months of starting treatment remains a challenge.

Table 10.4. Type of dialysis access at three months since dialysis start, stratified by first access type

Access in use at first dialysis (*N*)	Access in use at three months (%)								
	AVF	AVG	TL	NTL	PD catheter	Transplanted	Died	Stopped/LTFU	No data
AVF (1,485)	90.3	0.3	3.8	0.5	0.3	1.1	3.4	0.1	0.2
AVG (31)	0.0	90.3	0.0	0.0	0.0	3.2	6.5	0.0	0.0
TL (1,356)	12.9	0.3	76.4	0.1	2.9	1.3	5.3	0.2	0.7
NTL (775)	7.4	0.4	63.6	13.0	6.3	0.5	7.7	0.4	0.6
PD (1,021)	0.5	0.0	4.7	0.7	88.4	1.7	2.2	0.0	1.9

AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis; LTFU = lost to follow up

Figure 10.16 demonstrates the differences in access outcomes stratified by centre. By three months, 36% of patients were dialysing using an AVF (range 10% London West to 67% Colchester); 0.9% were using an AVG (0% many sites to 10% Exeter); 37% tunnelled lines (4% Liverpool Aintree to 79% London West); 3% non-tunnelled lines; and 23% were using a PD catheter (0% Colchester, Basildon, Dudley to 44% Derby).

Access at 3 months in patients referred to renal centres <90 days before starting dialysis was analysed. Only 41 centres were included in this analysis. The majority (71%) of patients presenting late were being dialysed using tunnelled lines at three months after dialysis start (figure 10.17). The between centre range was from 8% in Derby to 100% at Chelmsford and Sunderland. Amongst patients presenting late, only 11% were using an AVF at three months (individual centres ranged from 0% in nine centres to 42% in Exeter). PD catheters were used by 14% of patients (range 0% in 12 centres to 67% in Derby). It is interesting to note that in some centres late presentation is not always associated with poor start to a patient's dialysis pathway. These percentages must be interpreted with caution as reported numbers of patients presenting late tended to be low in many centres. Also further investigation is needed to review if patients who are dialysed via a tunnelled line at three months have a worse outcome compared to their counterparts who dialyse via AVF.

Figure 10.18 shows access in use at start of dialysis and at three months after commencing dialysis, displayed for all patients and also restricted to patients presenting late. There was a small increase in the proportion of patients dialysing with an AVF at three months for all patients (31.8% to 36.1%). The increase was higher in the late presenters from 4.8% to 11.2%. Use of a tunnelled line increased at three months in all patients (8.4%) and in late presenters (25.6%) respectively. This is clearly as a result of conversion from non-tunnelled line to tunnelled line. PD catheter use saw only a small increase for all patients (1.0%) and for late presenters (2.6%).

Figure 10.19 shows that the use of an AV fistula as the incident access was static between 2011and 2013, with the proportion reported as roughly 38% in each year. Use of an AV graft has fallen from 1.4% to 0.8% over the three year period. Reported use of a tunnelled line, non-tunnelled line and peritoneal dialysis catheter has been static.

Prevalent access

Five centres were excluded from the analysis as the reported prevalent access numbers did not match with the number of prevalent patients at each of the centres in the UKRR database.

The Renal Association guidelines on vascular access for haemodialysis recommends 85% of all prevalent patients on haemodialysis should dialyse using an AV fistula. Twenty-six centres were more than three standard deviations and five centres were more than two standard deviations below this target (figure 10.20). The results have to be again cautiously interpreted due to non-adjustment for any patient related factors.

Figure 10.21 shows type of dialysis access in prevalent patients by centre. Variations were apparent between centres when considering prevalent patients with an AV fistula, ranging from about 40% (Carlisle, Ipswich, London St Bartholemew's) to over 75% (Cambridge, Birmingham Heartlands, Truro). Three centres had over 40% of prevalent patients on a tunnelled or non-tunnelled line (Ulster, Ipswich, Belfast) with two centres (Derby, Truro) at the other end of the spectrum with less than 10% of patients. The use of an AV graft was between 0% and 12% with 35 centres opting to use this.

Use of a PD catheter in prevalent patients varied between 28% at Carlisle and 3% at Ulster (Colchester does not have any PD patients).

The percentage of prevalent patients using each type of dialysis access has not changed in the three years that the access audits have been collected (figure 10.22). Use of an AV fistula has been roughly 60% in each audit and use of PD has been approximately 15%.

Access failure

Figure 10.23 shows comparative access failure for the different access types within three months. Access failure was defined as a documented date of failure/discontinuation recorded within three months of starting dialysis unless a centre comment indicated that it was a planned discontinuation. But there were deficiencies in the way that failure was recorded in this audit. Failure rates were generally higher in the peritoneal dialysis group with failure rates for percutaneous and open surgery at 10.5% and 8.2% respectively. Failure rates were generally around 5% for haemodialysis access.

The number of access failures reported was small, however it can be seen from figure 10.24 that there was relatively poor reporting of the reason for failures. This may reflect the local documentation procedure. Infectious causes were reported as contributing to 10% of access failures of tunnelled lines and 0% for other haemodialysis accesses, and mechanical cause was reported as contributing to 90% of AVF failures.

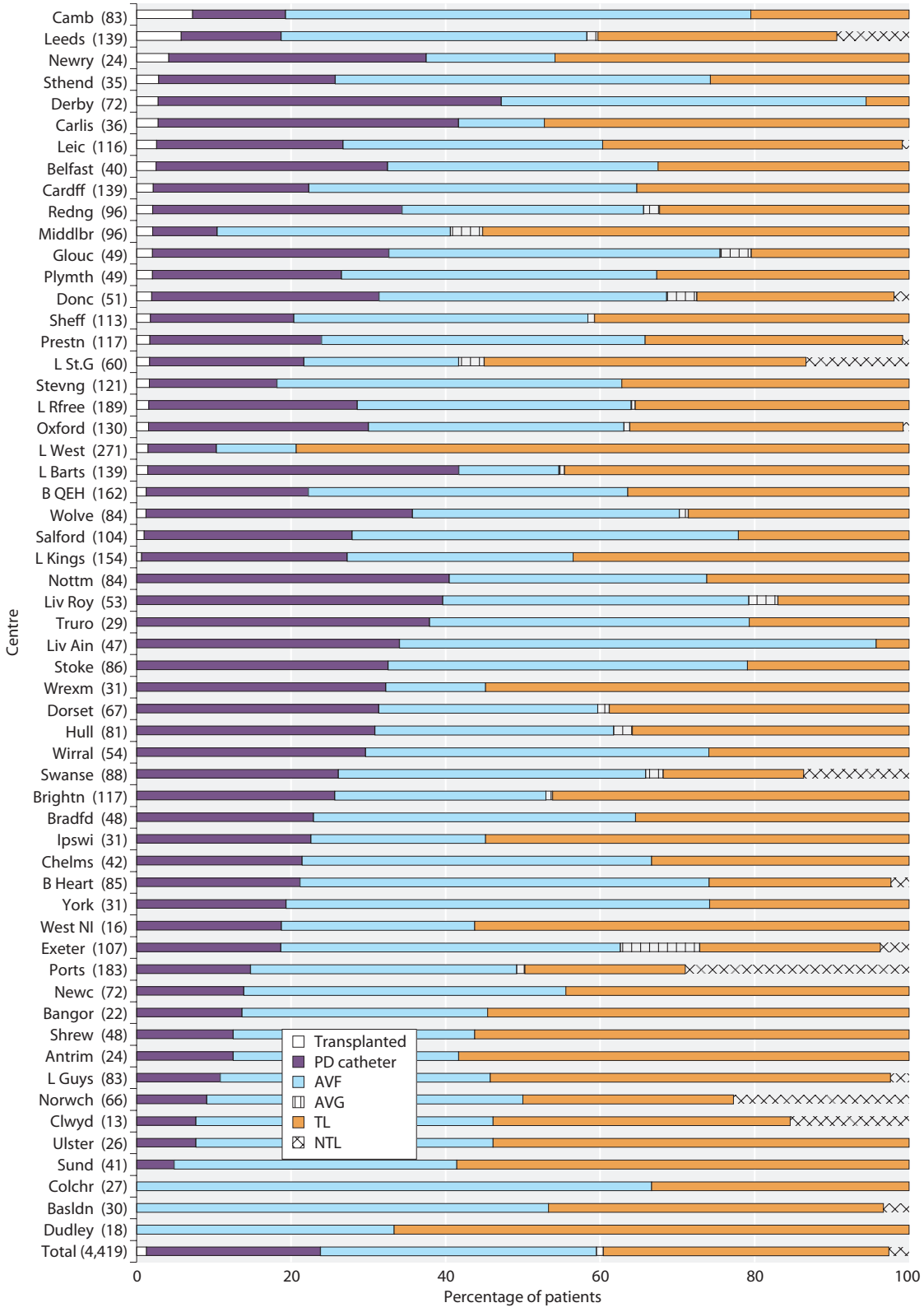

Fig. 10.16. Type of access at three months stratified by centre
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis

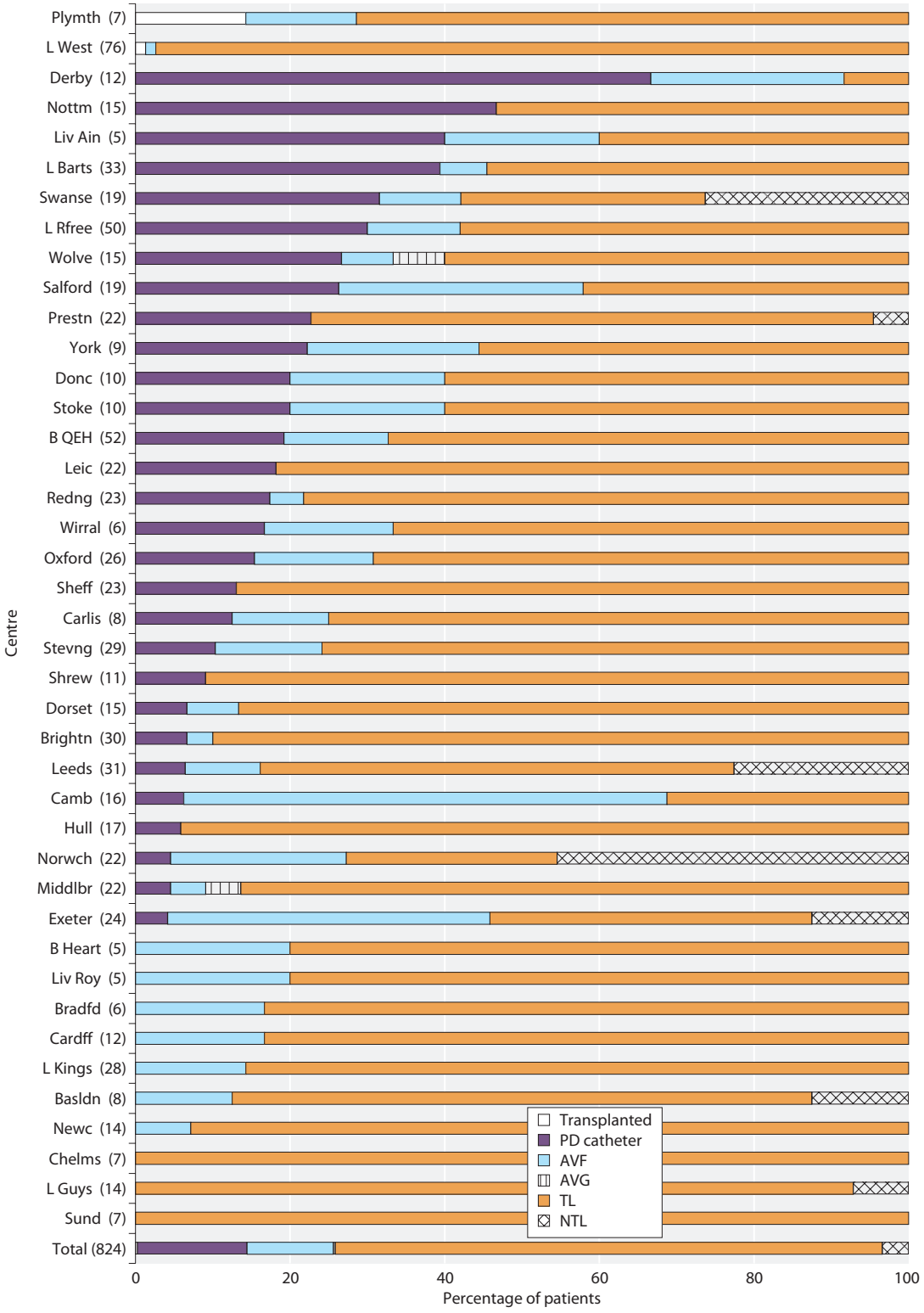

Fig. 10.17. Type of dialysis access at three months in patients referred to renal services <90 days before starting dialysis, stratified by centre

Centres reporting on fewer than five patients were excluded

AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis

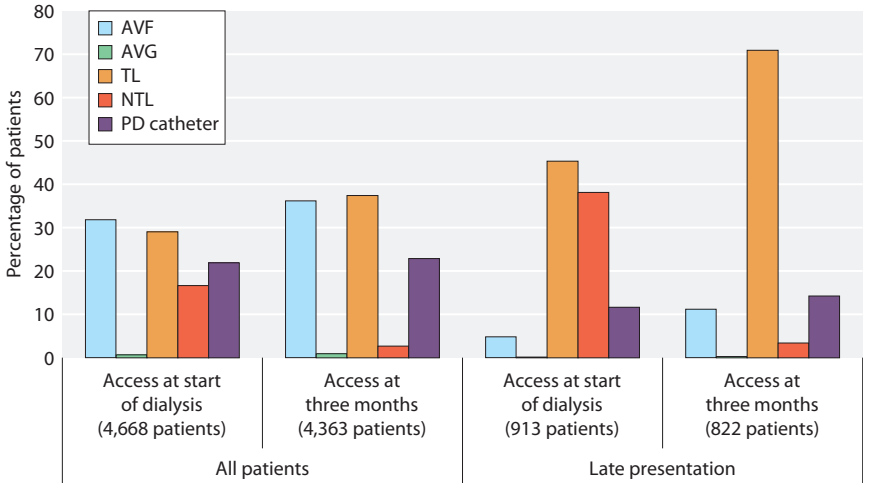

Fig. 10.18. Access in use at start of dialysis and after 3 months for those still on dialysis, displayed for all patients and also restricted to patients presenting late
AVF = arteriovenous fistula;
AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line;
PD = peritoneal dialysis

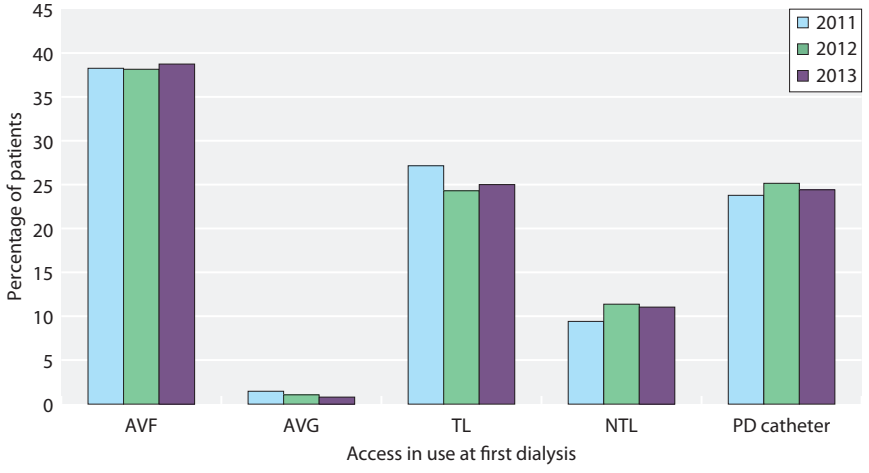

Fig. 10.19. Percentage trend in incident dialysis access use at first dialysis
AVF = arteriovenous fistula;
AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line;
PD = peritoneal dialysis

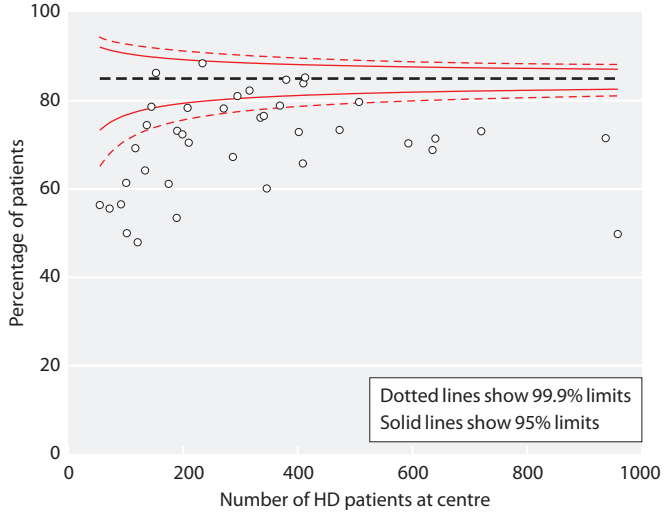

Fig. 10.20. Funnel plot of the percentage of prevalent HD patients dialysing using an AVF

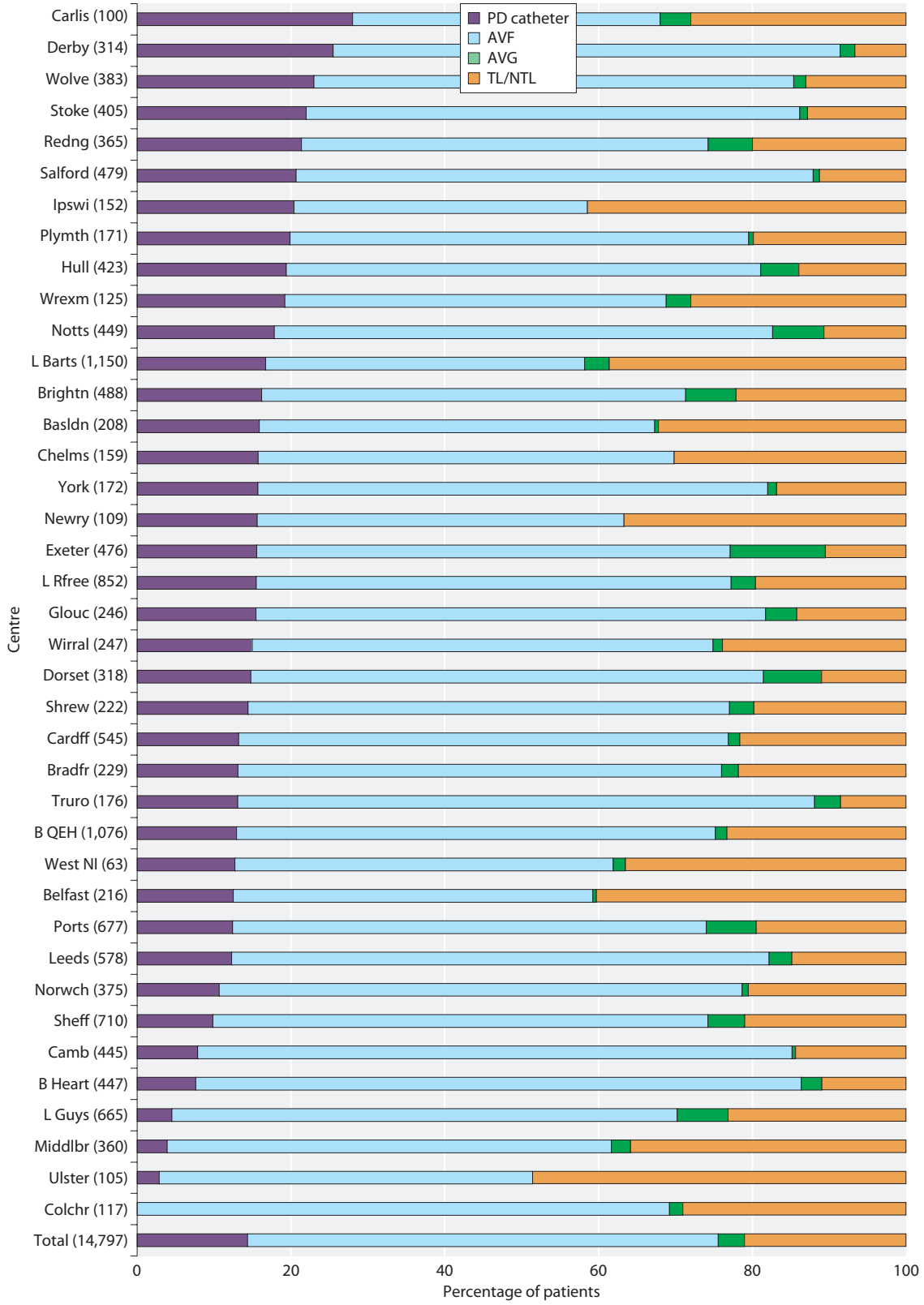

Fig. 10.21. Type of dialysis access in prevalent patients stratified by centre
PD = peritoneal dialysis; AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line

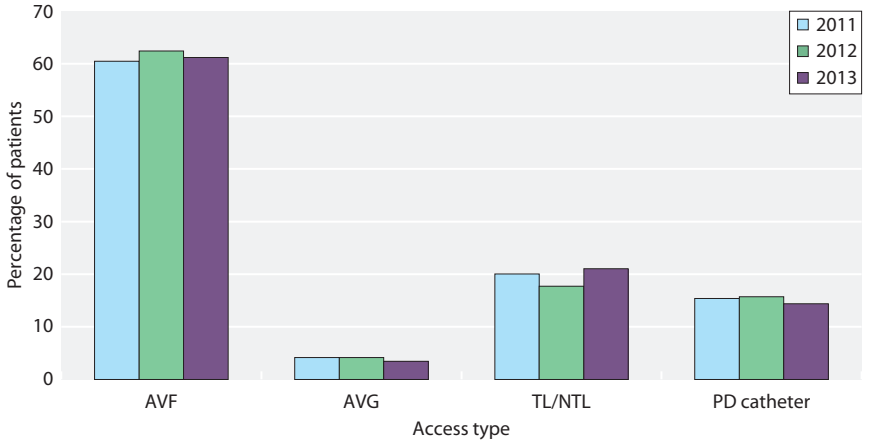

Fig. 10.22. Percentage of prevalent dialysis patients with each access type, by year
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis

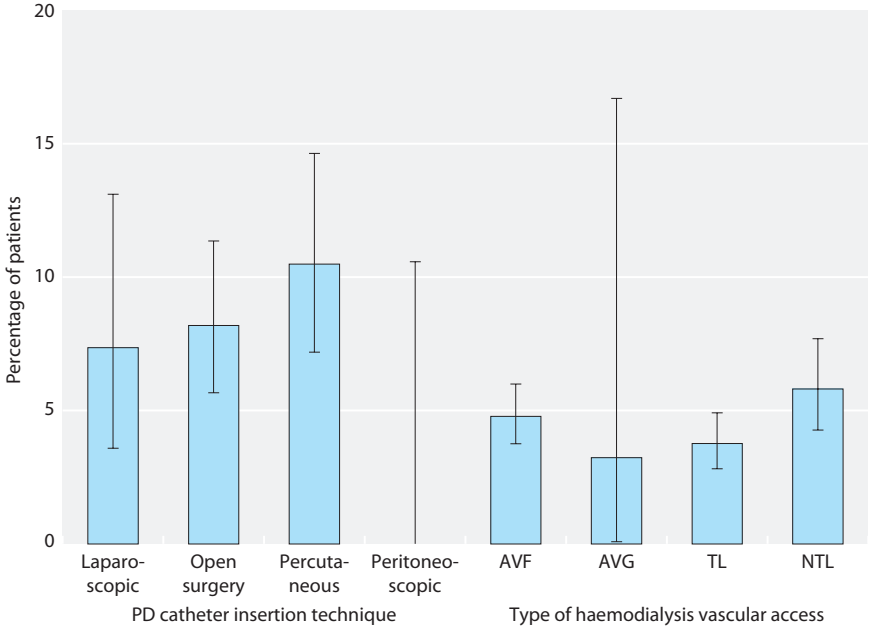

Fig. 10.23. Percentage of patients experiencing failure of first access within three months, by type of first access
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis

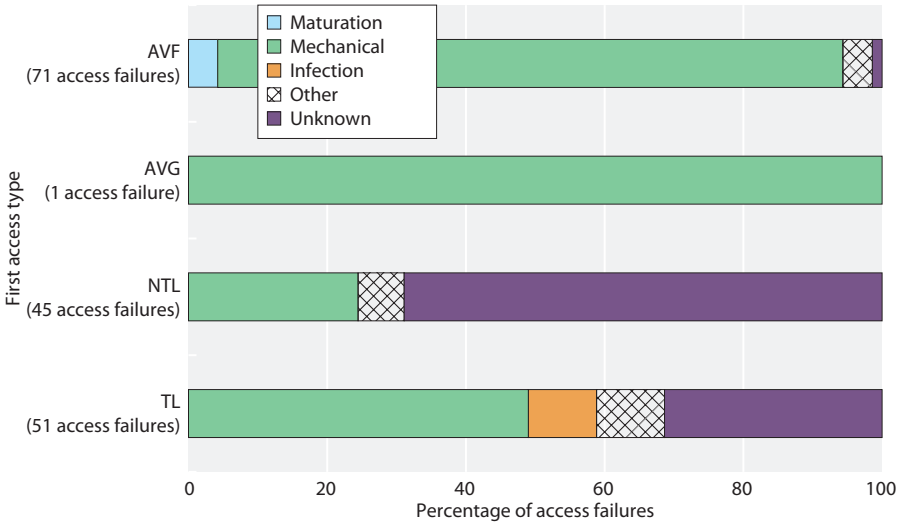

Fig. 10.24. Reported causes of haemodialysis access failure within three months stratified by first access type
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line

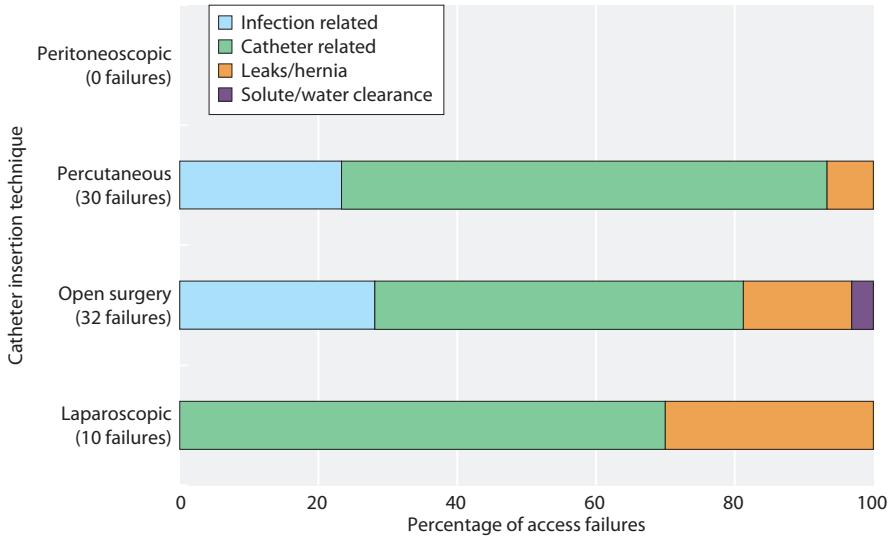

Fig. 10.25. Reported causes of peritoneal dialysis access failure within three months stratified by catheter insertion technique

Again, numbers of PD access failure were small and hence drawing any inferences is difficult. However, it can be seen from figure 10.25 that peritoneoscopic technique had no documented failures within three months. Catheter related cause ranged from 53% to 70% of PD failure for each of the three other listed insertion techniques. Failure associated with leaks or hernia was highest for laparoscopic insertion. Twenty-seven out of 832 (3.25%) PD patients were reported as experiencing peritonitis within two weeks of catheter insertion (data not shown). This was significantly lower than the national target of 5%.

2012 PD access audit one-year follow-up

Centres who reported on PD patients in the 2012 vascular and peritoneal access audits were asked to complete a one year follow up of their PD patients. The additional information requested was the date of catheter failure, the reason for catheter failure, the number of catheters used during the year, and the modality in use at one year after starting PD. Of 50 centres who reported data on PD patients in 2012, 28 completed the one year follow up, returning data on 522 (56%) patients.

In these patients, 290 (55.5%) were still on PD at one year with 88.3% of these (256/290) on their first catheter.

The majority of centres maintained >50% of patients on PD at one year, however only four centres maintained >80% on PD at one year. Modality change to haemodialysis varied from 0% (Antrim, Newry, Doncaster) to 43% (Sunderland, Chelmsford). For patients who started on PD in 2012, transplantation varied at centres from 0% to 55% (figure 10.26).

Causes of PD access failure within one year of starting on PD were analysed. The reported numbers were too low to draw firm conclusions. Unsurprisingly the principal causes of catheter failure were mechanical or infection related (figure 10.27).

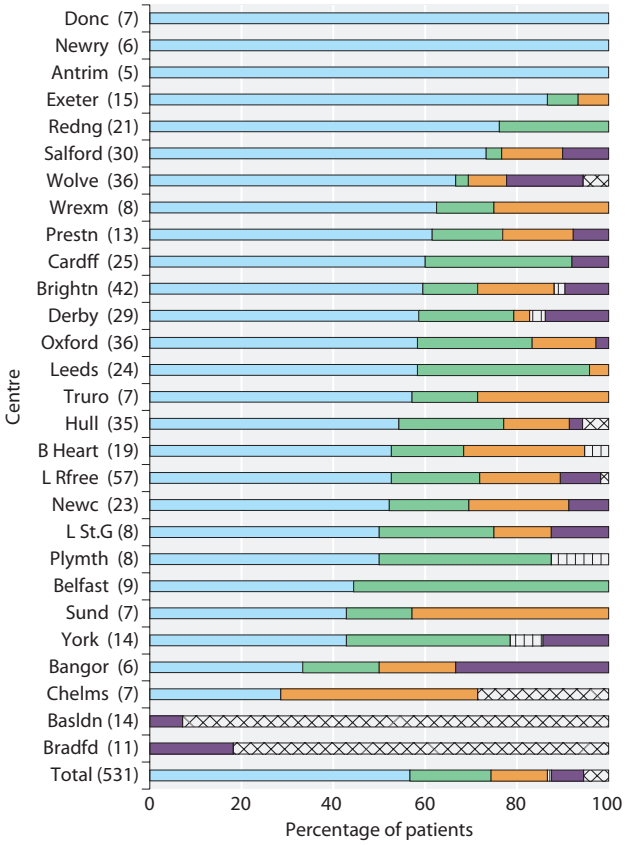

Fig. 10.26. Modality at one year after commencing PD, by centre

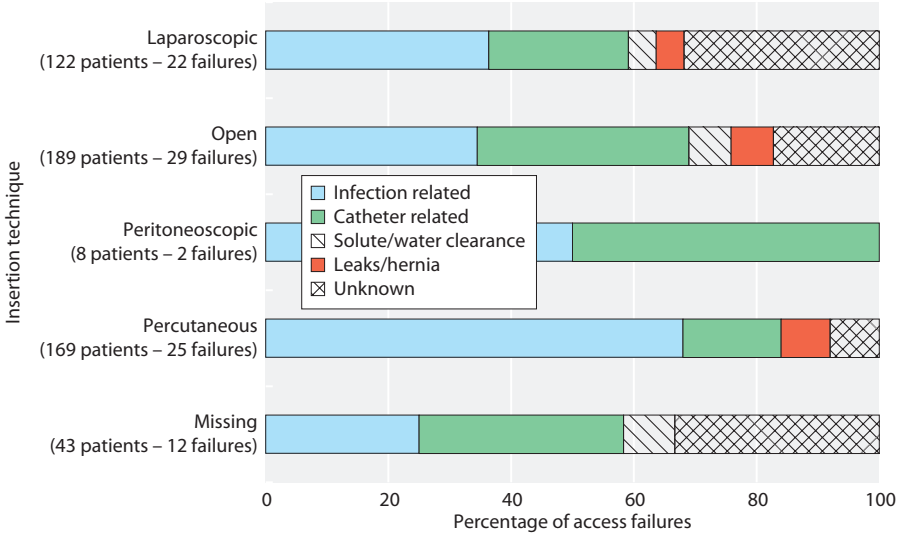

Fig. 10.27. Causes of PD access failure within one year of PD catheter insertion

Figure 10.28 is a funnel plot which graphically displays the unadjusted percentage of PD patients experiencing a catheter failure within one year of commencement of RRT across multiple renal centres. PD catheter failure was censored for transplantation, elective transfer to HD or death. The results have to be cautiously interpreted due to the extent of and variation in missing data, small numbers of patients in some centres and non-adjustment for any patient related factors.

Of the centres for which data were available ($n = 17$), no outlier centres were identified with failure rates above the upper 95% 'alert' or 99.9% 'alarm' limits for PD catheter failures. One renal centre reported one-year catheter failure rate below the 95% control limit. The mean one-year catheter failure rate was 17% which was below the rate recommended in the guidelines issued by the ISPD/RA (23% and 20% respectively).

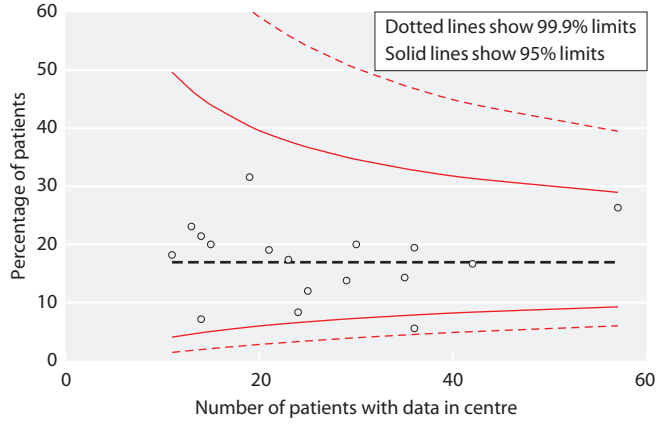

Fig. 10.28. Funnel plot of the percentage of PD catheter failures within one year of insertion

Conclusions

This second multisite dialysis access audit from England, Wales and Northern Ireland has provided important information regarding the variation in access provision and failure. Data collection is still not optimal as significant amounts of missing data across a range of fields exist. Several operational definitions need to be refined for further audit collections. As over a fifth of haemodialysis patients start dialysis on a non-tunnelled line, it may be preferable to collect dialysis access at the fourth week as well as the first dialysis session since both non-tunnelled and tunnelled catheters are often used before more permanent access is placed (PD catheter, AVG or AVF). Of concern is that tunnelled lines continued to be used in approximately a third of patients three months post dialysis start and this figure was higher for patients presenting late. The practice of PD catheter insertion in patients presenting late was used by relatively few centres. Only 13 out of 43 centres with sufficient data on patients presenting late placed a peritoneal dialysis catheter in more than 15% of patients as first dialysis access. It was also interesting to note that in some centres late presentation was not always associated with poor start to a patient's dialysis pathway.

Surgical assessment was key to formation of permanent vascular access (AVF/AVG), 73% started dialysis on an AVF whereas of those who were not seen by a surgeon only 10% did. Twenty-four centres were 2 or 3 standard deviations below the 65% target for incident patients starting haemodialysis on AVF and 31 centres were below the 85% target for prevalent haemodialysis patients on AVF. The vascular access clinical practice guidelines are due for review this year and the authors need to reconsider whether these current standards should be changed. Further analyses are being planned to explore why there is such a wide variation in access provision between centres and whether the type of vascular access in use at dialysis start explains the different outcomes.

Acknowledgement

Thanks are expressed to the Healthcare Quality Improvement Partnership (HQIP) who contributed to the funding of the PD access audit and all renal centres for their assistance in providing the data.

Conflicts of interest: none

References

1 Briggs V, et al.: UK Renal Registry 15th annual report: Chapter 8 UK multisite peritoneal dialysis access catheter audit for first PD catheters 2011. Nephron Clin Pract, 2013;123(Suppl 1):165–81

2 NHS Information Centre. National Kidney Care Audit Vascular Access Report: 2011 [cited 2013 1st October]. Available from: http://www.hqip.org.uk/assets/NCAPOP-Library/VAReport2011Interactive03082011–FINAL.pdf

3 Fluck R, Kumwenda Dr M: Renal Association Vascular Access for Haemodialysis clinical guidelines, 2011. Available from: http://www.renal.org/guidelines/modules/vascular-access-for-haemodialysis#sthash.8TAwquhO.dpbs

4 Wilkie M, Jenkins S, Shrestha B: Renal Association Peritoneal dialysis access clinical guidelines. 2009. Available from: http://www.renal.org/guidelines/modules/peritoneal-access#sthash.xqAutugK.dpbs

UK Renal Registry 17th Annual Report: Chapter 11 Centre Variation in Access to Renal Transplantation in the UK (2008–2010)

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Key Words
Centre variation · Comorbidity · Donor after brainstem death · Donor after cardiac death · Equity of access · Living kidney donor · Outcomes · Patient factors · Quality improvement · Renal transplantation · Transplant waiting list

Summary

- A patient starting dialysis in a non-transplanting renal centre was less likely to be registered for transplantation (OR (odds ratio) 0.74, 95% CI 0.68–0.81) compared with a patient treated in a transplanting renal centre.
- A patient starting dialysis in a non-transplanting renal centre was less likely to receive a transplant from a donor after cardiac death or a living kidney donor (OR 0.75, 95% CI 0.67–0.84) compared with a patient treated in a transplanting renal centre.
- Once registered for kidney transplantation, patients in both transplanting and non-transplanting renal centres had an equal chance of receiving a transplant from a donor after brainstem death (OR 0.93, 95% CI 0.78 to 1.10).
- After adjustment for case mix, this analysis identified significant centre differences for the probability of being activated on the kidney transplant waiting list ($p < 0.0001$) and the probability of receiving a renal transplant from a donor after brainstem death ($p = 0.0003$) or a donor after cardiac death/living kidney donor ($p < 0.0001$).

Introduction

For 'suitable' patients with established renal failure, renal transplantation confers both better quality of life and life expectancy than dialysis [1–3] and is the preferred modality of renal replacement therapy. Achieving prompt and timely activation on the waiting list is important not least because increasing length of time on dialysis adversely affects graft and patient survival, but also because the current organ allocation algorithm introduced in April 2006 takes time spent on the waiting list into account when allocating deceased donor kidneys in the UK [4]. Thus, centres that achieve earlier listing for transplantation provide an advantage for their patients compared with centres that take longer.

This analysis aims to evaluate whether equity of access to the renal transplant list exists for patients with end stage renal disease across the UK, whether centres differ in the time taken to activate suitable patients on the waiting list and whether equity exists in the receipt of a renal transplant once the patient is on the transplant list (that is, the conversion efficiency from being on the waiting list to receiving a transplant). Patient specific and independent variables that influenced access to the waiting list or transplantation were analysed.

Methods

Study population

All adult patients starting renal replacement therapy ($N = 20{,}076$) between 1st January 2008 and 31st December 2010 in renal centres ($N = 71$) returning data to the UK Renal Registry (UKRR) were considered for inclusion. For the analysis of the proportion of a centre's patients included on the waiting list, patients aged 65 years or above ($n = 9{,}908$), patients with inappropriate activation and early suspension as described below ($n = 55$) and patients listed for multi-organ transplants other than pancreas ($n = 34$) were excluded, resulting in a final cohort of 10,079 patients. These patients were followed to 31st December 2012 or until they were put on the waiting list for kidney transplant alone, kidney plus pancreas transplant, or death, whichever was earliest. For the analysis of the proportion transplanted, all patients from the incident cohort who were activated on the waiting list before 31st December 2011 ($N = 5{,}239$) were followed until 31st December 2013, to estimate the proportion transplanted with a kidney alone or kidney plus pancreas within two years of inclusion on the waiting list.

Exclusions

Patients listed for multi-organ transplants other than pancreas were excluded as were those who were suspended for more than 30 days within 90 days of first activation. The latter avoided any potential bias from centres that may activate patients on the transplant list and then immediately suspend them before more permanent activation at a later date after more formal medical assessment of the patient's fitness.

Data analysed

Information on start date of renal replacement therapy and relevant patient level data including age (grouped as 18–29, 30–39, 40–49, 50–59, 60–64), gender, ethnicity (White, non-White, missing) and (primary renal diagnosis (PRD) classified as: patient with diabetes, patient without diabetes, missing) came from the UKRR. The date of activation on the kidney transplant waiting list, date of transplantation, or both came from the UK Transplant Registry held by the Organ Donation and Transplantation Directorate of NHS Blood and Transplant.

Statistical methods

A logistic regression model was developed to identify the influence of patient specific variables including age, gender, ethnicity and PRD, on the probability of access to the transplant list and receipt of a transplant once on the waiting list. After adjusting for patient specific variables, the percentage of patients activated on the transplant list and the percentage of patients on the waiting list who achieved a transplant in each centre was determined. The overall effect of the centre associated with each analysis was assessed by including renal centre as a random effect in the risk-adjusted logistic regression model. The extent of variation between centres was determined by using a log likelihood ratio test that provided the change in the value of -2 LogL on inclusion of the random centre effect. SAS 9.4 was used for analyses; a p value of less than 5% was considered significant.

To analyse access to the transplant list, the proportion of incident patients with end stage renal disease in each centre who were subsequently activated on the waiting list within two years of starting renal replacement therapy (RRT) was identified. All patients who achieved live donor transplantation without prior activation on the national transplant waiting list were assumed to have been activated for the purposes of this analysis. Time to activation on the waiting list was defined as the interval between the start of RRT and the date of activation on the waiting list. Patients achieving pre-emptive deceased donor transplantation were considered to have been activated on the same day as starting RRT i.e. a time to activation of zero days. Patients achieving pre-emptive live donor transplantation without prior activation on the national transplant list were considered to have been 'active' on the list for an arbitrary time of six months. This was to take into account an average of six months required by most centres to complete live donor fitness evaluation and hence the likelihood that the intended recipient was considered fit for transplantation (and by inference suitable to be active on the waiting list) for that duration. This was done to account for different centre practices with regard to listing patients on the deceased donor list prior to receiving a living donor transplant.

The median time to activation was estimated from the Kaplan-Meier plot for patients at each renal centre, with the event as the date of activation and censoring at death or on 31st December 2012, whichever was earlier. Data from patients who did not achieve activation were included in the calculation of median times using this method, thus providing a meaningful estimate of the true time to activation. Including only those patients activated would produce

a biased estimate. The overall centre effect associated with time to activation was calculated by including renal centre as a variable in a risk-adjusted Cox regression model.

To analyse the difference between centres in renal transplantation once listed, the percentage of patients activated on the waiting list who received a renal transplant within two years of being activated was estimated (conversion efficiency). The conversion efficiency for receiving a transplant from a donor after brainstem death or a donor after cardiac death/living kidney donor was analysed separately. Receipt of a kidney from a donor after brainstem death was predominantly influenced by national allocation policy, whereas receipt from a donor after cardiac death/live donor kidney was much more dependent on local transplant centre practices. For the cohort under consideration, donor after cardiac death transplantation was predominantly a locally managed service.

Funnel plots are used to present the results for each outcome of interest, providing a visual comparison of each centre's performance compared with its peers. Where relevant, the funnel plots are adjusted for patient specific variables influencing that outcome. The solid black straight line in each funnel plot shows the overall average together with the 95% and 99.8% confidence intervals, which correspond to two and three standard deviations from the mean. Each point on the plot represents one renal centre. With 71 centres included, for each outcome of interest, three centres would be predicted to fall between the 95% and 99.8% confidence intervals and no centre should fall outside the 99.8% confidence interval. Centres ($n = 3$) with fewer than 10 patients activated on the waiting list are not included in the funnel plots.

The analysis methodology described above is identical to a previous independent peer reviewed publication [5].

Results

The results of the logistic regression model analysis of patient characteristics influencing access to the waiting list are presented in table 11.1. Ethnicity data were missing for 11% of patients and PRD for 6% of patients.

Tables 11.2 and 11.3 show the results of the logistic regression analysis of factors influencing the likelihood of receiving a transplant from a donor after brainstem death and the analysis of factors influencing receipt of a transplant from a donor after cardiac death or a living kidney donor. Ethnicity data were missing for 8.1% of patients and PRD for 6.1% of patients (table 11.3).

A patient starting dialysis in a non-transplanting renal centre was less likely to be registered for transplantation (OR 0.74, 95% CI 0.68–0.81) or receive a transplant from a donor after cardiac death or a living kidney donor (OR 0.75, 95% CI 0.67–0.84) compared with patients managed in transplanting renal centres. Once registered for kidney transplantation, patients in both transplanting and non-transplanting renal centres had an equal chance of receiving a transplant from a donor after brainstem death (OR 0.93, 95% CI 0.78–1.10).

After adjusting for patient specific variables that were shown to influence outcome (age, ethnicity, gender, PRD), significant centre effects were identified for the probability of being activated on the waiting list (figure 11.1, table 11.4) (change in $-2\,\text{logL} = 188.6$, df (degrees of freedom) $= 1$, $p < 0.0001$).

After adjustment for patient variables, significant centre differences were seen in the probability of receiving a renal transplant from a donor after brain stem death (figure 11.2, table 11.5) (change in $-2\,\text{logL} = 13.3$, $\text{df} = 1$, $p = 0.0003$) or a donor after cardiac death/living kidney donor (figure 11.3, table 11.5) (change in $-2\,\text{logL} = 136.1$, $\text{df} = 1$,

Table 11.1. Patient factors influencing activation on the national kidney transplant waiting list within two years of RRT start

Factor	Category (at baseline)	Patients *N* (%)	Odds ratio	95% CI	*P* value
Age	(18–29)	899 (8.9)	1	ref	n/a
	30–39	1,425 (14.1)	1.06	0.88–1.27	0.57
	40–49	2,400 (23.8)	0.70	0.59–0.83	<0.0001
	50–59	3,239 (32.1)	0.36	0.31–0.43	<0.0001
	60–64	2,116 (21.0)	0.20	0.17–0.24	<0.0001
Ethnicity	(White)	6,697 (66.5)	1	ref	n/a
	Non-White	2,274 (22.6)	0.80	0.72–0.89	<0.0001
	Missing	1,108 (11.0)	0.50	0.43–0.57	<0.0001
Gender	(Male)	6,086 (60.4)	1	ref	n/a
	Female	3,993 (39.6)	0.95	0.88–1.04	0.28
PRD	(Non-diabetic)	7,017 (69.6)	1	ref	n/a
	Diabetic	2,455 (24.4)	0.44	0.40–0.49	<0.0001
	Missing	607 (6.0)	0.84	0.71–1.00	0.06

ref – reference category, n/a – not applicable

Table 11.2. Patient factors affecting the probability of receiving a transplant from a donor after brainstem death within two years of registration on the national kidney transplant waiting list

Factor	Category (at baseline)	Patients *N* (%)	Odds ratio	95% CI	*P* value
Age	(18–29)	646 (12.3)	1	ref	n/a
	30–39	1,014 (19.4)	1.05	0.80–1.38	0.7
	40–49	1,457 (27.8)	0.78	0.60–1.01	0.06
	50–59	1,444 (27.6)	0.40	0.30–0.54	<0.0001
	60–64	678 (12.9)	0.23	0.15–0.35	<0.0001
Ethnicity	(White)	3,639 (69.5)	1	ref	n/a
	Non-White	1,176 (22.5)	0.65	0.52–0.81	0.0001
	Missing	424 (8.1)	1.05	0.78–1.40	0.7
Gender	(Male)	3,180 (60.7)	1	ref	n/a
	Female	2,059 (39.3)	1.32	1.11–1.56	0.002
PRD	(Non-diabetic)	4,045 (77.2)	1	ref	n/a
	Diabetic	874 (16.7)	3.79	3.13–4.57	<0.0001
	Missing	320 (6.1)	1.04	0.71–1.52	0.8

ref – reference category, n/a – not applicable

$p < 0.0001$). As shown, several centres fall outside the 95% and 99.8% confidence intervals.

Figure 11.4 and table 11.6 show the unadjusted median time taken to activate patients on the transplant list for each renal centre.

The funnel plot is based on the assumption of an exponential distribution for time to activation. Although this assumption is broadly consistent with the data, the model based estimate of the national median was greater than that observed. This leads to an unusually large number of centres falling outside the lower 99.8% confidence limit for this national rate and perhaps too few occurring outside the upper limit. However, the plot highlights those centres that have significantly longer time to activation but small numbers on the waiting list. The Cox model giving a risk-adjusted analysis of time to activation identified a significant effect of centre variation (change in $-2\,\text{logL} = 372.7$, $\text{df} = 70$, $p < 0.0001$). In general, centres with the longest unadjusted waiting times also had the longest risk-adjusted waiting times. The three centres lying outside the upper 99.8% confidence limit all had hazard ratios that indicated a significant delay in the

Table 11.3. Patient factors affecting the probability of receiving a transplant from a donor after cardiac death or living kidney donor within two years of registration on the national kidney transplant waiting list

Factor	Category (at baseline)	Patients *N* (%)	Odds ratio	95% CI	*P* value
Age	(18–29)	646 (12.3)	1	ref	n/a
	30–39	1,014 (19.4)	0.64	0.53–0.79	<0.0001
	40–49	1,457 (27.8)	0.57	0.47–0.70	<0.0001
	50–59	1,444 (27.6)	0.51	0.42–0.62	<0.0001
	60–64	678 (12.9)	0.5	0.40–0.63	<0.0001
Ethnicity	(White)	3,639 (69.5)	1	ref	n/a
	Non-White	1,176 (22.5)	0.51	0.44–0.59	<0.0001
	Missing	424 (8.1)	0.54	0.43–0.67	<0.0001
Gender	(Male)	3,180 (60.7)	1	ref	n/a
	Female	2,059 (39.3)	0.77	0.68–0.86	<0.0001
PRD	(Non-diabetic)	4,045 (77.2)	1	ref	n/a
	Diabetic	874 (16.7)	0.37	0.31–0.44	<0.0001
	Missing	320 (6.1)	1.42	1.13–1.80	0.003

ref – reference category, n/a – not applicable

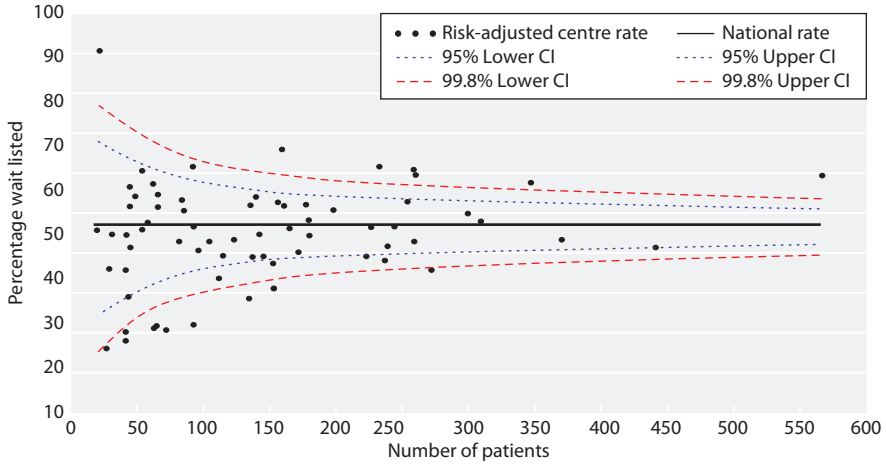

Fig. 11.1. Percentage of patients wait-listed for a kidney transplant by renal centre, prior to or within two years of starting dialysis (centres with <10 patients excluded)

Table 11.4. Percentage of patients wait-listed for a kidney transplant by renal centre, prior to or within two years of starting dialysis

Centre	RRT *N*	Registrations *N*	% wait listed Unadjusted	% wait listed Risk-adjusted	Centre	RRT *N*	Registrations *N*	% wait listed Unadjusted	% wait listed Risk-adjusted
England					Plymth	96	64	66.7	65.9
B Heart	143	65	45.5	44.4	Ports	231	154	66.7	65.1
B QEH	370	181	48.9	48.3	Prestn	221	98	44.3	44.4
Basldn	37	10	27.0	25.2	Redng	157	109	69.4	68.8
Bradfd	111	51	45.9	44.7	Salford	252	145	57.5	56.7
Brightn	135	62	45.9	44.3	Sheff	237	114	48.1	46.7
Bristol	257	130	50.6	47.7	Shrew	61	16	26.2	28.4
Camb	153	91	59.5	56.8	Stevng	177	97	54.8	52.5
Carlis	41	27	65.9	60.4	Sthend	44	25	56.8	58.2
Carsh	270	114	42.2	41.3	Stoke	120	60	50.0	48.3
Chelms	62	35	56.5	58.4	Sund	101	50	49.5	47.8
Colchr	41	23	56.1	55.9	Truro	58	35	60.3	60.9
Covnt	169	79	46.7	45.3	Wirral	89	26	29.2	28.7
Derby	108	41	38.0	39.4	Wolve	131	47	35.9	34.7
Donc	50	30	60.0	64.2	York	50	27	54.0	50.9
Dorset	81	47	58.0	57.4	**N Ireland**				
Dudley	69	19	27.5	27.5	Antrim	40	14	35.0	35.0
Exeter	149	62	41.6	42.9	Belfast	93	43	46.2	45.5
Glouc	82	45	54.9	54.7	Newry	28	13	46.4	49.5
Hull	139	60	43.2	49.5	Ulster	16	7	43.8	50.4
Ipswi	54	30	55.6	52.2	West NI	38	21	55.3	49.2
Kent	175	103	58.9	56.2	**Scotland**				
L Barts	441	206	46.7	46.4	Abrdn	88	46	52.3	64.9
L Guys	298	168	56.4	54.2	Airdrie	78	28	35.9	47.7
L Kings	234	101	43.2	43.3	D&Gall	18	10	55.6	91.6
L Rfree	308	165	53.6	52.2	Dundee	62	25	40.3	55.6
L St.G	158	91	57.6	55.9	Edinb	137	63	46.0	58.1
L West	568	346	60.9	62.9	Glasgw	257	127	49.4	64.3
Leeds	225	120	53.3	51.4	Inverns	37	15	40.5	41.3
Leic	346	216	62.4	61.4	Klmarnk	49	13	26.5	37.8
Liv Ain	60	16	26.7	28.1	Krkcldy	41	14	34.1	46.4
Liv Roy	177	96	54.2	49.3	**Wales**				
M RI	246	135	54.9	51.6	Bangor	37	9	24.3	27.3
Middlbr	132	79	59.8	56.1	Cardff	243	128	52.7	51.4
Newc	162	85	52.5	50.9	Clwyd	22	5	22.7	23.4
Norwch	89	46	51.7	51.2	Swanse	150	56	37.3	37.1
Nottm	196	115	58.7	55.1	Wrexm	25	11	44.0	41.2
Oxford	259	170	65.6	63.0					

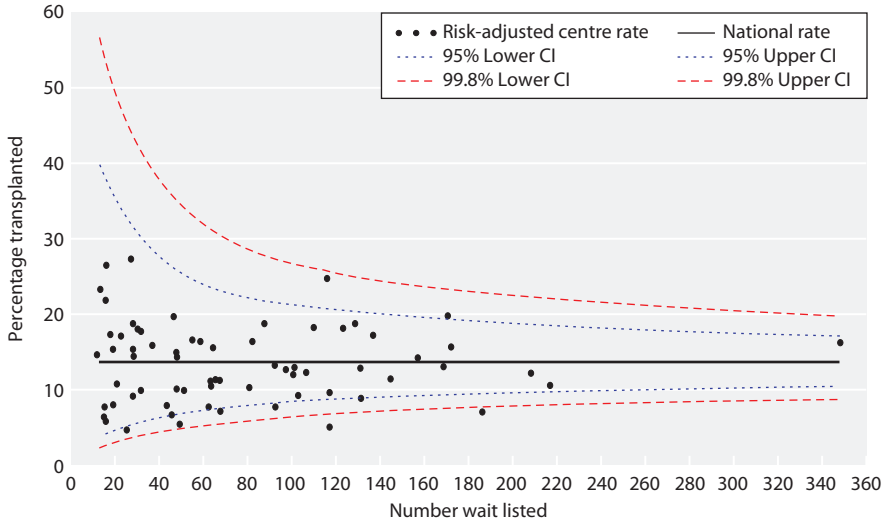

Fig. 11.2. Percentage of patients receiving a transplant from a donor after brainstem death by renal centre, within two years of transplant waiting list registration (centres with <10 patients excluded)

chance of wait-listing compared with a baseline centre that had a median time comparable to the national median.

Discussion

Centre variation

The analyses performed within this report highlight a significant centre effect in relation to the proportion of patients wait-listed with nearly 20% of centres lying outside the lower 95% confidence interval, and seven centres outside the lower 99.8% confidence interval, despite adjusting for a range of patient characteristics. Inter-centre differences are also noted in access to transplants from donors after cardiac death/living kidney donors with nine centres lying outside the lower 99.8% confidence interval.

Whilst both these outcomes are subject to individual centre practices and policies (which thus could be deemed a cause of the observed variation), one needs to interpret these results with caution as this study is limited by the lack comprehensive comorbidity data on all patients. Centres with higher prevalence rates of comorbidities would be expected to list proportionally fewer patients to reflect the fact that fewer patients are fit for transplantation. Additionally, it may take longer to activate patients in these centres due to the need for more intensive investigation and medical optimisation prior to transplantation. Indeed lack of comorbidity data limits definitive adjustment for case mix. Other patient level factors which this study also fails to adjust for include social deprivation which has been associated with reduced access to transplantation of a range of organs, as well as the impact of primary renal diagnoses (other than diabetes), health literacy and human leucocyte antigen (HLA) sensitisation. Additonally, this study has not analysed the interplay between factors such as social deprivation and ethnicity and whether the observed differences based on ethnicity are likely to persist after adjustment for social deprivation and varying comorbidity burden in different ethnic groups. In essence, the available dataset does not permit definitive adjustment for case mix.

The observation that a patient starting dialysis in a non-transplanting renal centre was less likely to be registered for transplantation or receive a transplant from a donor after cardiac death (or a living kidney donor) compared with patients managed in transplanting renal centres, has been a consistent finding in similar analyses by the UKRR over the last five years. The finding implies increasing distance from the transplanting centre diminishes access to treatment. Despite the inability to conclusively adjust for case mix in our analyses, the consistent finding in the same direction, suggests centre practice patterns rather than patient dependant variables may explain this finding. Further detailed analyses to understand the reasons for such variability is currently being undertaken as part of the Access to Transplant and Transplant Outcome Measures (ATTOM) study. Once registered for kidney transplantation, patients in both transplanting and non-transplanting renal centres had an equal chance of receiving a transplant from a donor after brainstem death. This is reassuring as organ allocation is subject to the national allocation algorithm which one would expect to allocate organs equitably.

Table 11.5. Percentage of patients receiving a transplant, by donor type and renal centre, within two years of transplant waiting list registration

		Organ from donor after brainstem death			Organ from living kidney donor/donor after cardiac death		
			Transplant rate (%)			Transplant rate (%)	
Centre	Listed *N*	Transplanted *N*	Unadjusted	Risk-adjusted	Transplanted *N*	Unadjusted	Risk-adjusted
England							
B Heart	66	4	6.1	6.6	15	22.7	23.9
B QEH	186	11	5.9	6.4	56	30.1	31.2
Basldn	13	4	30.8	21.4	4	30.8	32.1
Bradfd	54	9	16.7	16.1	10	18.5	20.5
Brightn	63	10	15.9	15.1	16	25.4	23.8
Bristol	130	11	8.5	8.3	59	45.4	42.3
Camb	91	11	12.1	12.7	62	68.1	61.5
Carlis	27	5	18.5	18.3	16	59.3	50.3
Carsh	116	10	8.6	8.8	58	50.0	47.4
Chelms	35	5	14.3	15.3	19	54.3	53.7
Colchr	23	1	4.3	4.2	11	47.8	43.7
Covnt	79	7	8.9	9.7	47	59.5	56.3
Derby	42	3	7.1	7.4	3	7.1	6.6
Donc	30	3	10.0	9.3	3	10.0	9.6
Dorset	48	2	4.2	4.8	15	31.3	27.7
Dudley	19	2	10.5	10.2	2	10.5	10.5
Exeter	62	7	11.3	10.6	24	38.7	38.4
Glouc	45	7	15.6	19.2	11	24.4	23.0
Hull	61	4	6.6	6.9	22	36.1	36.1
Ipswi	30	5	16.7	17.3	18	60.0	51.9
Kent	105	12	11.4	11.7	53	50.5	46.6
L Barts	208	21	10.1	11.6	91	43.8	50.1
L Guys	171	26	15.2	15.1	99	57.9	58.8
L Kings	102	8	7.8	8.6	30	29.4	31.6
L Rfree	168	16	9.5	12.4	80	47.6	43.2
L St.G	91	6	6.6	7.1	47	51.6	53.0
L West	349	51	14.6	15.7	153	43.8	52.3
Leeds	122	21	17.2	17.7	49	40.2	38.7
Leic	216	19	8.8	9.9	85	39.4	38.5
Liv Ain	17	3	17.6	14.8	10	58.8	49.9
Liv Roy	96	13	13.5	12.2	40	41.7	39.0
M RI	136	25	18.4	16.6	53	39.0	39.5
Middlbr	81	14	17.3	15.9	49	60.5	56.5
Newc	86	16	18.6	18.2	49	57.0	53.4
Norwch	46	6	13.0	14.4	25	54.3	50.1
Nottm	115	28	24.3	24.4	38	33.0	31.3
Oxford	170	36	21.2	19.4	74	43.5	43.7
Plymth	64	7	10.9	10.9	29	45.3	42.4
Ports	156	24	15.4	13.6	51	32.7	32.2
Prestn	100	11	11.0	11.3	32	32.0	29.5
Redng	109	19	17.4	17.6	39	35.8	38.7
Salford	144	14	9.7	10.8	47	32.6	31.1
Sheff	116	5	4.3	4.4	47	40.5	38.1
Shrew	17	1	5.9	7.4	7	41.2	38.1
Stevng	100	13	13.0	12.4	51	51.0	49.8
Sthend	25	7	28.0	26.9	8	32.0	33.9
Stoke	62	6	9.7	10.1	26	41.9	37.8
Sund	50	5	10.0	9.4	32	64.0	61.1
Truro	36	2	5.6	5.4	20	55.6	53.0
Wirral	27	3	11.1	8.7	11	40.7	38.3
Wolve	47	5	10.6	9.5	14	29.8	29.1
York	27	5	18.5	13.7	9	33.3	33.4

Table 11.5. Continued

Centre	Listed N	Organ from donor after brainstem death: Transplanted N	Transplant rate (%): Unadjusted	Transplant rate (%): Risk-adjusted	Organ from living kidney donor/donor after cardiac death: Transplanted N	Transplant rate (%): Unadjusted	Transplant rate (%): Risk-adjusted
N Ireland							
Antrim	14	1	7.1	7.0	5	35.7	30.5
Belfast	44	3	6.8	5.9	14	31.8	28.6
Newry	13	1	7.7	5.8	1	7.7	7.6
Ulster	7	0	0.0	0.0	1	14.3	14.6
West NI	21	3	14.3	16.5	5	23.8	20.5
Scotland							
Abrdn	46	7	15.2	13.8	12	26.1	31.7
Airdrie	29	7	24.1	17.5	5	17.2	23.0
D&Gall	10	2	20.0	13.9	1	10.0	17.5
Dundee	26	5	19.2	14.8	7	26.9	36.6
Edinb	66	8	12.1	10.6	29	43.9	55.9
Glasgw	130	19	14.6	12.3	40	30.8	40.5
Inverns	16	3	18.8	16.8	1	6.3	5.8
Klmarnk	14	4	28.6	26.1	1	7.1	9.0
Krkcldy	14	1	7.1	5.4	2	14.3	19.9
Wales							
Bangor	9	5	55.6	70.1	2	22.2	20.4
Cardff	128	24	18.8	18.2	49	38.3	35.4
Clwyd	5	0	0.0	0.0	2	40.0	33.3
Swanse	57	11	19.3	15.9	28	49.1	48.2
Wrexm	11	3	27.3	22.9	4	36.4	31.3

Patient level factors affecting access

The finding that certain patient variables, such as increasing age, have a negative association with access to transplantation was not unexpected as the risk-benefit ratio of receiving a renal transplant alters with age. Increased comorbidity burden in older patients may require more intensive time consuming investigations prior to listing and may also deem them unsuitable in some cases. In this study 'non-White' ethnicity was negatively associated with access to transplantation and receiving a kidney once listed (from a donor after brainstem death, and from a living kidney donor/donor after cardiac death). This may partly be explained by the importance given to HLA matching in the national allocation protocol which may have favoured a predominantly white donor pool being matched with white recipients and also the widely acknowledged lack of donors from ethnic minorities contributing to the

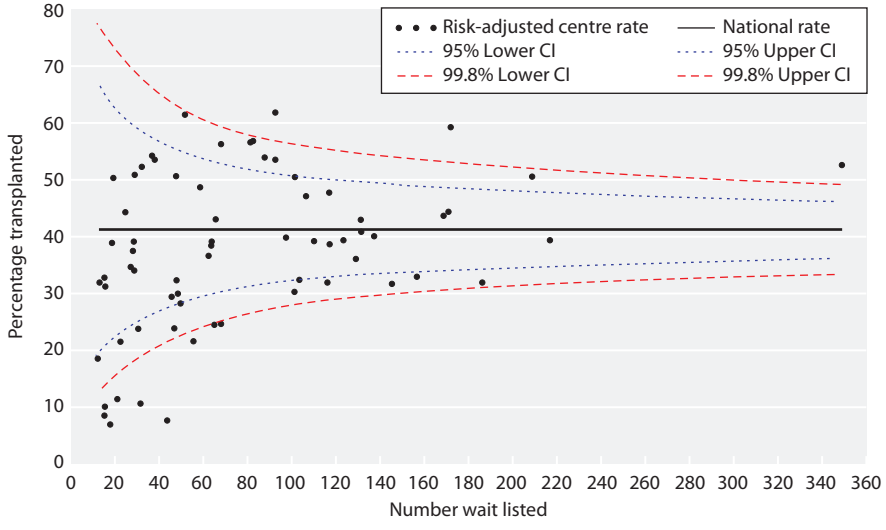

Fig. 11.3. Percentage of patients receiving a transplant from a living kidney donor/donor after cardiac death by renal centre, within two years of transplant waiting list registration (centres with <10 patients excluded)

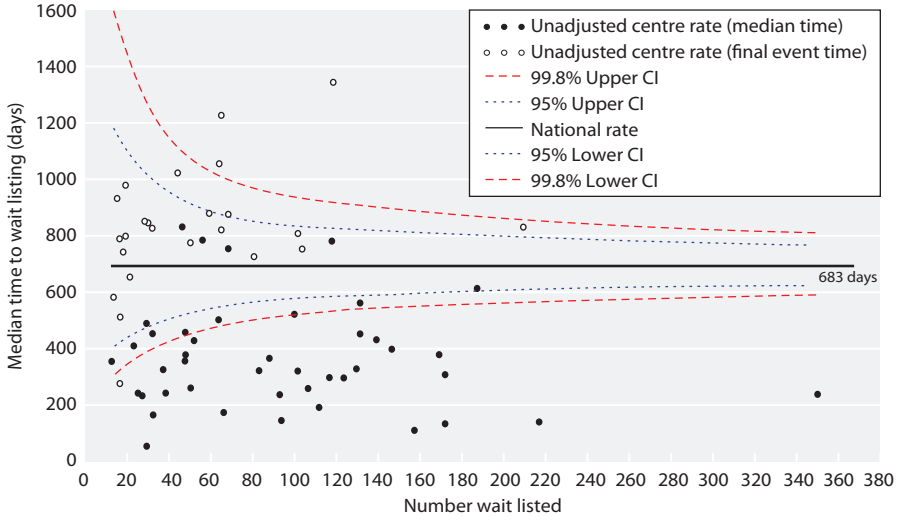

Fig. 11.4. Median time to wait listing for a kidney transplant, by renal centre (centres with <10 patients excluded)

Table 11.6. Median time to wait listing for a kidney transplant, by renal centre (censoring at the earliest of death or 31st December 2012)

Centre	RRT *N*	Registrations *N*	Median time to listing (days)	Centre	RRT *N*	Registrations *N*	Median time to listing (days)
England				Plymth	96	64	157
B Heart	143	66	***867****	Ports	231	156	91
B QEH	370	186	598	Prestn	221	100	***797****
Basldn	37	13	***923****	Redng	157	110	174
Bradfd	111	54	773	Salford	252	145	380
Brightn	135	63	***811****	Sheff	237	116	769
Bristol	257	130	436	Shrew	61	17	***787****
Camb	153	92	128	Stevng	177	100	302
Carlis	41	27	36	Sthend	44	25	215
Carsh	270	117	***1,345****	Stoke	120	62	488
Chelms	62	35	309	Sund	101	50	413
Colchr	41	23	226	Truro	58	36	223
Covnt	169	79	***712****	Wirral	89	27	***835****
Derby	108	42	***1,017****	Wolve	131	48	***765****
Donc	50	30	147	York	50	27	472
Dorset	81	48	243	**N Ireland**			
Dudley	69	19	***641****	Antrim	40	14	***495****
Exeter	149	63	***1,225****	Belfast	93	44	821
Glouc	82	45	340	Newry	28	13	***683****
Hull	139	62	***1,049****	Ulster	16	7	***180****
Ipswi	54	30	438	West NI	38	21	397
Kent	175	105	240	**Scotland**			
L Barts	441	208	***816****	Abrdn	88	46	365
L Guys	298	171	291	Airdrie	78	30	***816****
L Kings	234	102	***742****	D&Gall	18	10	335
L Rfree	308	168	364	Dundee	62	26	***838****
L St.G	158	91	216	Edinb	137	66	741
L West	568	350	220	Glasgw	257	130	548
Leeds	225	122	281	Inverns	37	16	***735****
Leic	346	216	116	Klmarnk	49	14	***779****
Liv Ain	60	17	***967****	Krkcldy	41	14	***258****
Liv Roy	177	98	508	**Wales**			
M RI	246	138	416	Bangor	37	9	***716****
Middlbr	132	81	304	Cardff	243	128	311
Newc	162	86	348	Clwyd	22	5	***682****
Norwch	89	46	440	Swanse	150	57	***870****
Nottm	196	115	280	Wrexm	25	11	***564****
Oxford	259	171	115				

*Results in ***bold italics*** are final event times as median times could not be estimated

donor pool. Lack of adjustment for social deprivation may also explain some of this association, as Udayaraj has previously published data showing that adjusting for social deprivation may partly explain the reduced access to transplantation seen in ethnic groups [6].

Diabetes was also seen to affect wait-listing adversely although this is not surprising as many would be subject to additional diabetic complications and increased cardiovascular risk that would need to be managed. The higher proportion of patients with diabetes receiving a transplant corresponds to an increase in the number of simultaneous kidney-pancreas transplants during the study period, as the allocation algorithm prioritised dual organ recipients.

When interpreting the analyses in this chapter it is important to consider the potential impact of missing data on the results. Missing data occurs as a result of either a renal centre failing to complete relevant fields on their renal IT system or a failure to extract this data. Missing data may not be at random; sicker patients may die more quickly, allowing inadequate time for their physician to enter relevant comorbidity data. The very process of working up and listing a patient makes it less likely that data will be missing. It is therefore perhaps not surprising that patients activated on the national kidney transplant waiting list are more likely to have ethnicity and PRD data reported ($p < 0.0001$) (table 11.1).

The UKRR is collaborating with other researchers in the National Institute for Health Research (NIHR) funded ATTOM research project to study access to kidney transplantation in greater detail. This will allow those practices identified in the better performing centres to be disseminated to other centres, thereby facilitating equity of access to transplantation across the UK.

Conclusions

This study highlights the persistence of significant centre variation in access to transplantation with respect to the proportion of patients listed and the time taken to activate suitable patients, even after correction for available relevant patient related variables. Significant differences exist between transplanting and non-transplanting centres, with increasing age, non-White ethnicity and diabetes showing a negative association in terms of accessing the transplant wait-list.

Conflicts of interest: none

References

1 Wolfe RA, Ashby VB, Milford EL, Ojo AO, Ettenger RE, Agodoa LY, Held PJ, Port FK. Comparison of mortality in all patients on dialysis, patients on dialysis awaiting transplantation, and recipients of a first cadaveric transplant. N Engl J Medicine 1999;341(23):1725–30
2 Pinson CW, Feurer ID, Payne JL, Wise PE, Shockley S, Speroff T. Health related quality of life after different types of solid organ transplantation. Ann Surg 2000;232(4):597–607
3 Sureshkumar KK, Patel BM, Markatos A, Nghiem DD, Marcus RJ. Quality of life after organ transplantation in type 1 diabetes with end stage renal disease. Clin Transplant 2006;20(1):19–25
4 http://www.uktransplant.org.uk/ukt/about_transplants/organ_allocation/kidney_(renal)/kidney_(renal).jsp
5 Variation between centres in access to renal transplantation in UK: longitudinal cohort study. Ravanan R, Udayaraj U, Ansell D, Collett D, Johnson R, O'Neill J, Tomson CR, Dudley CR. BMJ. 2010 Jul 20; 341:c3451. doi: 10.1136/bmj.c3451
6 Social deprivation, ethnicity, and access to the deceased donor kidney transplant waiting list in England and Wales. Udayaraj U, Ben-Shlomo Y, Roderick P, Casula A, Dudley C, Johnson R, Collett D, Ansell D, Tomson C, Caskey F. Transplantation. 2010 Aug 15;90(3):279–85. doi: 10.1097/TP.0b013e3181e346e3

UK Renal Registry 17th Annual Report: Chapter 12 Epidemiology of Reported Infections amongst Patients Receiving Dialysis for Established Renal Failure in England in 2012 to 2013: a Joint Report from Public Health England and the UK Renal Registry

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Key Words

Clostridium Difficile · Dialysis · Epidemiology · *Escherichia Coli* · Established Renal Failure · Infection · MRSA · MSSA · *Staphylococcus*

Summary

- From 1st May 2012 to 30th April 2013 there were 31 episodes of Methicillin resistant *Staphylococcus aureus* (MRSA) bacteraemia in end stage renal failure patients on dialysis.
- This represented a further small decline in MRSA bacteraemia rates which have been falling since data collection began in 2007.
- Methicillin sensitive *Staphylococcus aureus* (MSSA) bacteraemia rates were 1.59 per 100 dialysis patient years with 372 episodes of blood stream infection reported.
- There were 123 *Clostridium difficile* infection episodes with a rate of 0.55 per 100 dialysis patient years.
- *Escherichia coli* data showed a reported rate of 1.32 per 100 dialysis patient years, an increase on the rate reported last year.
- In each infection for which access data were collected, the presence of a central venous catheter appeared to correlate with increased risk.
- Future years require consistency of reporting to enable trends to be more clearly defined.

Introduction

Infection remained the second leading cause of death in patients with established renal failure (ERF) who received renal replacement therapy (RRT). The high rates of systemic infection reported in haemodialysis (HD) patients are related to their impaired immune system, the high number of invasive procedures they are exposed to and the type of vascular access used [1]. This report covers one year of reporting for Methicillin resistant *Staphylococcus aureus* (MRSA), Methicillin sensitive *Staphylococcus aureus* (MSSA), *Escherichia coli* (*E. coli*) bloodstream infections (BSI) and *Clostridium difficile* infections (CDI) in patients with ERF who were receiving dialysis in England.

Previous UK Renal Registry (UKRR) reports have detailed the epidemiology of staphylococcal bacteraemias in patients with ERF receiving dialysis. In addition to *staphylococcal* bacteraemias, last year surveillance was expanded to incorporate *E. coli* BSIs and CDIs [2]. As well as the mandatory reporting of MRSA BSIs, reporting of MSSA has been mandated since January 2011 and *E. coli* BSIs since June 2011; CDI reporting has been mandatory for all patients aged two and above since 2007. CDIs are reported according to a national testing protocol although during the timeframe of this report there may have been some inter-hospital variation in testing methods [3].

The data were supplied by clinical staff and captured using a secure web-based system, the Healthcare Associated Infection Data Capture System (HCAI-DCS). The previous report confirmed that whilst dialysis patients remained at increased risk from MRSA there has been a continued year on year decline in the number of reported episodes of bacteraemia [2].

Methods

This report covers the period of 1st May 2012 to 30th April 2013. It should be noted that although reporting is mandatory for these data collections (MRSA, MSSA and *E. coli* BSI and CDI), completion of documentation on information relating to renal failure and dialysis is currently conducted on a voluntary basis depending on the data entry policy within the reporting NHS acute Trust. Therefore variation in reported infection rates may reflect differences in reporting policies between individual units.

The methods used have been described in previous registry reports (see appendix 1) [4, 5]. Briefly, three stages of data collection and validation were undertaken by Public Health England (PHE):

1 Identification of bacteraemias and CDI potentially associated with dialysis patients. These data were captured by the NHS acute Trusts using the clinical details provided and the setting in which the sample was obtained.
2 This record was 'shared' with the parent renal centre. The NHS acute Trusts attributed the record to the renal unit responsible for the dialysis of the patient which in turn triggered an email alert to the identified contact within the parent renal centre.
3 The renal centre then 'completed' the additional renal data on the case via the HCAI-DCS website.

This data reporting mechanism applies only to centres in England. Renal centres in Wales, Scotland and Northern Ireland are not included in the report. These data were then passed to the UKRR who implemented an additional validation and data capture step as not all records were shared or completed. This involved emailing clinical or infection control leads in the NHS acute Trusts with the records reported to PHE and requesting they completed the following actions:

1 Confirm that each of the cases in the PHE file was correct, i.e. that it related to a dialysis patient receiving treatment at their unit at the time of the infection
   a Remove any cases that occurred in patients not on dialysis and receiving treatment at their unit at the time of the infection
   b Add any cases that were not known to PHE but occurred in patients on dialysis and receiving treatment at their unit at the time of the infection
2 For all cases, to provide details on the dialysis modality and access in use at the time of the infection.

The number of alterations made by renal units varied considerably. The extent to which this reflects differences in the accuracy of the PHE data for their renal unit is not known. A centre may not have made any alterations (or even indicated that no alterations were needed) for a number of reasons ranging from their data being completely accurate to them not examining the data as critically as others. Until a new system for validating the PHE cases for renal units is developed funnel plots indicate where a centre has (1) provided no confirmation of accuracy of their PHE data, (2) confirmed accuracy of their PHE data or (3) confirmed accuracy of their PHE data and added cases. This interim measure is not intended as a judgement on quality of reporting by a renal unit, it just identifies an issue that needs to be addressed in future work.

Centre-specific rates for each infection are presented per 100 dialysis patient years. The denominator for this rate was calculated at each centre by summing the number of days that every dialysis patient contributed between the 1st May 2012 and 30th April 2013, utilising the UKRR database. For example, a patient who started dialysis on the 1st April 2013 and remained on dialysis until at least the 30th April 2013 would contribute 30 days to the total. Similarly, when calculating the modality specific rates, the number of days that every dialysis patient spent on each modality during the collection period was summed.

In order to adjust for variation in precision of estimated rate, the rate of bacteraemia/CDI per 100 dialysis patient years has been plotted against the centre size in a funnel plot. However, due to uncertainty about whether all centres were reporting on

Table 12.1. Summary of all audit measures stated in Renal Association (RA) clinical practice guidelines relating to infection

	RA audit measure	Reported	Reason for non-inclusion
1	Centres should audit all *Staphylococcus aureus* bacteraemia (MRSA and MSSA) episodes recorded as episodes per 100 patient years or episodes per 100 catheter days or episodes per 100 AVF years	Yes	
2	The annual *Staphylococcus aureus* bacteraemia rate should be less than 2.5 episodes per 100 HD patients and less than 1.0 for MRSA over two years	Yes	
3	Centres should audit all episodes of *Clostridium Difficile* toxin (CDT) and express rates as per 100 patient years	Yes	
4	Data should be collected on all episodes of VRE and ESBL bacteraemia episodes per 100 patient years	Partly	Only data on *E. coli* received from PHE

ESBL = Extended-Spectrum betaLactamase; VRE = vancomycin-resistant enterococci

the same data, the confidence limits that are usually displayed on funnel plots have been removed. Despite the removal of the confidence limits, interpretation remains similar to a funnel plot where centres towards the left of the plot can be expected to display greater variation around the country average due to smaller numbers of patients. Table 12.1 lists the summary of audit measures stated in the Renal Association clinical practice guidelines.

Results

Validation

This was the first year that the UKRR performed the additional validation and data capture step in which centres were requested to add any additional episodes which were not captured by PHE. Table 12.2 displays the number of infectious episodes reported to PHE and the changes to the data that occurred during the validation process. The majority of episodes were rejected because the patient was not receiving dialysis for established renal failure however others were removed during the validation process with no explanation.

Table 12.2. Number of infectious episodes reported to Public Health England (PHE) and validated by renal centres

	MRSA	MSSA	CDI	*E.coli*
Number of infectious episodes reported to PHE	27	301	130	317
Number of episodes rejected by centres during validation	1	16	24	47
Number of episodes added by centres during validation	5	87	17	38
Total number of episodes after validation process	31	372	123	308

There was wide variation in the response from centres to the validation process with some centres adding many additional episodes, and other centres not adding any. A Mann-Whitney U test found that there were significantly more infection episodes in centres adding additional cases than in those that did not.

Methicillin resistant Staphylococcus aureus

Thirty-one MRSA bacteraemias were recorded as being associated with a dialysis patient during the time frame of this report, at a rate of 0.13 (95% CI 0.09–0.19) per 100 dialysis patient years (table 12.3). This rate was lower than the 0.22 per 100 patients reported last year, continuing the year-on-year reduction displayed by the boxplot in figure 12.1. The modality in use at the time of infection was completed for all episodes but comparisons between the modalities are difficult due to small numbers.

Centre level data can be seen in table 12.4 and includes the absolute number of episodes and rates per 100 dialysis patient years. The majority of centres did not report any MRSA bacteraemia episodes and no centre had an infection rate in excess of one per 100 dialysis patient years. Figure 12.2 plots each centre's estimated rate against the number of patient years to take into account the greater variation expected as centre size decreases. The extremely low numbers of episodes at each centre make comparisons of rates uncertain.

The Renal Association (RA) audit standard states that the annual MRSA rate should be less than 1.0 per 100 HD patients averaged over two years. Figure 12.3 displays a funnel plot of MRSA rate per 100 prevalent HD patients across the two year period from 1st May 2011

Table 12.3. Number and rate of infectious episodes in patients with established renal failure between 1/05/2012 and 30/04/2013, by modality

	Infection			
	MRSA	MSSA	CDI	*E.coli*
Number of episodes				
Total	**31**	**372**	**123**	**308**
HD	30	341	94	228
PD	1	7	12	19
Not completed	0	24	17	61
Rate (95% CI) per 100 patient years				
Total	**0.13 (0.09–0.19)**	**1.59 (1.43–1.76)**	**0.55 (0.46–0.66)**	**1.32 (1.17–1.47)**
HD	0.15 (0.10–0.21)	1.70 (1.53–1.89)	0.49 (0.40–0.60)	1.14 (1.00–1.30)
PD	0.03 (0.00–0.17)	0.21 (0.08–0.43)	0.37 (0.19–0.65)	0.57 (0.34–0.88)

HD = haemodialyis; PD = peritoneal dialysis

to 30th April 2013. No centres had rates higher than this standard.

Methicillin sensitive Staphylococcus aureus

In total, 372 episodes of MSSA bacteraemia were recorded in the period covered by this report, at a rate of 1.59 per 100 dialysis patient years (95% CI 1.43–1.76). This was higher than last year's rate of 1.15 per 100 dialysis patient years. Four centres did not report any MSSA episodes and the highest reported rate was 7.22 per 100 dialysis patient years (table 12.4). Based on the reported data, the rate of MSSA at renal centres in England has remained fairly steady over the past three years, but figure 12.4 demonstrates the impact of the additional episodes included by some of the centres in the validation step on the distribution and variation in rates.

Figure 12.5 plots each centre's estimated rate against the number of patient years to take into account the greater variation expected as centre size decreases. Caution must be exercised when interpreting the rates as centres appear to have taken differing approaches to the validation of the data collection questioning the value of between-centre comparisons.

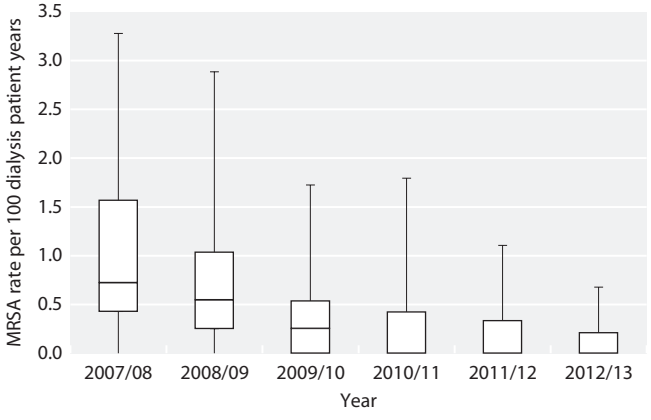

Fig. 12.1. Box and whisker plot of renal centres' MRSA rates per 100 dialysis patient years by reporting year

The peritoneal dialysis (PD) cohort had a lower rate of MSSA bacteraemia per 100 patient years than the HD cohort (0.21, 95% CI 0.08–0.43 compared with 1.7, 95% CI 1.53–1.89) (table 12.3). Modality data was not completed for 6% of the episodes.

Type of dialysis access and infection

There were major variations in the number of episodes of both MRSA and MSSA bacteraemia according to access type. Patients dialysing through a central venous catheter (CVC) at the time of the infection were subject to more episodes of bacteraemia than those with other types of access (table 12.5). Rates have not been calculated because of lack of data on denominators.

Clostridium difficile

In total, 123 episodes of CDI were recorded in the period covered by this report, at a rate of 0.55 (95% CI 0.46–0.66) per 100 dialysis patient years. Based on the reported data, this was slightly lower than last year's rate of 0.61 per 100 dialysis patient years. Nineteen centres did not report any CDI episodes and the highest reported rate was 2.97 per 100 dialysis patient years (table 12.4). Figure 12.6 plots each centre's estimated rate against the number of patient years to take into account the greater variation expected as centre size decreases. Caution must be exercised when interpreting the rates as centres appear to have taken differing approaches to the validation stage of the data collection

Table 12.4. Number and rate of infectious episodes in patients with established renal failure by renal centre

Centre	Dialysis patient years	Number of episodes (1/05/2012–30/04/2013)				Rate per 100 dialysis patient years			
		MRSA	MSSA	CDI	*E.coli*	MRSA	MSSA	CDI	*E.coli*
B Heart	479	1	7	7	2	0.21	1.46	1.46	0.42
B QEH	1,169	2	15	1	6	0.17	1.28	0.09	0.51
Basldn	194	0	14	0	1	0.00	7.22	0.00	0.52
Bradfd	232	1	6	5	3	0.43	2.59	2.16	1.29
Brightn	457	0	8	4	3	0.00	1.75	0.88	0.66
Bristol	573	1	5	4	3	0.17	0.87	0.70	0.52
Camb	470	0	8	1	5	0.00	1.70	0.21	1.06
Carlis	89	0	0	0	2	0.00	0.00	0.00	2.24
Carsh	866	3	11	2	8	0.35	1.27	0.23	0.92
Chelms	157	0	0	0	0	0.00	0.00	0.00	0.00
Colchr	116	0	3	0	1	0.00	2.58	0.00	0.86
Covnt	464	0	9	0	7	0.00	1.94	0.00	1.51
Derby	322	0	5	1	0	0.00	1.55	0.31	0.00
Donc	192	0	3	1	0	0.00	1.56	0.52	0.00
Dorset	307	1	5	0	1	0.33	1.63	0.00	0.33
Dudley	231	0	1	0	2	0.00	0.43	0.00	0.87
Exeter	462	1	4	0	2	0.22	0.87	0.00	0.43
Glouc	253	0	8	1	14	0.00	3.17	0.40	5.54
Hull	411	1	10	2	3	0.24	2.43	0.49	0.73
Ipswi	160	0	1	0	2	0.00	0.63	0.00	1.25
Kent	447	0	8	2	2	0.00	1.79	0.45	0.45
L Barts	1,094	0	1	0	25	0.00	0.09	0.00	2.28
L Guys	669	1	11	4	7	0.15	1.64	0.60	1.05
L Kings	590	1	0	3	2	0.17	0.00	0.51	0.34
L Rfree	816	3	11	8	18	0.37	1.35	0.98	2.21
L St.G	344	0	0	1	5	0.00	0.00	0.29	1.45
L West	1,530	4	34	11	22	0.26	2.22	0.72	1.44
Leeds	577	0	16	7	5	0.00	2.77	1.21	0.87
Leic	1,030	0	21	*	34	0.00	2.04	*	3.30
Liv Ain	169	0	5	5	2	0.00	2.97	2.97	1.19
Liv Roy	480	0	6	4	4	0.00	1.25	0.83	0.83
M RI	591	4	2	8	11	0.68	0.34	1.35	1.86
Middlbr	343	0	5	4	4	0.00	1.46	1.16	1.16
Newc	331	1	2	0	1	0.30	0.61	0.00	0.30
Norwch	372	0	2	0	3	0.00	0.54	0.00	0.81
Nottm	496	0	12	0	9	0.00	2.42	0.00	1.82
Oxford	548	0	6	2	11	0.00	1.10	0.37	2.01
Plymth	171	1	5	2	2	0.58	2.92	1.17	1.17
Ports	628	0	6	1	4	0.00	0.96	0.16	0.64
Prestn	597	1	13	2	11	0.17	2.18	0.33	1.84
Redng	356	0	2	0	0	0.00	0.56	0.00	0.00
Salford	505	2	4	11	4	0.40	0.79	2.18	0.79
Sheff	655	0	20	2	5	0.00	3.05	0.31	0.76
Shrew	232	0	10	2	7	0.00	4.31	0.86	3.02
Stevng	528	0	8	1	9	0.00	1.52	0.19	1.71
Sthend	131	0	3	0	1	0.00	2.28	0.00	0.76
Stoke	386	0	1	1	2	0.00	0.26	0.26	0.52
Sund	214	0	5	0	1	0.00	2.33	0.00	0.47
Truro	172	1	2	0	3	0.58	1.16	0.00	1.74
Wirral	230	1	3	0	3	0.43	1.30	0.00	1.30
Wolve	378	0	11	2	11	0.00	2.91	0.53	2.91
York	162	0	2	3	4	0.00	1.23	1.85	2.47
England	**23,377**	**31**	**372**	**123**	**308**	**0.13**	**1.59**	**0.55**	**1.32**

*Leicester were unable to confirm their CDI episodes within the timescale but confirmed the data from PHE was incomplete

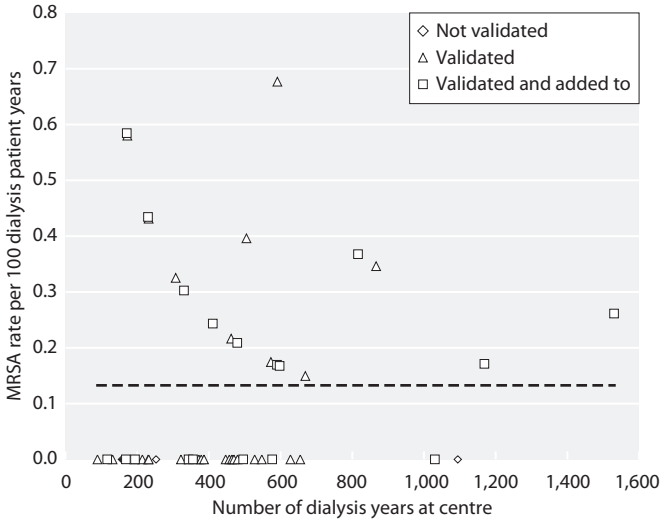

Fig. 12.2. Funnel plot of the MRSA bacteraemia rate per 100 dialysis patient years by renal centre, 1st May 2012 to 30th April 2013
Dotted line depicts rate for whole cohort

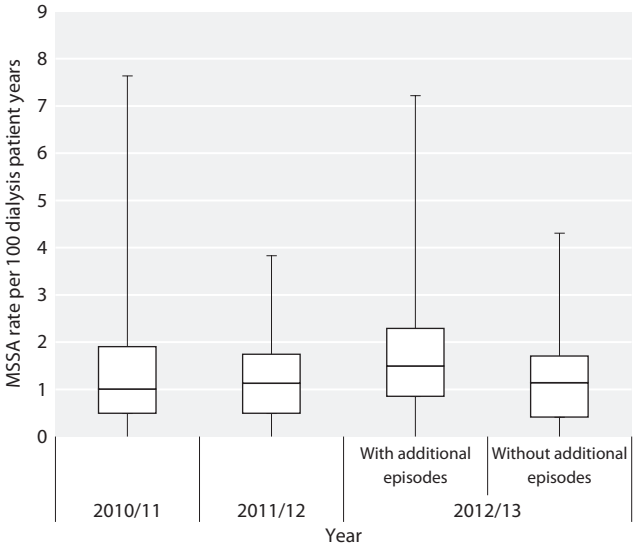

Fig. 12.4. Box and whisker plot of renal centres' MSSA rates per 100 dialysis patient years by reporting year
The additional episodes were added by centres during the UKRR validation step of the data collection process

calling into question the value of between-centre comparisons. Rates were slightly higher in the HD than the PD cohort (table 12.3).

Escherichia coli

A total of 308 episodes of *E. coli* bacteraemia were recorded in the period covered by this report, at a rate of 1.32 per 100 dialysis patient years (95% CI 1.17–1.47). This was higher than last year's rate of 0.92 per

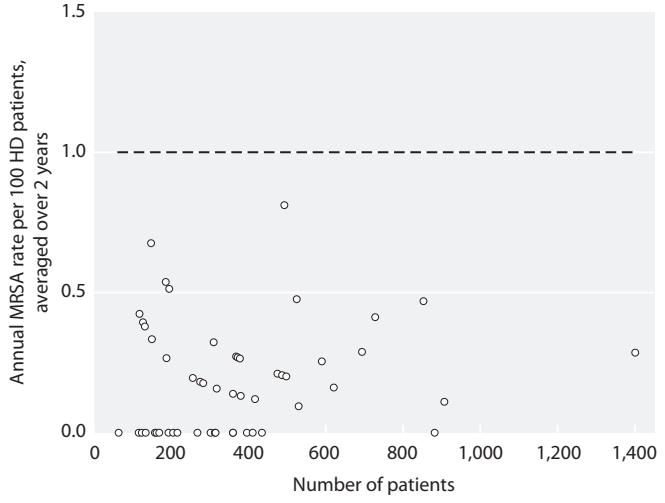

Fig. 12.3. Funnel plot of the MRSA bacteraemia two-year rate per 100 prevalent HD patients, 1st May 2011 to 30th April 2013
Dotted line depicts Renal Association standard

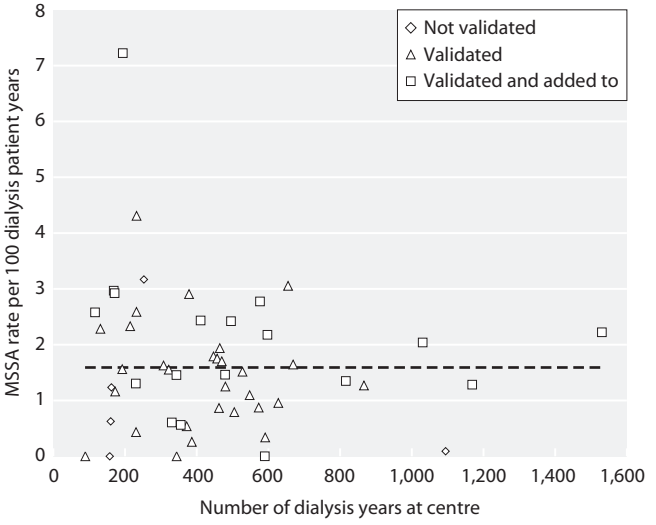

Fig. 12.5. Funnel plot of the MSSA bacteraemia rate per 100 dialysis patient years by renal centre, 1st May 2012 to 30th April 2013
Dotted line depicts rate for whole cohort

Table 12.5. Type of dialysis access in use at the time of infection for HD patients

Centre	Number of episodes (1/05/2012–30/04/2013)				
	AVF	AVG	CVC	PD	No data
MRSA	8	0	22	1	0
MSSA	127	27	186	7	25

AVF = arteriovenous fistula; AVG = arteriovenous graft; CVC = central venous catheter; PD = peritoneal dialysis

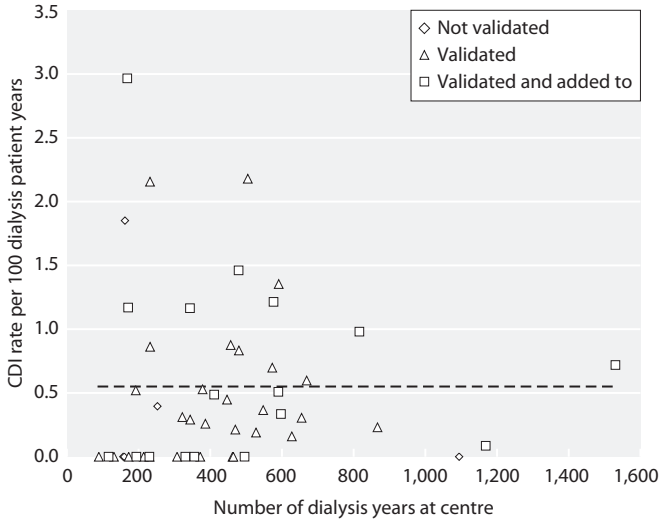

Fig. 12.6. Funnel plot of the CDI rate per 100 dialysis patient years by renal centre, 1st May 2012 to 30th April 2013
Dotted line depicts rate for whole cohort

100 dialysis patient years, and remains higher even if episodes added by the centres during the additional validation stage are excluded from the rate calculation.

Centre level data are displayed in table 12.4 and as with MSSA there was considerable between-centre variation in bacteraemia rates. Four centres did not report any episodes and the highest reported rate was 5.54 per 100 dialysis patient years. Figure 12.7 plots each centre's estimated rate against the number of patient years to take into account the greater variation expected as centre size decreases. Again, caution must be exercised when interpreting the rates as centres appear to have taken differing approaches to the validation stage of the data collection calling into question the value of between-centre comparisons.

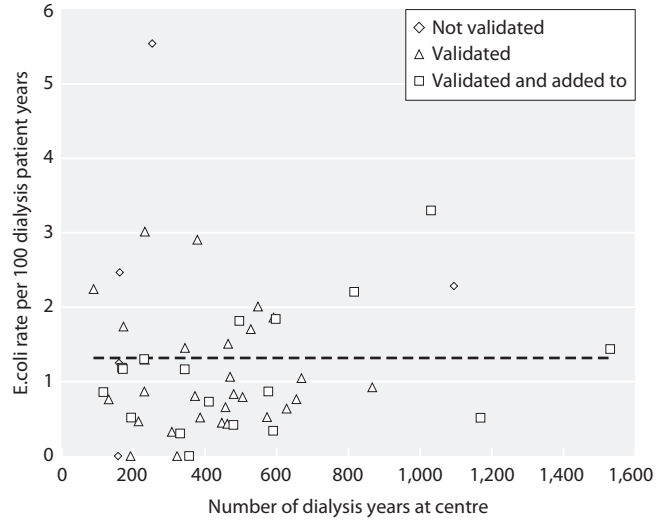

Fig. 12.7. Funnel plot of the *Escherichia coli* bacteraemia rate per 100 dialysis patient years by renal centre, 1st May 2012 to 30th April 2013
Dotted line depicts rate for whole cohort

Here too PD was associated with a lower rate of infection per 100 patient years than HD (0.57, 95% CI 0.34–0.88 compared with 1.14, 95% CI 1.00–1.30, respectively) (table 12.3). Modality data was not completed for 20% of the episodes.

Conclusions

This report has presented data from one year of infections in ERF patients receiving dialysis and extends the work done in previous reports from Public Health England and the UK Renal Registry [2]. Numbers and rates of MRSA BSIs in dialysis patients have fallen in each of the last six years this report has been published. This is likely to be due to a number of factors including the effect of enhanced screening programmes and increased attention to care of access.

This report also presents the second full year of reporting of MSSA bacteraemia. The rate of MSSA bacteraemia was significantly higher than for MRSA. The presence of a central venous catheter confers an increased risk of MSSA bacteraemia on the patient as opposed to an arteriovenous fistula. The discrepancy between the rates of MRSA and MSSA is notable and suggests that MSSA continues to be a significant issue in the dialysis population. Whilst it is true that caution should be exercised due to the apparent differing approaches to validation taken by centres, the number of additional episodes added suggests underreporting of infection. Whilst only two full years of reported data are available the figures raise the possibility that although screening and decolonisation programmes for MRSA are an undoubted success, the reduction of MRSA strains has left patients still vulnerable to MSSA.

The considerable between-centre variation in infection rates in the data submitted to PHE was increased during the validation step implemented this year, with some centres submitting additional episodes, some others rejecting episodes that had been allocated to them by reporting NHS acute Trusts and other centres not completing the validation step. Due to the UKRR undertaking

the data validation for the first time this year, the deadlines were extremely tight and did not allow centres sufficient time to fully investigate the infection data. In future years, the process will be refined to enable centres to contribute accurate and fully completed data, and also to ensure that all centres are applying the same definitions. This will allow much greater clarity and interpretation in an area which is of high importance.

Further work is needed to establish the overall trend in MSSA, CDI and *E. coli* and to also refine the data definitions and data collection process to ensure consistency of reporting across centres. Increased awareness of infection reporting amongst both renal units and microbiology units would also help to improve the robustness of this data set, as would better data linkage between UK Renal Registry and Public Health England data systems.

Conflicts of interest: none

Acknowledgements

The authors wish to acknowledge the help of our colleagues at renal centres across the country for their assistance in compiling this report.

References

1 Bray BD, Boyd J, Daly C, Donaldson K, Doyle A, Fox JG, et al.: Vascular access type and risk of mortality in a national prospective cohort of haemodialysis patients. QJM – an International Journal of Medicine. 2012;105(11):1097–103

2 Crowley L, Pitcher D, Wilson J, Guy R, Fluck R: UK Renal Registry 16th Annual Report: Chapter 15 Epidemiology of Reported Infections amongst Patients Receiving Dialysis for Established Renal Failure in England from May 2011 to April 2012: a Joint Report from Public Health England and the UK Renal Registry. Nephron Clinical Practice. 2013;125:295–308

3 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/215135/dh_133016.pdf

4 Fluck R, Wilson J, Tomson CRV: UK Renal Registry 12th Annual Report (December 2009): Chapter 12 Epidemiology of Methicillin Resistant *Staphylococcus Aureus* Bacteraemia Amongst Patients Receiving Dialysis for Established Renal Failure in England in 2008: a joint report from the UK Renal Registry and the Health Protection Agency. Nephron Clinical Practice. 2010;115:C261–C70

5 Fluck R, Wilson J, Davies J, Blackburn R, O'Donoghue D, Tomson C: UK Renal Registry 11th Annual Report: Chapter 12 Epidemiology of Methicillin Resistant *Staphylococcus aureus* bacteraemia amongst patients receiving Renal Replacement Therapy in England in 2007. Nephron Clinical Practice. 2009;C247–C56

Appendix 1: Processes for reporting of infections to Public Health England

All infection cases are reported via the Healthcare Associated Infection Data Capture System (HCAI-DCS) which is a real-time, secure web enabled system. Criteria for what constitutes an infection are as follows:

1 MRSA bacteraemia: The following MRSA positive blood cultures must be reported to PHE:
All cases of MRSA bacteraemia caused by *S. aureus* resistant to methicillin, oxacillin, cefoxitin or flucloxacillin. Further details on surveillance of MRSA bacteraemia in patients with renal disease are available online [1].
All reported MRSA bacteraemia are subject to a post infection review [2]. The included renal data includes *all* cases regardless of whether they were assigned to a Trust or CCG via the post infection review process.
2 MSSA bacteraemia: The following MSSA positive blood cultures must be reported to PHE:
All cases of MSSA bacteraemia caused by *S. aureus* which are not resistant to methicillin, oxacillin, cefoxitin, or flucloxacillin i.e. not subject to MRSA reporting.
3 *E. coli* bacteraemia: The following *E. coli* positive blood cultures must be reported to PHE:
All laboratory confirmed cases of *E. coli* bacteraemia.
4 *C. difficile* Infection: Any of the following defines a *C. difficile* infection case in patients aged 2 years and above and must be reported to PHE [3]:

a Diarrhoeal stools (Bristol Stool types 5–7) where the specimen is *C. difficile* toxin positive.
b Toxic megacolon or ileostomy where the specimen is *C. difficile* toxin positive.
c Pseudomembranous colitis revealed by lower gastro-intestinal endoscopy or Computed Tomography.
d Colonic histopathology characteristic of *C. difficile* infection (with or without diarrhoea or toxin detection) on a specimen obtained during endoscopy or colectomy
e Faecal specimens collected post-mortem where the specimen is *C. difficile* toxin positive or tissue specimens collected post-mortem where pseudomembranous colitis is revealed or colonic histopathology is characteristic of *C. difficile* infection.

Information on patient identifiers, date the specimen was taken, the patient's location at the time the sample was taken and whether the patient was an inpatient or outpatient was collected for each episode. Cases were considered to be renal patients where it is indicated that the patient was in established renal failure at the time the specimen was taken. For these cases it was intended that they were to be shared with the renal service. 'Shared' records were required to have additional fields completed by the designated local contact in each renal centre.

The relevant renal hub for each record is identified using pre-defined relationships on the PHE surveillance system (Trusts are mapped to renal units behind the scenes). Low levels of cases being shared and completed may be the result of the fact that these listings have not recently been updated.

References

1 http://webarchive.nationalarchives.gov.uk/20140714084352/http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1194947399620
2 http://www.england.nhs.uk/wp-content/uploads/2014/04/mrsa-pir-guid-april14.pdf
3 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/215135/dh_133016.pdf

UK Renal Registry 17th Annual Report: Appendix A The UK Renal Registry Statement of Purpose

A:1 Executive summary

1.1 The UK Renal Registry (UKRR) was established by the Renal Association to act as a resource in the development of patient care in renal disease.

1.2 The UKRR acts as a source of comparative data for audit, benchmarking, planning, policy and research. The collection and analysis of sequential biochemical and haematological data is a unique feature of the UKRR.

1.3 The Renal Registry Data Set Specification (RRDSS) defines the data items that are required to be sent from participating renal centres for analysis by the UKRR.

1.4 Data is collected quarterly to maintain centre-level quality assurance, with the results being published in an annual report.

1.5 Core activity is funded from commissioning agencies by a capitation fee on renal patients.

1.6 The UKRR is responsible, with the express agreement of participants, for providing data to Trusts, commissioning authorities and the European Renal Association – European Dialysis and Transplant Association (ERA–EDTA) Registry.

1.7 The development of the UKRR is open to influence from all interested parties, including clinicians, Trusts, commissioning authorities and patient groups.

1.8 The Registry is non-profit making and has a registered charitable status through the Renal Association.

A:2 Introduction

2.1 Registry-based national specialty comparative audit is one of the cornerstones of NHS development. The Renal National Service Framework (NSF), published in two sections in 2004 and 2005, recommended the participation of all renal centres in comparative audit through the UK Renal Registry.

2.2 The Chief Executives of Trusts are responsible for clinical governance and audit is an essential part of that agenda [1].

2.3 Demographic information on patients receiving renal replacement therapy (RRT) throughout Europe was collected from 1965 in the Registry of the ERA-EDTA. This voluntary exercise was conducted on paper and by post, demanded considerable effort and time from participating centres and eventually proved impossible to sustain. Latterly, the incompleteness of UK data returns to the ERA-EDTA made it impossible to build a picture of the activity of RRT in the UK for planning and policy purposes.

Subsequently, five ad hoc national data collections from England & Wales were solicited from renal centres in 1992, 1996, 1999, 2002 and 2004 to fill this gap. The UKRR through its quarterly returns has established a system to place routine data collection and analysis on a permanent basis. The next stage is to progress the work to include information on chronic and acute kidney disease.

2.4 Together with the need to know demographic and structural elements, the NHS has developed a need to underpin clinical activity more rigorously through the scientific evidence base (for example, the Cochrane Initiative) and by quality assurance activity through audit. These initiatives require comprehensive information about the structures, processes and outcomes of RRT, which go well beyond the detail previously compiled by the ERA-EDTA.

2.5 The UKRR is recognised as one of the very few high quality clinical databases available for general use [2]. The collection of data by download of electronic records from routine clinical databases, has been highly successful and is being imitated worldwide.

2.6 The Renal Association has made a start in the area of audit by publishing guidelines in renal 'Clinical Standards' documents. It was apparent during the development of the standards that many of the desirable criteria of clinical performance were uncertain or unknown and that only the accumulated data of practicing renal centres could provide the evidence for advice on best practice and what might be achievable. A common data registration provides the simplest device for such an exercise. The data currently gathered audits a proportion of the Renal Association standards, partly due to some data items required not being available in the dataset and partly due to data not being either completed in or extracted from renal systems. There therefore needs to be a review of the dataset and a drive for more complete data returns by renal centres.

2.7 It can be seen that the need for a registry of RRT has developed for a variety of reasons: international comparisons, national planning, local Trust and health authority management, standard setting, audit and research. The opportunity for data gathering arises partly from improvements in information technology. Although it was possible to see the need for a national renal database 20 years ago, the circumstances have become ideal for the maintenance of a data repository, supported by the clinical users and resourced for national benchmarking as a routine part of RRT management.

2.8 The provisional expectations of earlier Annual Reports can now be replaced by confident assertions, built on the experience of sixteen years of publication, about the role and potential of the UKRR. The integration of the various elements of Renal Association strategy is being pursued through the Clinical Affairs Board (CAB) and Academic Affairs Board (AAB).

A:3 Statement of intent

The UKRR provides a focus for the collection and analysis of standardised data relating to the incidence, clinical management and outcome of renal disease. Data will be accepted quarterly by automatic downloading from renal centre databases. There will be a core dataset, with optional elements of special interest that may be entered by agreement for defined periods. A report will be published annually to allow a comparative audit of facilities, patient demographics, quality of care and outcome measures. Reports using the data collected can be generated at centre, regional and national level by interested parties via the data portal on the UKRR website www.renalreg.com. Participation is mandated in England through the recommendation in the Renal National Service Framework and the NHS Standard Contract for Renal Service provision. There has been an early concentration on RRT, including transplantation, with an intention to extend this to other nephrological activity in the near future. The UKRR will provide an independent source of data and analysis on national activity in renal disease.

A:4 Relationships of the UK Renal Registry

4.1 The UK Renal Registry is a registered charity through the Renal Association (No. 2229663). It was established by a committee of the Renal Association, with additional representation from the British Transplantation Society, the British Association for Paediatric Nephrology, the Scottish Renal Registry, Wales and Northern Ireland. There is

cross-representation with both the Renal Association Clinical Practice Guidelines Committee, the Clinical and Academic Affairs Boards. The UKRR is maintaining links with the Department of Health, the National Kidney Federation (NKF) (patients' association), the Royal College of Nursing, the Association for Clinical Biochemistry and Health and Social Care Commissioners.

4.2 A number of sub-committees were instituted as the database and renal centre participation developed, particularly for data analysis and interpretation for the Annual Report. Further specialised panels may be developed for publications and the dissemination of UKRR analyses.

4.3 The Scottish Renal Registry sends data to the UK Renal Registry for joint reporting and comparison.

4.4 The return of English, Welsh and Northern Irish data to the EDTA-ERA Registry will be through the Renal Registry. The Scottish Renal Registry already sends data directly to the EDTA-ERA Registry.

4.5 A paediatric database has been developed in collaboration with the UKRR. The two databases are in the process of being integrated, which will allow long-term studies of renal cohorts over a wide age range.

4.6 Close collaboration has been achieved with the NHS Blood and Transplant organisation giving joint benefits. Data aggregation and integration has led to joint presentations and publications. The description of the entire patient journey in RRT by this means is a source of continuing insight and usefulness.

4.7 The retention of patient identifiable information, necessary in particular for the adequate tracing of patients, has been approved by the Care Quality Commission's National Information Governance Committee (NIGC). This is renewed on an annual basis along with audit of the information governance arrangements within the UKRR through completion of the Connecting for Health Toolkit.

A:5 The role of the UK Renal Registry for patients

5.1 The goal of the UKRR is to improve care for patients with renal disease. The appropriate use of UKRR information should improve equity of access to care, adequacy of facilities, availability of important but high cost therapies and the efficient use of resources. The continuing comparative audit of the quality of care should facilitate the improvement of care and outcomes of care.

5.2 A leaflet and poster has been provided, in collaboration with the NKF, by which patients may opt out of the collection of identifiable data by the UKRR if they wish. This was renewed in 2012 as part of the Renal Registry's NIGB submission, however opt out remains low.

5.3 Information from the UKRR will complement the individual records available on 'PatientView' where it is accessible.

5.4 A patient council has been convened. The role of the Patient Council is to:

- Act as representatives for kidney patients and their carers.
- Guide and influence methods of delivery of care.
- Advise on opportunities for new work ideas and initiatives for the UKRR.
- Contribute to the development of new audit, research and survey proposals.
- Provide an arena that will encourage discussions between patients and clinical teams to promote patient involvement at renal centre, regional and national levels.
- Monitor and review patient facing initiatives recommended by the Department of Health.
- Review applications and contribute towards the production of patient leaflets, posters, reports and other patient information products developed by the Renal Association.
- Support the UK in issues relating to information governance and patient consent.
- Use personal networks to spread awareness of the UKRR and its work with the council.
- Occasionally represent the Patient Council and the UKRR at other external meetings.

A:6 The role of the UK Renal Registry for nephrologists

6.1 The clinical community have become increasingly aware of the need to define and understand their activities, particularly in relation to national standards and in comparison with other renal centres.

6.2 In 2013, the Registry Committee was disbanded and the UKRR is now run by a 'guiding coalition' and therefore by colleagues with similar concerns and experience.

6.3 The Renal Standards documents are designed to give a basis for centre structure and performance, as well as patient-based elements such as case mix and outcomes. It is anticipated that Standards will become increasingly based on research evidence.

6.4 The UKRR data are available to allow the comparative review of many elements of renal centre practice. Centre data are presented to allow a contrast of individual centre activity and results against national aggregated data. Sophisticated analyses of patient survival for example, are a unique resource to exclude any anomalies of performance and standardise for centre caseload, etc.

6.5 Reports of demographic and treatment variables are available to the participating centres for distribution to Trusts, Health Authorities and Commissioners, as well as renal networks, as required and agreed with the centre. Reports should facilitate discussion between clinicians, Trust officers and commissioners.

6.6 The UKRR welcomes suggestions for topics of national audit or research that colleagues feel are of sufficiently widespread interest for the UKRR to undertake.

6.7 The database has been designed to provide research facilities and for future participation in national and international trials. Members of the Renal Association and other interested parties are welcome to apply to the UKRR Study Groups to conduct local or national audit and research using the database. All such projects will need the agreement of the UKRR Study Groups and any costs involved may need to be met by the applicants.

6.8 These facilities will be sustainable only through co-operation between nephrologists and the UKRR. There is a need for high-quality and comprehensive data entry at source.

6.9 Centres will need to develop an 'annual informatics plan', to review the maintenance and improvement of data collection, organisation and returns to the UKRR. This will help maintain the accuracy, timeliness and completeness of clinical data and also in parallel, support the career development of informatics staff.

A:7 The role of the UK Renal Registry for Trust managers

7.1 As the basis of the clinical governance initiative, the gathering and presentation of clinical data are regarded as essential parts of routine patient management in the health service.

7.2 One of the principles of health service informatics is that the best data are acquired from clinical information recorded at the point of health care delivery.

7.3 Renal services data entered on local systems by staff directly engaged with patients are likely to be of the highest quality and it is these that the UKRR intends to capture.

7.4 The UKRR provides a cost-effective source of detailed information on renal services.

7.5 The regular reports of the UKRR supply details of patient demographics, treatment numbers, treatment quality and outcomes. Data are compared with both national standards and national performance, for benchmarking and quality assurance. The assessment of contract activity and service delivery is possible through these data returns, without the need for further costly Trust or commissioner administrative activity. These data should be particularly valuable to contracts managers and those responsible for clinical governance.

7.6 Data are available on centre case mix, infrastructure and facilities.

7.7 Work is progressing on the data capture and analysis from patients with renal disease other than those requiring RRT and will become available in time (e.g. chronic kidney disease and acute kidney injury).

A:8 The role of the UK Renal Registry for Commissioners of health care

8.1 The commissioning of healthcare within England is evolving again providing uncertainty around the arrangements. However, from meetings with commissioners it is apparent however the powerful role accurate data plays in their decisions.

8.2 The use of information sources such as the UKRR is advised in the National Renal Review in order to promote benchmarking and quality assurance of renal programmes. The comprehensive tracking of relatively small but costly renal cohorts should be regarded as a routine part of speciality case management.

8.3 The UKRR provides validated, comparative reports of renal centre activity on a regular basis to participating centres. These allow assessment of centre

performance across a wide range of variables relating to structure, process and outcome measures.

8.4 There are economies of scale in the performance of audit through the UKRR, since multiple local audits are not required.

8.5 The incidence of RRT treated locally, mortality and renal transplant rates should also be of interest. The assessment of referral and treatment patterns of patients with established (end stage) renal failure by postcode analysis indicates the geographical origin. This information also allows the expression of differences relating to geography, ethnicity and social deprivation. These data may also identify potential unmet need in the population and permit assessment on the equity of service provision. In the future, the UKRR database should also provide information on nephrology and pre-dialysis patients (CKD). This will allow a prediction of the need for RRT facilities, as well as indicating the opportunities for beneficial intervention.

8.6 UKRR data are used to track patient acceptance and prevalence rates over time, which allows the modelling of future demand and the validation of these predictions.

8.7 Information on the clinical diagnosis of new and existing RRT patients may help identify areas where possible preventive measures may have maximal effect.

8.8 The higher acceptance rates in the elderly, and the increasing demand from ethnic groups due to a high prevalence of renal, circulatory and diabetic disease, are measurable.

8.9 Comparative data are available in all categories for national and regional benchmarking.

8.10 The UKRR offers independent expertise in the analysis of renal services data and their interpretation, a resource that is widely required but difficult to otherwise obtain.

8.11 In 2015 the cost of supporting the UKRR core work on RRT audit will be £19 per registered RRT patient per annum (no change from 2014), which is less than 0.05% of the typical cost of a dialysis patient per annum. It is expected that this cost will need to be made explicit within the renal services contract.

A:9 The role of the UK Renal Registry for national quality assurance agencies

9.1 The role of the UKRR in the national quality assurance programme of the Healthcare Quality Improvement Partnership, will depend on the decisions on the role and responsibilities of that agency and their means to discharging them.

9.2 The demographic, diagnostic and outcomes data could support the investigation of clinical effectiveness.

9.3 The case mix information and comorbidity data that would allow better assessment of survival statistics remains incomplete. There is also some clinical scepticism whether 'correction' of outcome data would reflect the realities of clinical practice.

A:10 References

1 Black N: Clinical governance: fine words or action? Br Med J 1998;316: 297–8

2 Black N: High-quality clinical databases: breaking down barriers [Editorial]. Lancet 1999;353:1205–6

UK Renal Registry 17th Annual Report: Appendix B Definitions and Analysis Criteria

B:1 Definition of the incident (take-on) population

The take-on population is defined as all patients over 18 who started renal replacement therapy (RRT) at UK renal centres and did not have a recovery lasting more than 90 days within 90 days of starting RRT.

The treatment timeline is used to define take-on patients as follows.

If a patient has timeline entries from more than one centre then these are all combined and sorted by date. Then, the first treatment entry gives the first date of when they received RRT. This is defined as a 'start date'. However, in the following situations there is evidence that the patient was already receiving RRT before this 'start date' and these people are not classed as take-on patients:

- patients with an initial entry on the timeline of transferred in (modality codes 39 to 69)
- those with an initial entry of transferred out (modality code 38)
- those with an initial treatment of lost to follow up (modality code 95)
- those who had graft acute rejection (modality code 31) and did not have a transplant on the same day
- those with an initial entry of transfer to adult nephrology (modality code 37)
- those with an initial entry of graft functioning (modality code 72)
- those with an initial entry of nephrectomy transplant (modality code 76)

Where none of the above apply, the entry is defined as a take-on (providing there is no recovery of more than 90 days within 90 days of the start date).

If there is a recovery lasting more than 90 days which begins **more** than 90 days after starting RRT then the program looks at the modality codes after this date to see if the patient restarted RRT. If they did, then this is classed as another take-on.

For example, a patient may start RRT in 2010, recover and then restart RRT in 2010. Providing that they do not have a recovery lasting more than 90 days within 90 days of start on either occasion, such patients will be counted twice.

See section B:4 'Start of established renal failure' below for information on 'acute' codes such as 81 'acute haemodialysis'.

Provided the UK Renal Registry (UKRR) received a modality code 36 from the work-up centre, pre-emptive transplants are allocated as incident patients of the work-up centre and not of the centre where the transplant took place.

Note: patients restarting dialysis after a failed transplant are not counted as incident patients.

B:2 Definition of the prevalent population for each year

The adult prevalent population for a year is defined as all RRT patients over 18, being treated at centres returning data to the UKRR for that year and who were alive on 31 December of that year. It includes both incident patients for that year and patients who had been on treatment for longer. Note that any patients over 18 still being treated at paediatric centres are excluded.

Patients who had transferred out, recovered function, stopped treatment without recovery of function or been lost to follow up before the end of the quarter are excluded.

When quarterly data is received from more than one centre (often when there is joint care of renal transplant recipients between the referring centre and the transplant centre) the patient is only included under one of these. The centre to be used is defined by the steps below (as many steps as necessary are followed in this order until data is only left from one centre):

(a) the treatment timeline is used to eliminate any centre(s) which the patient was not still at, at the end of the quarter;
(b) a centre with biochemistry data (at least 1 of the 6 fields – creatinine, haemoglobin, albumin, albuminium, serum potassium, urea) is favoured over one without;
(c) a centre with quarterly modality of transplant is favoured over one without;
(d) non-transplanting centres are favoured over transplanting centres;
(e) the centre with the most of the six biochemistry fields (listed above) populated is favoured;
(f) if the above steps do not decide between centres then the centre is set manually after examining all relevant data.

Further exclusions when analysing quarterly biochemistry or blood pressure data

For these analyses, further restrictions are made to the prevalent cohort for each quarter.

Patients who had 'transferred in' to the centre in that particular quarter are excluded.

Patients who had changed treatment modality in that particular quarter are excluded.

Patients who had been on RRT for less than 90 days are excluded.

Note: the length of time on RRT is calculated from the most recent take-on date. So if a patient starts, then recovers and then starts again, this second start date is used. Also, for patients who are not defined as take-on patients because their start date is unknown (for example, if their first timeline entry is a transfer in code) it is assumed that they have been on RRT for longer than 90 days and they are included for every quarter.

B:3 Statistical definitions

Death rate calculation

A death rate per 100 patient years is calculated by counting the number of deaths and dividing by the person years exposed. This includes all patients, including those who died within the first three months of therapy. The person years at risk are calculated by adding, for each patient, the number of days at risk (until they died or transferred out) and dividing by 365.

Odds ratio

This is the odds of an event in one group divided by the odds in a reference group. For example, if the event is death (within a certain time) and phosphate groups are being compared, then for phosphate group 1.8 to 2.1 mmol/L the odds of the event are:

$$\frac{\text{(probability of dying for someone with a phosphate of 1.8–2.1 mmol/L)}}{\text{(probability of surviving for someone with a phosphate of 1.8–2.1 mmol/L)}}$$

The odds ratio is then:

$$\frac{\text{(odds of dying if phosphate 1.8–2.1 mmol/L)}}{\text{(odds of dying for reference group)}}$$

Note that when the event being analysed is death, often the odds ratio would not be used but a 'survival analysis' used instead. This takes into account the time when the event occurs and also allows for censoring (for example if people are lost to follow up). Such an analysis gives hazard ratios (see below) rather than odds ratios.

Hazard function

The hazard function is the probability of dying in a short time interval, conditional on survival up to that point.

Hazard ratio

For the same example as above, the hazard ratio is the:

$$\frac{\text{(probability of dying in the next interval for a phosphate of 1.8–2.1 mmol/L)}}{\text{(probability of dying in the next interval for a phosphate in the reference range)}}$$

Funnel plots

Percentages achieving Renal Association and other standards are displayed in several ways in the Annual Report. Caterpillar plots show the percentage meeting the targets along with 95% confidence intervals (CIs) for each centre and overall. Funnel plots show the percentage meeting the target plotted against the size of the centre (the number

of people with a measurement). 'Funnels' are plotted around the average percentage meeting the target. Any centres which fall outside the funnels are significantly different from the average. The funnel shape of the limits reflects the fact that for smaller centres, for which the percentage meeting the target is less reliably estimated, a greater observed difference from the average is required for it to be statistically significantly different.

In survival analysis the funnel plot methodology is similar except that the funnel plots show the percentage survival plotted against the size of the centre (the number of patients in the cohort) and 'funnels' are plotted around the average survival. Survival for any centres falling outside the 95% confidence intervals is therefore significantly different from the average survival.

B:4 General and modality definitions

Definitions of analysis quarters

Quarter	Dates
1	1 January–31 March
2	1 April–30 June
3	1 July–30 September
4	1 October–31 December

The quarterly biochemistry data are extracted from renal centre systems as the last data item stored for that quarter. If the patient treatment modality was haemodialysis, the software should try to select a pre-dialysis value (unless otherwise specified in the data specification).

Home haemodialysis

Home haemodialysis patients cease to be classed as such if they need longer than two weeks of hospital dialysis when not an inpatient.

Satellite dialysis unit

A renal satellite unit is defined as a haemodialysis facility that is linked to a main renal centre, is not autonomous for medical decisions and provides chronic outpatient maintenance haemodialysis but with no acute or inpatient nephrology beds on site.

Start of established renal failure

Established renal failure (also known as end stage renal failure or end stage renal disease) was defined as the date of the first dialysis (or of pre-emptive transplant).

A patient starting RRT on 'chronic' haemodialysis should be entered on the UKRR timeline on the date of the first HD episode.

If a patient started RRT with an episode of acute (or acute-on-chronic) kidney injury in which it was felt that kidney function had potential to recover, then acute haemodialysis (or acute haemofiltration or acute peritoneal dialysis where appropriate) should be entered on the UKRR timeline. If subsequently it is felt that kidney function is no longer likely to recover, a timeline modality should be added of 'chronic dialysis' at the time when this becomes apparent (accepting that the timing of this change will vary between clinicians). The UKRR will interrogate the timeline of patients starting 'chronic' RRT and if there is evidence of recent 'acute' RRT, will backdate the date of start of RRT to the first episode of 'acute' RRT provided there has been less than 90 days recovery of kidney function between acute and chronic episodes.

If a patient was started on dialysis and dialysis was temporarily stopped for less than 90 days for any reason (including access failure and awaiting the formation of further access), the date of start of renal replacement therapy (RRT) in UKRR analyses remained the date of first dialysis.

The date of start of peritoneal dialysis is defined as the date of first PD fluid exchange given with the intention of causing solute or fluid clearance. This is in contrast with a flush solely for confirming or maintaining PD catheter patency. In general, exchanges which are part of PD training should be considered as the start of PD (unless earlier exchanges have already been given). However, if it is not planned that the patient starts therapy until a later date, exchanges as part of PD training need not necessarily be considered the start of RRT.

Change of modality from PD to HD

Sites are requested to log in their timeline changes from PD to HD if the modality switch is for longer than 30 days.

Date first seen by a nephrologist

This is the date the patient first attended clinic or was an inpatient under the care of a dialysing nephrologist (whichever is the earlier). If a patient transfers into a renal centre from another renal centre then this date should be left blank by the new renal centre.

Date of CKD5

When a patient has two eGFRs recorded as <15 ml/min/1.73 m^2 over a time period of greater than three

months apart without an intervening eGFR >15, then the earlier of these two dates is defined as the date the patient reached CKD5.

If the patient dies or goes onto RRT within the three month period of eGFR reaching <15, then the date of eGFR <15 is still the date of CKD5.

B:5 Comorbidity definitions

Angina

History of chest pain on exercise with or without ECG changes, ETT, radionucleotide imaging or angiography.

Previous MI within last three months

Detection of rise and/or fall of a biomarker (CK, CK-MB or Troponin) with at least one value above the 99th percentile together with evidence of myocardial ischaemia with at least one of either:

(a) ischaemic symptoms;
(b) ECG changes indicative of new ischaemia (new ST-T changes or new left bundle branch block);
(c) development of pathological Q waves;
(d) imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.

This definition is from the European Society of Cardiology and American College of Cardiology.

Previous MI >3 months ago

Any previous MI at least three months prior to start of renal replacement therapy.

Previous CABG or coronary angioplasty

Previous episode of heart failure

Whether or not due to fluid overload.

Cerebrovascular disease

Any history of strokes (whatever cause) and including transient ischaemic attacks caused by carotid disease.

Diabetes (not causing ESRF)

This includes diet controlled diabetics.

Chronic obstructive pulmonary disease

Chronic obstructive pulmonary disease (COPD) is characterised by airflow obstruction. The airflow obstruction is usually progressive, not fully reversible and does not change markedly over several months.

- Airflow obstruction is defined as a reduced FEV1 (forced expiratory volume in 1 second) and a reduced FEV1/FVC ratio (where FVC is forced vital capacity), such that FEV1 is less than 80% predicted and FEV1/FVC is less than 0.7.
- The airflow obstruction is due to a combination of airway and parenchymal damage.
- The damage is the result of chronic inflammation that differs from that seen in asthma and which is usually the result of tobacco smoke.

There is no single diagnostic test for COPD. Making a diagnosis relies on clinical judgement based on a combination of history, (exertional breathlessness, chronic cough, regular sputum production, frequent winter 'bronchitis', wheeze) physical examination and confirmation of the presence of airflow obstruction using spirometry, (source: British Thoracic Society guidelines).

Liver Disease

Persistent enzyme evidence of hepatic dysfunction or biospy evidence or HbeAg or hepatitis C antigen (polymerase chain reaction) positive serology.

Malignancy

Defined as any history of malignancy (even if curative) e.g. removal of melanoma, excludes basal cell carcinoma.

Claudication

Current claudication based on a history, with or without Doppler or angiographic evidence.

Ischaemic/neuropathic ulcers

Current presence of these ulcers.

Angioplasty, stenting, vascular graft (all non coronary)

This category now includes vascular grafts (e.g. aortic bifurcation graft) and renal artery stents.

Amputation for peripheral vascular disease

Smoking

Current smoker or history of smoking within the last year.

UK Renal Registry 17th Annual Report: Appendix C Renal Services Described for Non-physicians

This appendix provides information on the issues discussed in this report, background information on renal failure and discusses the services available for its treatment.

The role of the kidneys

1.1 The kidneys are paired organs located behind the abdominal cavity. Their primary function is to produce urine, which allows the removal of metabolism-related waste products from the blood. The kidneys also have a role in controlling fluid balance, blood pressure, red blood cell production and the maintenance of healthy bones.

Kidney diseases

1.2 At least 13,000 people die from kidney (renal) disease in the UK each year, although this is an underestimation as many deaths of patients with renal failure are not recorded as such in mortality statistics. Kidney diseases can occur suddenly ('acute') or over months and years ('chronic'). Chronic kidney disease is relatively common, with the majority of patients being elderly and having mild impairment of their renal function.

Acute kidney injury

1.3 Acute kidney injury (AKI) has replaced the previous term 'acute renal failure'. AKI, which is often a reversible process, occurs when there is a rapid loss of renal function due to kidney damage. The causes of AKI can be divided into three categories: pre-renal (interference with the renal blood supply), intrinsic (damage to the kidney itself) and post-renal (obstructive causes in the urinary tract). Some patients with AKI require dialysis for a few days or weeks until their renal function improves, although a small proportion of individuals never recover kidney function. AKI normally occurs in the context of other illness and patients are often unwell; approximately 50% of patients with AKI who receive dialysis do not survive.

Chronic kidney disease (CKD) and established renal failure (ERF)

1.4 Chronic kidney disease affects approximately three million people in the UK and occurs because of slow damage to the kidneys over a number of months or years. The incidence increases with age and is higher in certain ethnic groups, such as people of South Asian and African descent. In the initial stages of CKD, patients are usually well and there is little to find on clinical examination. Early abnormal findings may include blood (haematuria) and protein (proteinuria) in the urine or elevated blood pressure (hypertension). However, the lack of symptoms means many patients present to medical services with advanced disease. In the latter stages of CKD, patients may complain of tiredness, a loss of appetite, feeling sick (nausea) and itching

(pruritus). Other symptoms, such as ankle swelling (oedema), may be present depending on the underlying condition causing CKD.

1.5 Other terms used for chronic kidney disease include chronic renal impairment, chronic renal insufficiency and chronic renal failure. Established renal failure (ERF) refers to kidney function that has deteriorated to a level where treatment is required to sustain life. Treatment options include dialysis and renal transplantation but some patients decide not to receive dialysis and opt for conservative management. Conservative care involves input from specialist nurses and palliative care services, and focuses on treating the complications of kidney disease and managing symptoms.

Causes of CKD

1.6 Most renal diseases that cause renal failure fall into five categories.

1. Generalised (systemic) disease. Diabetes mellitus is by far the most common systemic disease that affects the kidneys (around 20% of all renal disease). Diabetic patients often develop progressive kidney damage over many years, particularly if blood glucose levels and blood pressure are poorly controlled. Careful lifelong supervision of diabetes has a major impact in preventing kidney damage. Other systemic diseases that can cause kidney damage include auto-immune conditions (e.g. systemic lupus erythematous and vasculitis), amyloidosis and multiple myeloma.
2. Glomerulonephritis. This term describes conditions that damage the glomeruli (the filtering units of the kidneys that start the process of urine formation). There are many different causes of glomerulonephritis and treatment depends on the form of the disease. Some types of glomerulonephritis are relatively benign and unlikely to progress to established renal failure. Other forms are more aggressive with treatment making only a small impact on disease progression and the development of established renal failure.
3. High blood pressure (hypertension). Severe ('accelerated') hypertension causes chronic kidney disease, but early recognition and treatment of high blood pressure can halt (and to some extent reverse) the associated kidney damage. Hypertension is a common cause of renal failure in patients of African origin.
4. Obstruction. CKD can be a consequence of any pathology that obstructs the free flow of urine through the urinary system. Most often obstruction is secondary to enlargement of the prostate gland in elderly men, but other causes include kidney stones, bladder tumours, and congenital abnormalities of the renal tract.
5. Genetic disease. The commonest genetic disease causing CKD is polycystic kidney disease. This condition, along with many rare inherited diseases affecting the kidneys, accounts for about 8% of all kidney failure in the UK.

Prevention and management

1.7 Within the UK, risk factors for CKD, such as diabetes, obesity and hypertension are becoming more common. Consequently, the NHS is increasingly focusing on the prevention, early detection and treatment of CKD. Although many of the diseases causing CKD are not preventable, their recognition is important to allow appropriate treatment of any complications and preparation for renal replacement therapy. Some diseases, such as urinary obstruction, may be reversible to some extent and intervention is appropriate. Good diabetic control and blood pressure management may halt the rate of future renal function decline.

1.8 Clear guidelines are in place for the management of CKD by both general practitioners and hospital kidney specialists (nephrologists) [1]. Currently there is no general population screening for renal disease; instead, targeted screening of patients groups 'at-risk' of renal disease, such as diabetic or hypertensive patients, occurs. This normally involves testing the urine for the presence of blood or protein, plus blood tests for the level of substances normally excreted by the kidney such as creatinine and urea.

Complications and comorbidity

1.9 Patients with chronic kidney disease often have accompanying illnesses (comorbidities). Some are

due to the primary disease, e.g. diabetes may cause blindness and diseases of the nerves and blood vessels. Others, such as anaemia, bone disease and heart failure, are consequences of the renal failure. In addition, many patients with established renal failure, have diseases affecting the heart and blood vessels (vascular) particularly ischaemic heart disease and peripheral vascular disease. Comorbidity can influence the choice of treatment for renal failure and may reduce its benefits. Early and aggressive management of CKD-related complications, such as bone mineral abnormalities (hyperparathyroidism), may reduce the incidence of vascular disease.

Renal replacement therapy

1.10 The term renal replacement therapy (RRT) encompasses the three treatments used in established renal failure: haemodialysis, peritoneal dialysis and kidney transplantation. Both forms of dialysis remove waste products from the blood, but the other complications of established renal failure, such as anaemia and abnormal bone metabolism (hyperparathyroidism), require treatment with medications. Patients, usually (but not always) under 70 years of age, may undergo kidney transplantation as a form of treatment. If successful, a kidney transplant returns an individual to good health and removes the need for dialysis.

Renal dialysis

1.11 Dialysis involves the removal of waste products from the blood by allowing these products to diffuse across a thin membrane into dialysis fluid, which is then discarded along with the toxic waste products. The fluid is chemically composed to draw or 'attract' excess salts and water from the blood to cross the membrane, without the blood itself being in contact with the fluid.

Haemodialysis

1.12 The method first used to achieve dialysis was the artificial kidney, or haemodialysis. This involves the attachment of the patient's circulation to a machine through which fluid is passed and exchange can take place. A disadvantage of this method is that some form of permanent access to the circulation must be produced to be used at every treatment. The majority of patients on haemodialysis receive three four-hour sessions a week, at either a hospital-based dialysis unit or a community-based unit (satellite unit) away from the main renal centre. A small number of patients perform their own dialysis at home (home haemodialysis) and the number and duration of treatments will vary.

Peritoneal dialysis

1.13 An alternative form of dialysis is peritoneal dialysis, most commonly in the form of continuous ambulatory peritoneal dialysis (CAPD). In this technique, dialysis fluid is inserted, via a plastic tube (catheter), into the peritoneal cavity (which lies around the bowel) for approximately six hours before being removed and replaced. The fluid must be sterile in order to avoid infection and inflammation of the peritoneum (peritonitis), which is the main complication of the treatment. Each fluid exchange takes 30 to 40 minutes to perform and is repeated three or four times daily.

Renal transplantation

1.14 Renal transplantation replaces all the kidneys' functions, so erythropoietin and vitamin D supplementation are unnecessary. Transplantation involves the placement of a single kidney in the pelvis, close to the bladder, to which the ureter is connected. The immediate problem is the body's immune system recognising the new organ as foreign tissue – a process known as rejection. Consequently, all patients receiving a kidney transplant require anti-rejection drugs, such as tacrolimus, cyclosporine and mycophenolate mofetil, for the lifetime of the transplant. These drugs, known as immunosuppressants, have many undesirable side effects, including the acceleration of vascular disease, increased risk of infection and higher rates of cancer (malignancy). This often means

that myocardial infarctions and strokes are commoner in transplant patients than in healthy individuals of the same age. As transplants get older, there is a progressive loss of function due to chronic rejection (chronic allograft nephropathy). The average lifespan of a kidney transplant is between 10 and 15 years, which means some younger patients, will receive more than one transplant during their lifetime, often with periods of dialysis in-between.

1.15 For many patients, renal transplantation, from both live and deceased donors, is the best treatment in terms of survival and quality of life. Unfortunately, despite changes in policy and legislation there remains a shortage of kidneys for transplant; it appears likely that whatever social and medical structures are present, there will inevitably be a shortage of kidneys from humans.

Nature of renal services

1.16 The work of a nephrologist includes the early detection and diagnosis of renal disease and the long-term management of its complications such as high blood pressure, anaemia and bone disease. The nephrologist may share the management with the general practitioner or local hospital physician; relying on them to refer patients early for initial diagnosis and specific treatment. At any one time, perhaps only 5% of patients under their care are inpatients in wards with a further 20% attending the renal centre regularly for haemodialysis. However, inpatient nephrology and the care of patients receiving centre-based dialysis are specialised, complex and require experienced medical advice to be available on a 24 hour basis. Other renal work is sustained on an outpatient basis; this includes renal replacement therapy by dialysis and the care of transplant patients.

1.17 There are six major components to renal medicine.

1. Renal replacement therapy. The most significant element of work relates to the preparation of patients with advanced CKD for RRT and their medical supervision for the remainder of their lives. The patient population will present increasing challenges for renal staffing as more elderly and diabetic patients are accepted for treatment.
2. Emergency work. The emergency work associated with the specialty consists of:
   i. Treatment of acute renal failure, often involving multiple organ failure and acute-on-chronic renal failure. Close co-operation with other medical specialties, including critical care, is therefore a vital component of this aspect of the service.
   ii. Management of medical emergencies arising from an established renal failure programme. This workload is expanding as the number, age and comorbidity of patients on renal replacement therapy increases.
3. Routine nephrology. A substantial workload is associated with the immunological and metabolic nature of renal disease which requires investigative procedures in an inpatient setting. It is estimated that ten inpatient beds per million of the population are required for this work.
4. Investigation and management of fluid and electrolyte disorders. This makes up a variable proportion of the nephrologists work, depending on the other expertise available in the hospital.
5. Outpatient work. The outpatient work in renal medicine consists of the majority of general nephrology together with clinics for dialysis and renal transplant patients.
6. Research activities. Many nephrologists have clinical or laboratory-based research interests.

References

1 National Collaborating Centre for Chronic Conditions: Chronic kidney disease: national clinical guideline for early identification and management in adults in primary and secondary care. London: Royal College of Physicians, September 2008

UK Renal Registry 17th Annual Report: Appendix D Methodology used for Analyses of PCT/HB Incidence and Prevalence Rates and of Standardised Ratios

Described here are the methods for calculating the standardised incidence ratios for the incident UK RRT cohort, the standardised prevalence ratios for the total UK RRT cohort and the ratios for prevalent transplant patients.

Patients

For the incidence rate analyses, all new cases recorded by the UK Renal Registry (UKRR) as starting RRT in each year were included. For the prevalence rates analyses, prevalent patients at the end of the year were included.

Years used

Analyses have been completed for each of the last six years. Combined analyses over the six years have also been done for the incidence rates and rate ratios analyses as there can be small numbers of incident patients particularly in the smaller areas.

Geography

The areas used were the 211 English Clinical Commissioning Groups (CCGs), the seven Welsh Local Health Boards, the 14 Scottish Health Boards and the five Health and Social Care Trusts in Northern Ireland; these different types of area are collectively called CCG/HBs here. Patients were allocated to CCG/HBs using the patient's postcode (rather than the GP postcode). For the incidence rates analyses the patient's postcodes at start of RRT were used. For the prevalent rates analyses the postcodes at the end of the relevant year were used. Each postcode was linked to the ONS postcode directory (ONSPD) to give the CCG/HB code. The ONSPD contains National Statistics data © Crown copyright and database right 2014 and also Ordnance Survey data © Crown copyright and database right 2014.

Areas included in the UK Renal Registry 'covered' population

This year all renal centres again sent data to the UKRR so coverage of the UK is complete for the six years used in these analyses (2008 to 2013).

Population data

Mid-2012 population estimates by CCG/HB, gender and age group were obtained from the Office for National Statistics (ONS) website (www.statistics.gov.uk), the Northern Ireland Statistics and Research Agency (NISRA) website (www.nisra.gov.uk) and the National Records of Scotland website (www.nrscotland.gov.uk). These mid-2012 population estimates are projections

based on the 2011 Census data. The population of the CCG/HBs range from 21,500 (Orkney) to 1.22 million (Greater Glasgow and Clyde).

The analysis for each year uses this mid-2012 population data. As the analyses only cover six years this was a reasonable approximation.

Calculation of rates and rate ratios

Crude rates

The crude rates, per million population (pmp), were calculated for each CCG/HB for each year:

$$1{,}000{,}000 \times (\text{observed number})/(\text{population size})$$

For the combined years analyses the observed cases are summed over the available years and the population is multiplied by the number of years that the area has been covered. This is a rate per million population **per year**. It is an average over the available years.

Confidence intervals have not been calculated for these (single or combined years) rates but, if required, an assessment can be made of whether the rate for a given area is consistent with the rate in the whole covered population. This can be done by using the figures provided here showing the confidence intervals around the overall average rates for a range of CCG/HB population sizes. These are figures D.1 and D.2 for incidence rates, and D.3 and D.4 for prevalence rates.

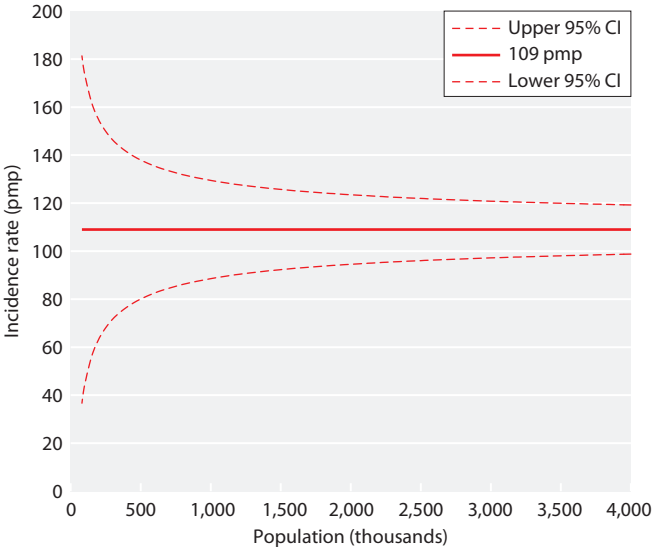

Fig. D.2. 95% confidence limits for incidence rate of 109 pmp for population size 80,000–4 million

Note that when using the confidence interval figures to assess how different an area's combined years crude incidence rate is from the overall average, the population looked up on the x-axis should be the area's population multiplied by the number of years of data that has been used (i.e. six). In doing this, the confidence intervals obtained become narrower, consistent with the analysis now being based on more than one year of data.

These confidence intervals have been obtained using the Normal approximation to the Poisson distribution.

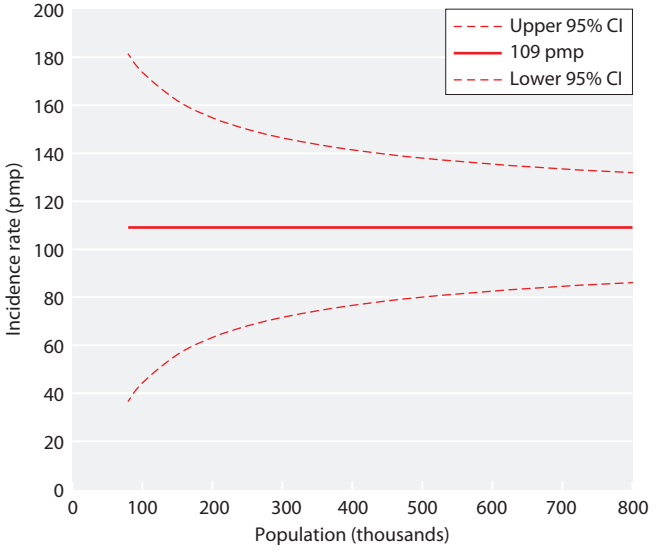

Fig. D.1. 95% confidence limits for incidence rate of 109 pmp for population size 80,000–800,000

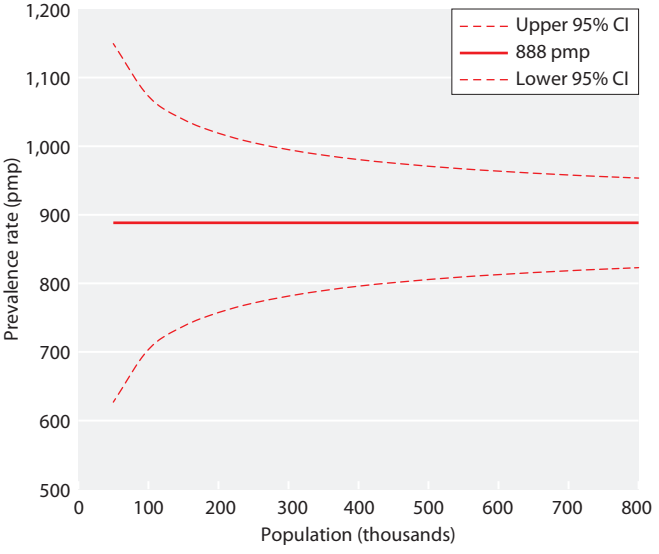

Fig. D.3. 95% confidence limits for prevalence rate of 888 pmp for catchment population size 50,000–800,000

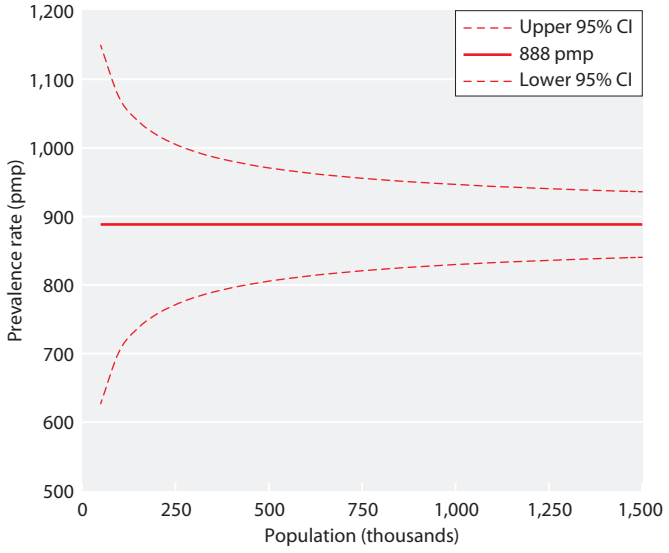

Fig. D.4. 95% confidence limits for prevalence rate of 888 pmp for catchment population size 50,000–1.5 million

For the incident analyses, confidence intervals have only been calculated around the overall average for populations of over 80,000. This is because below this level the number of cases you would expect per area is low and so the Poisson distribution is skewed and the Normal approximation is not appropriate. Due to prevalence rates being higher, confidence intervals can be obtained using this method for lower population sizes.

Standardised incidence/prevalence ratios (SIR/SPR or SR)

There are large differences in incidence and prevalence rates for RRT between age and gender groups. As there are also differences in the age/gender breakdowns of the different areas it is useful to produce estimates standardised for age and gender. The method used is *indirect* standardisation.

Observed cases (O_i) were calculated by summing all cases in all age and gender bands for each CCG/HB. Expected cases (E_i) for each CCG/HB were calculated as follows:

Overall crude rates (for each year) were calculated for the whole covered population (the *standard population*) by summing the observed numbers, over the CCG/HBs, for each age/gender band and dividing this by the total covered population in that age/gender band. These crude rates (by age/gender band) were then multiplied by the population each CCG/HB has in each band to give the number of cases expected in that band if that CCG/HB had the same rates as the standard population.

These expected numbers were then summed over the age/gender bands to give an expected total number of cases in each CCG/HB. The age/gender standardised ratio (SR) for CCG/HB *i* is then O_i/E_i.

The expected number of cases is the number you would see if the rates seen in the standard population applied to that individual CCG/HB's age/gender breakdown. 95% confidence intervals were calculated for each area using an error factor (EF) as follows:

$$\text{LCL} = \text{SR}/\text{EF}$$

$$\text{UCL} = \text{SR} \times \text{EF}$$

Where $\text{EF} = \exp(1.96/\sqrt{(O_i)})$.

A standardised ratio (SR) of 1 indicates that the area's rate was as expected if the age/gender rates found in the total covered population applied to the CCG/HB area's population structure; a value above 1 indicates that the observed rate was greater than expected given the area's population structure, if the lower confidence limit was above 1 this was statistically significant at the 5% level. The converse applies to standardised ratios under one.

The combined years analyses are similar to the above except that the observed and expected numbers are summed over the years.

Remaining variability between rates

Even after standardisation there remains a large amount of variability between CCG/HBs–as can be seen by the large numbers of significantly low or high standard ratios. This is partly because these ratios have only been adjusted for age and gender and have not been adjusted for ethnicity (or any other factors). Much higher rates are expected in populations with a high percentage of patients from South Asian or Black backgrounds. It is hoped that in the future the UKRR will also do analyses further standardised for ethnicity.

UK Renal Registry 17th Annual Report: Appendix E Methodology for Estimating Catchment Populations of Renal Centres in the UK for Dialysis Patients

Introduction

Providing accurate centre-level incidence and prevalence rates for patients receiving renal replacement therapy (RRT) in the UK was limited until the 13th Annual Report by the difficulty in estimating the catchment population from which the RRT population was derived. One reason for this was that the geographical boundaries separating renal centres are relatively arbitrary and dependent upon a number of factors including referral practice, patient choice and patient movement. Previously, incidence and prevalence rates had been calculated at Local Authority/Primary Care Trust/Health Board level for which denominator data were available, but not at renal centre level.

UK Renal Registry (UKRR) Annual Reports prior to the 13th suggested an estimate of the size of the catchment populations. These were extrapolated figures originally derived from data in the 1992 National Renal Survey undertaken by Paul Roderick.

The purpose of this appendix is to present an estimate of the dialysis catchment population for all renal centres in the UK. It also contains a methodological description and discussion of the limitations of these methods. Previous UKRR Annual Reports contained estimates for English renal centres using 2001 Census data and a similar methodology as outlined here [1]. In last year's report the methodology was repeated using data from the 2011 Census in order to obtain more up to date estimates and also to include renal centres in Wales. This year, estimates for renal centres in Scotland and Northern Ireland have been calculated to complete full coverage of the UK.

Methods

The UK Renal Registry database of the incident dialysis population between 1st January 2008 and 31st December 2012 was used to estimate the size of each renal centre's catchment population. This used the postcode and centre for each individual at the time of starting RRT on dialysis.

Polygons were constructed to define an area around the geographical location of each dialysis patient. The lines of the polygons, representing the boundaries between areas, were drawn such that they were equidistant between adjacent patients, creating a map of non-overlapping polygons covering the entire area of England, Northern Ireland, Scotland and Wales (the process was done separately for each country). This method produces Thiessen polygons which have the property that all locations within each polygon share the same nearest dialysis patient [2].

The polygons of all patients starting at the same renal centre were combined to create the catchment area for that centre. The catchment area for one centre might comprise multiple unconnected polygons as a result of adjacent patients attending different renal centres. The Office for National Statistics (ONS) map of 2011 Census merged wards contains population estimates for England and Wales divided into 8,546 wards. The Northern Ireland Statistics and Research Agency (NISRA) published population estimates based on the 2011 Census for 4,537 geographical regions referred to as Small Areas. The General Register Office for Scotland published 2011 population estimates at 6,505 data zone level areas.

Wards, small areas and data zones will collectively be referred to as wards in the following paragraph.

The wards were overlaid on the map of renal centre catchment areas, enabling the proportion of each ward's area covered by each of the renal centre catchment areas to be calculated. Each ward's population was then allocated to the renal centres in proportions equal to the proportions of the overlaid areas. Summing these proportions of populations across all of the wards for each renal centre produced the estimates of the total catchment population for each centre.

Results

The estimated dialysis catchment populations for renal centres in England, Wales, Northern Ireland and Scotland are shown in Tables E.1, E.2, E.3 and E.4 respectively.

Table E.1. Estimated dialysis catchment populations of English renal centres based upon 2011 Census ONS Census ward population estimates (rounded to nearest 1,000)

Centre	Estimate	Centre	Estimate
B Heart	738,000	Leeds	1,670,000
B QEH	1,699,000	Leic	2,436,000
Basldn	415,000	Liv Ain	484,000
Bradfd	652,000	Liv Roy	1,000,000
Brightn	1,297,000	M RI	1,531,000
Bristol	1,439,000	Middlbr	1,004,000
Camb	1,158,000	Newc	1,121,000
Carlis	321,000	Norwch	787,000
Carsh	1,913,000	Nottm	1,088,000
Chelms	510,000	Oxford	1,690,000
Colchr	299,000	Plymth	470,000
Covnt	892,000	Ports	2,024,000
Derby	703,000	Prestn	1,493,000
Donc	410,000	Redng	910,000
Dorset	862,000	Salford	1,490,000
Dudley	442,000	Sheff	1,372,000
Exeter	1,089,000	Shrew	501,000
Glouc	587,000	Stevng	1,204,000
Hull	1,020,000	Sthend	317,000
Ipswi	399,000	Stoke	890,000
Kent	1,224,000	Sund	618,000
L Barts	1,830,000	Truro	413,000
L Guys	1,082,000	Wirral	572,000
L Kings	1,171,000	Wolve	669,000
L Rfree	1,518,000	York	492,000
L St G	797,800	**England**	**53,399,000**
L West	2,399,000		

Table E.2. Estimated dialysis catchment populations of Welsh renal centres based upon 2011 Census ONS Census Ward population estimates (rounded to nearest 1,000)

Centre	Estimate	Centre	Estimate
Bangor	218,000	Swanse	885,000
Cardff	1,420,000	Wrexm	240,000
Clwyd	190,000	**Wales**	**2,953,000**

Table E.3. Estimated dialysis catchment populations of renal centres in Northern Ireland based upon 2011 Census NISRA small area population estimates (rounded to nearest 1,000)

Centre	Estimate	Centre	Estimate
Antrim	295,000	Ulster	266,000
Belfast	637,000	West NI	352,000
Newry	261,000	**N Ireland**	**1,811,000**

Source: NISRA: Website: www.nisra.gov.uk

Table E.4. Estimated dialysis catchment populations of renal centres in Scotland based upon 2011 Census NRS data zone area population estimates (rounded to nearest 1,000)

Centre	Estimate	Centre	Estimate
Abrdn	600,000	Glasgw	1,624,000
Airdrie	552,000	Inverns	270,000
D & Gall	148,000	Klmarnk	361,000
Dundee	463,000	Krkcldy	317,000
Edinb	964,000	**Scotland**	**5,300,000**

Discussion

These results show estimates for the size of the catchment areas for each of the renal centres in the UK.

There are some limitations to these results. The main one is that the ward/small area/data zone allocated to each renal centre was based upon dialysis patients only. Therefore it is possible that non-dialysis patients may come from a different catchment population. This is more likely where a renal centre provides specialist services and especially likely for patients undergoing renal transplantation. The catchment population for renal transplant patients will depend largely upon the distribution of workload between the referral centre and the transplanting centre for pre-transplant work-up,

donor nephrectomy work-up and post-transplant care (including if and when care is returned to the referring centre).

Despite the limitations, this is the most valid methodology to date to estimate the size of the catchment populations for renal centres in the UK. The results of this analysis allow the UKRR to calculate estimates of the incidence and prevalence rates of RRT at renal centre level, rather than only at CCG/HB level.

These results also provide other opportunities for study of the catchment populations. The ONS provides data on gender, age and ethnicity of the population at ward level. It should be possible to use this information to consider centre differences in the demographics of patients commencing or receiving RRT with adjustment for the catchment population characteristics.

Acknowledgements

Thanks are expressed to Andrew Judge for calculating these catchment populations for the UK Renal Registry.

References

1 Judge A, Caskey FJ, Welton NJ, Ansell D, Tomson CR, Roderick PJ, Ben-Shlomo Y: Inequalities in rates of renal replacement therapy in England: does it matter who you are or where you live? Nephrol Dial Transplant 2012 Apr;27(4):1598–607 Nephron Dial Transplant 2012 Apr:27(4):1598–607. doi: 10.1093/ndt/gfr466. Epub 2011 Aug 30

2 Boots BN: Voronoi (Thiessen) Polygons (Concepts and Techniques in Modern Geography); Norwich: Geo Books, 1986

UK Renal Registry 17th Annual Report: Appendix F Additional Data Tables for 2013 new and existing patients

F:1 Patients starting renal replacement therapy in 2013

Table F.1.1. Number of patients on dialysis at 90 days (incident cohort 1/10/2012 to 30/09/2013)

	Aged <65		Aged ⩾65	
	HD *N*	PD *N*	HD *N*	PD *N*
England	1,804	721	2,101	439
N Ireland	45	19	70	19
Scotland	186	39	181	32
Wales	85	38	162	27
UK	**2,120**	**817**	**2,514**	**517**

Table F.1.2. Number of patients per treatment modality at 90 days (incident cohort 1/10/2012 to 30/09/2013)

	HD	PD	Transplant	Stopped treatment	Died
England	3,905	1,160	579	12	302
N Ireland	115	38	18	4	13
Scotland	367	71	41	0	18
Wales	247	65	31	1	24
UK	**4,634**	**1,334**	**669**	**17**	**357**

Table F.1.3. First treatment modality (2013 incident cohort)

Centre	% HD	% PD	% transplant
England			
B Heart	82	17	1
B QEH	72	18	10
Basldn	78	22	
Bradfd	69	19	11
Brightn	72	24	4
Bristol	68	19	13
Camb	62	12	27
Carlis	56	32	12
Carsh	73	23	4
Chelms	86	14	
Colchr	100		
Covnt	72	21	7
Derby	54	46	
Donc	73	27	
Dorset	65	30	5
Dudley	70	30	
Exeter	75	22	4
Glouc	70	24	6
Hull	67	28	4
Ipswi	74	21	5
Kent	75	17	8
Prestn	73	17	11
Redng	62	32	6
Salford	75	24	1
Sheff	77	17	6
Shrew	77	20	3
Stevng	79	16	5
Sthend	71	19	10
Stoke	73	26	1
Sund	86	10	4
Truro	61	26	13
Wirral	74	26	
Wolve	65	34	1
York	83	14	3
N Ireland			
Antrim	90	10	
Belfast	65	16	19
Newry	61	39	
Ulster	93	7	
West NI	70	27	3
Scotland			
Abrdn	86	14	
Airdrie	84	16	

Table F.1.3. Continued

Centre	% HD	% PD	% transplant	Centre	% HD	% PD	% transplant
L Barts	67	27	7	D & Gall	67	33	
L Guys	72	9	19	Dundee	81	19	
L Kings	74	23	3	Edinb	72	11	17
L Rfree	66	24	10	Glasgw	79	10	11
L St.G	57	24	20	Inverns	74	26	
L West	83	7	10	Klmarnk	76	22	2
Leeds	74	10	16	Krkcldy	84	16	
Leic	73	17	10	**Wales**			
Liv Ain	76	21	3	Bangor	88	13	
Liv Roy	56	23	20	Cardff	74	17	9
M RI	58	20	23	Clwyd	79	14	7
Middlbr	83	11	6	Swanse	81	15	5
Newc	73	12	16	Wrexm	68	27	5
Norwch	92	8		**England**	**71**	**20**	**9**
Nottm	56	27	17	**N Ireland**	**74**	**18**	**8**
Oxford	60	23	16	**Scotland**	**79**	**15**	**6**
Plymth	60	27	13	**Wales**	**77**	**17**	**7**
Ports	72	18	10	**UK**	**72**	**19**	**9**

Table F.1.4. First treatment modality, patient numbers (2013 incident cohort)

	HD	PD	Transplant
England	4,237	1,191	534
N Ireland	133	33	14
Scotland	397	73	32
Wales	271	60	23
UK	**5,038**	**1,357**	**603**

Table F.1.5. Gender breakdown by treatment modality at 90 days (2013 incident cohort)

	HD			PD		
Centre	% male	% female	M : F ratio	% male	% female	M : F ratio
England						
B Heart	54	46	1.2	53	47	1.1
B QEH	60	40	1.5	63	38	1.7
Basldn	59	41	1.4	44	56	0.8
Bradfd	71	29	2.4	58	42	1.4
Brightn	53	47	1.1	79	21	3.7
Bristol	67	33	2.0	71	29	2.5
Camb	74	26	2.8	80	20	4.0
Carlis	74	26	2.8	73	27	2.7
Carsh	64	36	1.7	67	33	2.0
Chelms	73	27	2.7	33	67	0.5
Colchr	71	29	2.5			
Covnt	63	38	1.7	73	27	2.7
Derby	58	43	1.4	67	33	2.0
Donc	57	43	1.3	60	40	1.5
Dorset	66	34	1.9	58	42	1.4
Dudley	58	42	1.4	77	23	3.3
Exeter	66	35	1.9	75	25	3.0
Glouc	68	33	2.1	71	29	2.5
Hull	64	36	1.8	61	39	1.5
Ipswi	73	27	2.7	50	50	1.0
Kent	69	31	2.2	50	50	1.0

Table F.1.5. Continued

Centre	HD			PD		
	% male	% female	M : F ratio	% male	% female	M : F ratio
L Barts	57	43	1.3	65	36	1.8
L Guys	69	31	2.3	50	50	1.0
L Kings	68	32	2.1	67	33	2.0
L Rfree	65	35	1.8	61	39	1.6
L St.G	62	39	1.6	47	53	0.9
L West	62	38	1.6	59	41	1.4
Leeds	63	37	1.7	70	30	2.3
Leic	64	36	1.7	66	34	1.9
Liv Ain	61	39	1.6	64	36	1.8
Liv Roy	72	28	2.5	75	25	3.0
M RI	59	41	1.4	41	59	0.7
Middlbr	71	29	2.5	55	46	1.2
Newc	68	32	2.1	67	33	2.0
Norwch	67	33	2.0	40	60	0.7
Nottm	55	45	1.2	47	53	0.9
Oxford	63	37	1.7	71	29	2.4
Plymth	74	26	2.9	69	31	2.2
Ports	67	33	2.0	80	20	4.0
Prestn	55	45	1.2	52	48	1.1
Redng	68	32	2.1	71	29	2.4
Salford	69	31	2.2	65	35	1.8
Sheff	67	33	2.0	50	50	1.0
Shrew	65	35	1.8	64	36	1.7
Stevng	62	38	1.7	68	32	2.1
Sthend	63	37	1.7	71	29	2.5
Stoke	56	44	1.3	65	36	1.8
Sund	73	28	2.6	75	25	3.0
Truro	61	39	1.5	70	30	2.3
Wirral	64	36	1.8	64	36	1.7
Wolve	71	29	2.5	78	22	3.5
York	36	65	0.6	80	20	4.0
N Ireland						
Antrim	86	14	6.0	60	40	1.5
Belfast	57	44	1.3	58	42	1.4
Newry	58	42	1.4	80	20	4.0
Ulster	43	57	0.8	100		
West NI	60	40	1.5		100	
Scotland						
Abrdn	56	44	1.3	54	46	1.2
Airdrie	62	38	1.6	75	25	3.0
D & Gall	80	20	4.0	100		
Dundee	63	38	1.7	80	20	4.0
Edinb	50	50	1.0	75	25	3.0
Glasgw	61	39	1.6	60	40	1.5
Inverns	30	70	0.4	25	75	0.3
Klmarnk	54	46	1.2	43	57	0.8
Krkcldy	67	33	2.0	20	80	0.3
Wales						
Bangor	70	30	2.3	50	50	1.0
Cardff	63	38	1.7	64	36	1.8
Clwyd	75	25	3.0	33	67	0.5
Swanse	71	29	2.4	76	24	3.2
Wrexm	68	32	2.1	100		
England	**64**	**36**	**1.8**	**64**	**36**	**1.8**
N Ireland	**60**	**40**	**1.5**	**76**	**24**	**3.2**
Scotland	**59**	**41**	**1.4**	**55**	**45**	**1.2**
Wales	**67**	**33**	**2.0**	**71**	**29**	**2.4**
UK	**63**	**37**	**1.7**	**64**	**36**	**1.8**

F:2 Prevalent patients on 31/12/2013

Table F.2.1. Treatment modalities for 2013 prevalent patients aged under and over 65

	Patients aged <65				Patients aged ⩾65			
Centre	% HD	% PD	% transplant	HD : PD	% HD	% PD	% transplant	HD : PD
England								
B Heart	55	7	39	7.9	80	5	14	14.9
B QEH	35	6	59	5.7	68	8	24	8.6
Basldn	47	12	42	3.9	74	10	16	7.2
Bradfd	31	6	63	5.6	58	6	36	9.3
Brightn	34	8	59	4.5	61	11	28	5.5
Bristol	20	5	75	4.4	62	5	34	12.8
Camb	15	1	84	12.6	60	4	36	16.7
Carlis	20	9	71	2.2	47	18	35	2.6
Carsh	36	8	56	4.5	71	9	21	8.3
Chelms	30	9	61	3.3	74	8	18	8.7
Colchr	100	0	0	0.0	100	0	0	0.0
Covnt	28	7	66	4.2	62	13	25	4.7
Derby	36	17	47	2.1	59	19	22	3.1
Donc	53	13	34	4.2	75	14	11	5.2
Dorset	26	5	68	4.8	59	10	31	6.0
Dudley	45	21	34	2.1	70	14	16	5.0
Exeter	25	6	68	4.0	68	10	21	6.6
Glouc	32	8	61	4.2	72	9	20	8.5
Hull	27	9	64	3.1	63	12	25	5.3
Ipswi	25	6	69	4.3	49	13	38	3.9
Kent	25	6	70	4.2	64	8	28	8.3
L Barts	37	7	56	5.0	68	15	18	4.6
L Guys	25	1	74	22.8	59	3	38	20.6
L Kings	42	11	47	4.0	68	11	21	6.0
L Rfree	25	6	69	4.2	61	8	31	7.5
L St.G	27	4	69	6.2	55	10	35	5.4
L West	33	1	66	23.0	67	3	30	22.8
Leeds	25	4	71	5.7	55	5	40	10.2
Leic	32	6	62	5.2	63	9	27	6.8
Liv Ain	71	24	5	3.0	90	9	1	10.3
Liv Roy	22	4	74	5.1	46	5	48	8.6
M RI	21	3	75	6.7	46	8	46	5.9
Middlbr	30	2	69	17.6	64	2	34	38.6
Newc	23	3	74	7.2	40	7	53	5.9
Norwch	32	4	64	7.9	68	8	24	8.5
Nottm	20	7	73	2.8	63	9	28	7.0
Oxford	19	5	76	4.0	48	10	42	4.8
Plymth	14	6	80	2.6	46	10	44	4.5
Ports	28	4	68	6.9	57	8	35	7.2
Prestn	40	4	56	9.9	68	7	25	9.7
Redng	27	9	63	2.9	54	12	34	4.6
Salford	35	10	55	3.7	62	9	29	6.8
Sheff	32	4	64	7.2	67	7	26	9.9
Shrew	45	9	46	5.1	67	10	23	6.7
Stevng	47	5	48	9.6	80	7	13	11.1
Sthend	41	9	50	4.6	69	7	24	9.3
Stoke	29	8	62	3.7	63	18	20	3.5
Sund	37	2	62	20.0	65	4	31	16.2
Truro	23	7	70	3.5	58	6	36	9.5
Wirral	78	19	3	4.1	91	9		9.8
Wolve	41	14	45	2.9	74	15	11	4.8
York	21	6	72	3.4	58	7	35	8.3

Table F.2.1. Continued

	Patients aged <65				Patients aged ⩾65			
Centre	% HD	% PD	% transplant	HD : PD	% HD	% PD	% transplant	HD : PD
N Ireland								
Antrim	35	5	59	6.7	78	8	14	9.7
Belfast	20	3	77	6.4	52	5	42	9.9
Newry	37	5	59	7.7	63	16	21	3.8
Ulster	42	4	54	10.0	89	4	7	25.3
West NI	29	5	66	6.0	76	9	16	8.9
Scotland								
Abrdn	30	4	66	7.6	70	7	23	10.6
Airdrie	39	2	59	19.8	67	7	26	10.3
D & Gall	28	10	62	2.7	54	17	29	3.2
Dundee	31	5	64	6.6	59	6	35	9.9
Edinb	31	3	66	12.1	55	8	37	6.7
Glasgw	25	2	73	10.8	65	4	31	17.3
Inverns	19	5	75	3.8	64	11	25	5.6
Klmarnk	35	12	53	3.0	65	19	16	3.4
Krkcldy	34	6	60	6.1	75	8	17	9.2
Wales								
Bangor	92	8		11.7	84	16		5.1
Cardff	19	4	77	5.3	53	7	40	7.7
Clwyd	43	5	53	8.5	58	14	29	4.2
Swanse	33	9	58	3.8	64	8	28	8.0
Wrexm	26	10	65	2.7	61	8	31	7.9
England	**30**	**6**	**65**	**5.3**	**63**	**8**	**29**	**7.5**
N Ireland	**27**	**4**	**69**	**6.9**	**68**	**8**	**24**	**9.0**
Scotland	**29**	**4**	**67**	**7.7**	**64**	**7**	**28**	**8.8**
Wales	**26**	**5**	**69**	**4.7**	**59**	**8**	**33**	**7.1**
UK	**29**	**5**	**65**	**5.4**	**63**	**8**	**29**	**7.6**

Table F.2.2. Number of 2013 prevalent patients under and over 65 per treatment modality

	Patients aged <65			Patients aged ⩾65		
	HD	PD	Transplant	HD	PD	Transplant
England	9,121	1,720	19,766	10,952	1,457	5,016
N Ireland	261	38	676	389	43	139
Scotland	888	115	2,050	972	111	428
Wales	430	91	1,158	648	91	359
UK	**10,700**	**1,964**	**23,650**	**12,961**	**1,702**	**5,942**

Table F.2.3. Dialysis modalities for 2013 prevalent patients aged under 65

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	9	76	5	6	0	5
B QEH	7	11	67	5	0	10
Basldn	0	74	6	7	0	13
Bradfd	2	76	7	4	0	11
Brightn	16	39	27	10	0	8
Bristol	8	21	53	9	0	10
Camb	14	43	35	0	7	0
Carlis	0	45	24	10	0	21
Carsh	4	29	49	4	0	14
Chelms	2	74	0	19	0	4
Colchr	0	100	0	0	0	0
Covnt	7	74	0	19	0	0
Derby	11	57	0	19	0	13
Donc	1	51	29	1	0	18
Dorset	3	19	61	11	0	6
Dudley	10	48	10	19	0	13
Exeter	2	10	68	10	0	10
Glouc	0	69	12	7	0	12
Hull	4	35	37	12	0	12
Ipswi	1	65	14	10	0	9
Kent	8	24	48	19	0	1
L Barts	2	41	40	2	0	15
L Guys	11	10	75	1	0	3
L Kings	2	15	63	6	0	14
L Rfree	4	4	73	6	0	13
L St.G	3	44	40	3	1	10
L West	2	20	74	2	0	2
Leeds	7	20	58	4	0	11
Leic	11	18	55	4	0	13
Liv Ain	10	4	61	5	0	20
Liv Roy	12	39	32	8	0	8
M RI	16	29	42	5	0	8
Middlbr	5	31	58	5	0	0
Newc	12	76	0	1	1	11
Norwch	11	51	27	8	0	3
Nottm	13	35	26	8	0	18
Oxford	7	29	43	4	0	16
Plymth	7	66	0	8	0	20
Ports	8	20	59	13	0	0
Prestn	9	22	60	1	0	8
Redng	4	29	41	18	0	8
Salford	8	32	39	11	0	11
Sheff	12	33	43	12	0	0
Shrew	13	44	26	16	0	0
Stevng	9	29	53	9	0	0
Sthend	0	82	0	18	0	0
Stoke	0	54	25	3	1	17
Sund	1	66	29	1	1	3
Truro	7	37	34	8	0	14
Wirral	7	32	42	3	0	16
Wolve	5	27	42	17	1	8
York	16	28	32	18	0	5
N Ireland						
Antrim	7	80	0	4	0	9
Belfast	11	76	0	1	0	13

Table F.2.3. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
Newry	0	88	0	0	0	12
Ulster	12	79	0	3	3	3
West NI	10	76	0	0	2	12
Scotland*						
Abrdn	4	84	0	8	0	4
Airdrie	0	95	0	4	0	1
D & Gall	8	65	0	15	0	12
Dundee	4	83	0	4	0	10
Edinb	3	90	0	1	0	7
Glasgw	8	84	0	3	0	5
Inverns	3	76	0	11	0	11
Klmarnk	3	72	0	2	0	23
Krkcldy	0	86	0	0	0	14
Wales						
Bangor	32	53	8	3	0	5
Cardff	15	15	55	10	0	5
Clwyd	5	84	0	11	0	0
Swanse	8	55	16	12	0	9
Wrexm	4	58	12	27	0	0
England	**7**	**32**	**45**	**7**	**0**	**9**
N Ireland	**8**	**79**	**0**	**1**	**1**	**11**
Scotland*	**4**	**84**	**0**	**4**	**0**	**8**
Wales	**12**	**39**	**32**	**12**	**0**	**6**
UK	**7**	**38**	**40**	**7**	**0**	**9**

*All haemodialysis patients in centres in Scotland are shown as receiving treatment at home or in centre as no data is available regarding satellite dialysis

Table F.2.4. Dialysis modalities for 2013 prevalent patients aged over 65

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	2	84	8	5	0	1
B QEH	2	9	78	4	0	6
Basldn	0	86	2	7	0	6
Bradfd	0	65	26	4	0	5
Brightn	5	45	35	10	0	5
Bristol	2	13	77	4	0	4
Camb	1	38	56	0	6	0
Carlis	0	48	24	17	0	11
Carsh	2	15	73	3	0	7
Chelms	1	89	0	8	0	2
Colchr	0	100	0	0	0	0
Covnt	2	80	0	17	0	0
Derby	8	67	0	18	0	7
Donc	0	40	44	0	0	16
Dorset	0	19	66	6	0	8
Dudley	2	64	18	12	0	5
Exeter	0	10	77	6	0	6
Glouc	1	77	12	2	0	8
Hull	0	39	44	8	0	8
Ipswi	1	69	10	14	0	6
Kent	2	21	67	9	0	2
L Barts	0	38	45	6	0	11
L Guys	2	19	75	2	0	2
L Kings	0	13	73	8	0	7
L Rfree	1	3	84	5	0	7

Table F.2.4. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
L St.G	1	31	52	5	1	10
L West	0	20	75	2	0	2
Leeds	0	13	78	2	0	7
Leic	3	15	69	4	0	9
Liv Ain	1	4	86	3	0	6
Liv Roy	4	37	49	9	0	2
M RI	3	23	60	2	0	13
Middlbr	2	21	75	3	0	0
Newc	2	83	0	1	1	13
Norwch	5	46	38	8	0	3
Nottm	2	41	45	6	0	7
Oxford	3	33	47	5	0	13
Plymth	2	75	5	8	0	10
Ports	1	16	71	12	0	0
Prestn	3	20	68	3	0	7
Redng	0	41	41	11	0	7
Salford	3	35	49	6	0	7
Sheff	2	42	48	9	0	0
Shrew	3	47	37	13	0	0
Stevng	3	31	58	8	0	0
Sthend	1	89	0	10	0	0
Stoke	0	51	26	3	6	13
Sund	0	54	40	3	0	3
Truro	3	46	42	5	0	4
Wirral	1	38	52	2	0	8
Wolve	2	23	58	13	0	4
York	0	34	55	11	0	0
N Ireland						
Antrim	0	91	0	1	0	8
Belfast	2	89	0	1	0	8
Newry	3	76	0	0	0	21
Ulster	1	95	0	0	0	4
West NI	1	89	0	0	1	9
Scotland*						
Abrdn	2	90	0	7	0	2
Airdrie	1	90	0	5	0	4
D & Gall	0	76	0	9	0	15
Dundee	0	91	0	3	0	6
Edinb	0	87	0	2	0	11
Glasgw	1	93	0	2	0	4
Inverns	2	83	0	9	0	7
Klmarnk	4	73	0	2	0	21
Krkcldy	0	90	0	1	0	9
Wales						
Bangor	3	56	25	15	0	2
Cardff	2	13	74	10	0	2
Clwyd	2	79	0	6	13	0
Swanse	3	62	24	9	0	3
Wrexm	0	69	20	11	0	0
England	**2**	**33**	**54**	**6**	**0**	**5**
N Ireland	**1**	**89**	**0**	**0**	**0**	**9**
Scotland*	**1**	**89**	**0**	**3**	**0**	**7**
Wales	**2**	**42**	**44**	**10**	**1**	**2**
UK	**2**	**39**	**48**	**6**	**0**	**5**

*All haemodialysis patients in centres in Scotland are shown as receiving treatment at home or in centre as no data is available regarding satellite dialysis

Table F.2.5. Prevalent patient 2013, age ranges by centre (%)

Centre	18–24	25–34	35–44	45–54	55–64	65–74	75–84	85+
England								
B Heart	1	6	11	17	20	22	20	3
B QEH	2	7	13	21	24	18	12	2
Basldn	3	6	11	17	16	22	20	5
Bradfd	4	11	15	21	21	16	11	1
Brightn	1	5	11	20	19	23	16	3
Bristol	3	8	12	19	21	21	14	3
Camb	2	6	14	20	21	20	13	4
Carlis	3	7	10	22	22	21	15	1
Carsh	1	5	11	20	19	23	16	5
Chelms	1	5	7	14	24	24	19	7
Colchr	3	4	8	3	16	30	32	5
Covnt	2	7	12	22	19	20	16	2
Derby	1	6	10	21	19	25	15	2
Donc	3	3	10	15	24	22	19	4
Dorset	2	5	8	17	18	28	18	4
Dudley	0	5	7	18	24	19	21	6
Exeter	2	5	9	18	20	24	17	6
Glouc	1	4	11	17	18	25	18	6
Hull	3	7	11	22	21	21	13	3
Ipswi	1	4	11	23	23	23	12	3
Kent	2	5	10	20	20	24	14	3
L Barts	2	8	15	25	23	17	10	1
L Guys	4	9	15	23	22	16	9	1
L Kings	1	5	13	22	22	19	15	3
L Rfree	2	9	13	21	20	19	12	3
L St.G	1	6	13	20	24	19	14	2
L West	1	6	12	21	25	21	12	2
Leeds	3	8	13	22	21	21	10	2
Leic	2	7	12	21	21	22	13	3
Liv Ain	1	3	11	16	16	21	25	8
Liv Roy	3	9	15	25	23	18	7	1
M RI	4	8	15	25	21	18	8	1
Middlbr	2	7	11	23	20	20	14	2
Newc	3	7	12	23	23	21	10	1
Norwch	2	6	9	21	18	21	16	6
Nottm	5	7	12	21	20	19	12	3
Oxford	2	7	15	22	22	17	12	2
Plymth	2	6	12	18	23	23	14	3
Ports	1	7	12	22	21	22	13	3
Prestn	2	6	11	21	24	22	13	2
Redng	1	4	14	18	22	24	15	3
Salford	2	7	14	21	23	20	12	1
Sheff	2	7	12	21	22	19	13	3
Shrew	1	7	10	20	18	23	18	2
Stevng	2	5	10	21	20	20	19	3
Sthend	3	6	9	15	19	22	21	5
Stoke	1	8	12	19	19	21	16	3
Sund	2	6	13	23	21	24	10	1
Truro	2	5	13	14	18	23	21	4
Wirral	2	4	9	17	17	22	25	4
Wolve	2	7	12	19	22	20	14	4
York	4	9	12	19	22	20	11	4
N Ireland								
Antrim	1	6	9	20	15	27	18	4
Belfast	3	9	14	27	18	17	10	1
Newry	3	6	13	16	26	23	12	2
Ulster	2	1	12	11	20	22	25	8
West NI	1	8	17	17	17	23	15	2

Table F.2.5. Continued

Centre	18–24	25–34	35–44	45–54	55–64	65–74	75–84	85+
Scotland								
Abrdn	3	9	14	18	24	19	12	2
Airdrie	1	7	15	21	20	20	14	1
D & Gall	4	3	11	27	13	21	17	3
Dundee	1	5	15	19	19	24	13	4
Edinb	2	8	15	27	22	17	8	1
Glasgw	3	7	13	22	24	19	11	2
Inverns	1	4	19	24	23	14	12	2
Klmarnk	1	4	11	24	21	22	11	4
Krkcldy	2	4	13	18	20	24	17	2
Wales								
Bangor	0	5	8	8	17	32	26	3
Cardff	2	7	13	22	21	20	11	3
Clwyd	3	7	3	20	20	31	14	3
Swanse	2	6	9	15	22	25	18	3
Wrexm	4	6	13	18	18	17	21	3
England	**2**	**7**	**12**	**21**	**21**	**20**	**13**	**3**
N Ireland	**2**	**7**	**13**	**22**	**19**	**21**	**14**	**2**
Scotland	**2**	**6**	**14**	**22**	**22**	**19**	**12**	**2**
Wales	**2**	**7**	**11**	**19**	**21**	**22**	**14**	**3**
UK	**2**	**7**	**12**	**21**	**21**	**20**	**13**	**3**

Table F.2.6. Dialysis modalities for 2013 prevalent patients without diabetes (all ages)

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	4	81	7	6	0	3
B QEH	6	9	71	5	0	9
Basldn	0	84	4	6	0	7
Bradfd	2	66	15	5	0	11
Brightn	10	42	31	11	0	7
Bristol	5	15	68	5	0	6
Camb	5	39	50	0	6	0
Carlis	0	41	24	17	0	17
Carsh	3	18	66	4	0	9
Chelms	2	81	0	15	0	3
Covnt	5	78	0	17	0	0
Derby	10	64	0	16	0	9
Donc	1	47	37	1	0	15
Dorset	2	18	64	8	0	8
Dudley	5	56	15	15	0	9
Exeter	1	9	75	9	0	7
Glouc	0	76	11	4	0	9
Hull	3	37	43	8	0	9
Ipswi	2	67	12	13	0	6
Kent	5	21	62	11	0	1
L Barts	2	39	42	4	0	13
L Guys	10	10	76	2	0	2
L Kings	1	12	68	8	0	11
L Rfree	3	5	77	7	0	9
L St.G	2	37	46	4	1	10
L West	2	19	75	2	0	2
Leeds	4	15	67	4	0	10
Leic	7	16	64	4	0	9

Table F.2.6. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
Liv Ain	5	4	75	3	0	13
Liv Roy	10	39	38	9	0	5
M RI	12	23	50	4	0	11
Middlbr	4	24	69	3	0	0
Newc	8	78	0	1	0	12
Norwch	7	49	33	8	0	3
Nottm	7	36	39	7	0	11
Oxford	5	32	43	5	0	15
Plymth	5	70	3	9	0	13
Ports	5	16	66	13	0	0
Prestn	7	21	62	3	0	8
Redng	2	36	43	12	0	7
Salford	9	36	41	6	0	8
Sheff	8	37	45	10	0	0
Shrew	10	44	31	15	0	0
Stevng	6	32	53	10	0	0
Sthend	0	86	0	14	0	0
Stoke	0	51	28	2	4	15
Sund	1	60	35	1	1	3
Truro	4	37	44	6	0	9
Wirral	5	38	48	1	0	9
Wolve	4	23	52	14	0	7
York	7	31	47	14	0	1
N Ireland						
Antrim	2	88	0	3	0	7
Belfast	8	80	0	1	0	11
Newry	3	79	0	0	0	19
Ulster	6	88	0	1	0	5
West NI	6	81	0	0	1	12
Scotland*						
Abrdn	4	85	0	7	0	4
Airdrie	1	93	0	4	0	3
D & Gall	2	80	0	9	0	9
Dundee	2	86	0	3	0	9
Edinb	2	88	0	2	0	8
Glasgw	5	89	0	2	0	4
Inverns	3	78	0	11	0	8
Klmarnk	5	69	0	2	0	24
Krkcldy	0	86	0	1	0	13
Wales						
Bangor	19	49	17	11	0	4
Cardff	7	14	64	11	0	4
Clwyd	4	78	0	9	9	0
Swanse	6	57	22	9	0	5
Wrexm	2	63	17	18	0	0
England	**5**	**32**	**49**	**7**	**0**	**7**
N Ireland	**5**	**83**	**0**	**1**	**0**	**11**
Scotland*	**3**	**86**	**0**	**3**	**0**	**8**
Wales	**7**	**39**	**38**	**11**	**1**	**4**
UK	**5**	**38**	**43**	**6**	**0**	**7**

Excluded one centre with ⩾40% primary renal diagnosis aetiology uncertain (Colchester)
Patients with diabetes as their primary renal disease and patients with a missing primary renal diagnosis code are excluded from this table
*All haemodialysis patients in centres in Scotland are shown as receiving treatment at home or in centre as no data is available regarding satellite dialysis

Table F.2.7. Number of 2013 prevalent patients without diabetes by treatment modality

	HD	PD	Transplant
England	14,671	2,330	21,636
N Ireland	492	66	745
Scotland	1,456	185	2,240
Wales	809	147	1,325
UK	**17,428**	**2,728**	**25,946**

Excluded one centre with ⩾40% primary renal diagnosis aetiology uncertain (Colchester)
Patients with diabetes as their primary renal disease and patients with a missing primary renal diagnosis code are excluded from this table

Table F.2.8. Dialysis modalities for 2013 prevalent patients without diabetes aged under 65

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	6	79	3	6	0	6
B QEH	8	11	65	6	0	11
Basldn	0	76	7	4	0	13
Bradfd	3	72	7	5	0	14
Brightn	16	39	27	10	0	7
Bristol	10	20	52	8	0	10
Camb	15	43	34	0	8	0
Carlis	0	41	22	13	0	25
Carsh	5	28	51	4	0	13
Chelms	3	68	0	26	0	3
Covnt	8	72	0	20	0	0
Derby	12	57	0	18	0	12
Donc	1	55	25	1	0	17
Dorset	4	18	60	11	0	7
Dudley	9	49	11	20	0	12
Exeter	2	9	67	12	0	11
Glouc	0	74	8	8	0	10
Hull	5	35	40	10	0	11
Ipswi	2	65	15	11	0	7
Kent	9	23	50	18	0	0
L Barts	3	40	41	2	0	15
L Guys	15	7	75	1	0	2
L Kings	2	14	63	7	0	14
L Rfree	5	5	70	7	0	13
L St.G	4	42	40	3	1	10
L West	2	19	74	2	0	3
Leeds	8	18	58	5	0	12
Leic	12	19	56	3	0	10
Liv Ain	11	5	58	4	0	22
Liv Roy	14	40	32	8	0	7
M RI	19	28	40	5	0	8
Middlbr	7	33	57	4	0	0
Newc	14	74	0	1	0	11
Norwch	13	48	29	7	0	4
Nottm	15	33	26	8	0	18
Oxford	8	31	41	5	0	15

Table F.2.8. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
Plymth	10	64	0	10	0	17
Ports	10	16	60	14	0	0
Prestn	10	22	58	2	0	8
Redng	5	30	44	14	0	8
Salford	11	34	41	5	0	9
Sheff	15	34	41	11	0	0
Shrew	18	42	25	15	0	0
Stevng	10	31	49	10	0	0
Sthend	0	80	0	20	0	0
Stoke	0	54	25	2	1	19
Sund	1	62	33	0	1	2
Truro	7	30	35	9	0	19
Wirral	8	35	41	1	0	14
Wolve	6	27	43	15	1	9
York	17	29	33	19	0	2
N Ireland						
Antrim	7	79	0	7	0	7
Belfast	13	73	0	1	0	12
Newry	0	88	0	0	0	12
Ulster	20	70	0	5	0	5
West NI	11	75	0	0	0	14
Scotland*						
Abrdn	6	82	0	7	0	6
Airdrie	0	95	0	5	0	0
D & Gall	5	68	0	16	0	11
Dundee	4	81	0	4	0	10
Edinb	4	89	0	1	0	7
Glasgw	9	84	0	2	0	5
Inverns	4	71	0	14	0	11
Klmarnk	4	68	0	3	0	25
Krkcldy	0	83	0	0	0	17
Wales						
Bangor	41	38	10	3	0	7
Cardff	14	17	52	12	0	6
Clwyd	7	79	0	14	0	0
Swanse	10	53	17	10	0	10
Wrexm	5	56	14	26	0	0
England	**8**	**32**	**44**	**7**	**0**	**9**
N Ireland	**11**	**76**	**0**	**2**	**0**	**11**
Scotland*	**5**	**83**	**0**	**4**	**0**	**8**
Wales	**13**	**37**	**32**	**12**	**0**	**6**
UK	**8**	**38**	**39**	**7**	**0**	**8**

Excluded one centre with ⩾40% primary renal diagnosis aetiology uncertain (Colchester)
Patients with diabetes as their primary renal disease and patients with a missing primary renal diagnosis code are excluded from this table
*All haemodialysis patients in centres in Scotland are shown as receiving treatment at home or in centre as no data is available regarding satellite dialysis

Table F.2.9. Number of 2013 prevalent patients without diabetes aged under 65 by treatment modality

	HD	PD	Transplant
England	6,701	1,244	17,106
N Ireland	195	29	612
Scotland	682	92	1,830
Wales	329	74	1,000
UK	**7,907**	**1,439**	**20,548**

Excluded one centre with ⩾40% primary renal diagnosis aetiology uncertain (Colchester)
Patients with diabetes as their primary renal disease and patients with a missing primary renal diagnosis code are excluded from this table

Table F.2.10. Dialysis modalities for 2013 prevalent patients without diabetes aged over 65

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	1	82	11	5	0	1
B QEH	2	8	78	5	0	6
Basldn	0	89	1	7	0	3
Bradfd	0	58	29	6	0	7
Brightn	5	44	34	12	0	6
Bristol	2	12	78	4	0	4
Camb	1	37	56	0	5	0
Carlis	0	42	26	21	0	12
Carsh	2	12	75	4	0	7
Chelms	1	87	0	9	0	3
Covnt	3	82	0	15	0	0
Derby	8	70	0	15	0	7
Donc	0	41	45	0	0	14
Dorset	1	19	66	6	1	9
Dudley	2	63	19	11	0	5
Exeter	0	9	78	7	0	6
Glouc	1	76	12	3	0	8
Hull	1	40	46	7	0	7
Ipswi	1	69	10	14	0	6
Kent	2	20	69	7	0	2
L Barts	0	37	45	7	0	11
L Guys	4	13	78	3	0	2
L Kings	0	10	76	8	0	6
L Rfree	1	4	85	6	0	4
L St.G	0	31	52	6	1	10
L West	1	18	77	2	0	2
Leeds	0	13	76	3	0	8
Leic	3	14	70	4	0	8
Liv Ain	1	4	86	2	0	7
Liv Roy	4	38	46	9	0	2
M RI	4	17	63	3	0	14

Table F.2.10. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
Middlbr	2	17	78	2	0	0
Newc	2	82	0	1	1	14
Norwch	4	49	36	8	0	3
Nottm	1	38	48	6	0	6
Oxford	2	33	45	5	0	15
Plymth	2	73	5	8	0	12
Ports	1	16	71	13	0	0
Prestn	3	19	67	3	0	8
Redng	1	41	41	10	0	7
Salford	7	38	43	6	0	6
Sheff	2	39	49	10	0	0
Shrew	3	46	36	15	0	0
Stevng	3	32	56	10	0	0
Sthend	0	91	0	9	0	0
Stoke	0	49	30	3	6	12
Sund	0	57	37	2	0	4
Truro	3	40	48	4	0	5
Wirral	1	40	54	1	0	4
Wolve	3	18	61	13	0	5
York	0	33	58	10	0	0
N Ireland						
Antrim	0	92	0	1	0	7
Belfast	2	87	0	1	0	10
Newry	5	71	0	0	0	24
Ulster	2	94	0	0	0	5
West NI	2	85	0	0	2	11
Scotland*						
Abrdn	2	88	0	8	0	2
Airdrie	1	91	0	3	0	5
D & Gall	0	88	0	4	0	8
Dundee	0	90	0	2	0	8
Edinb	0	86	0	3	0	11
Glasgw	1	93	0	2	0	4
Inverns	2	82	0	9	0	7
Klmarnk	5	70	0	1	0	23
Krkcldy	0	89	0	1	0	10
Wales						
Bangor	5	56	21	16	0	2
Cardff	2	12	74	11	0	2
Clwyd	3	77	0	5	15	0
Swanse	3	60	25	9	0	2
Wrexm	0	68	20	13	0	0
England	**2**	**32**	**54**	**6**	**0**	**5**
N Ireland	**2**	**87**	**0**	**1**	**0**	**10**
Scotland*	**1**	**88**	**0**	**3**	**0**	**8**
Wales	**2**	**41**	**43**	**10**	**1**	**2**
UK	**2**	**39**	**47**	**6**	**0**	**6**

Excluded one centre with ⩾40% primary renal diagnosis aetiology uncertain (Colchester)
Patients with diabetes as their primary renal disease and patients with a missing primary renal diagnosis code are excluded from this table
*All haemodialysis patients in centres in Scotland are shown as receiving treatment at home or in centre as no data is available regarding satellite dialysis

Table F.2.11. Number of 2013 prevalent patients without diabetes aged over 65 by treatment modality

	HD	PD	Transplant
England	7,970	1,086	4,530
N Ireland	297	37	133
Scotland	774	93	410
Wales	480	73	325
UK	**9,521**	**1,289**	**5,398**

Excluded one centre with ⩾40% primary renal diagnosis aetiology uncertain (Colchester)
Patients with diabetes as their primary renal disease and patients with a missing primary renal diagnosis code are excluded from this table

Table F.2.12. Dialysis modalities for 2013 prevalent patients with diabetes

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	8	80	5	5	0	3
B QEH	3	12	77	3	0	5
Basldn	0	70	4	11	0	15
Bradfd	0	86	13	2	0	0
Brightn	7	49	28	7	0	10
Bristol	3	18	69	6	0	4
Camb	6	50	39	0	6	0
Carlis	0	72	17	0	0	11
Carsh	2	12	73	5	0	9
Chelms	0	94	0	3	0	3
Covnt	0	79	0	21	0	0
Derby	8	57	0	24	0	12
Donc	0	35	38	0	0	26
Dorset	0	24	66	8	0	2
Dudley	7	56	9	16	0	12
Exeter	1	12	73	4	1	10
Glouc	0	66	18	3	0	13
Hull	1	38	30	18	0	13
Ipswi	0	67	11	11	0	11
Kent	4	25	51	18	0	2
L Barts	0	40	43	4	0	14
L Guys	1	21	74	1	0	3
L Kings	0	17	66	6	0	10
L Rfree	1	2	83	3	0	10
L St.G	1	36	47	4	0	12
L West	0	23	73	1	0	2
Leeds	1	21	75	0	0	3
Leic	3	23	58	3	0	13
Liv Ain	4	2	77	6	0	11
Liv Roy	4	35	44	8	0	9
M RI	4	32	53	3	0	8
Middlbr	1	30	63	6	0	0
Newc	2	86	0	2	2	9

Table F.2.12. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
Norwch	7	48	35	10	0	0
Nottm	3	47	29	6	0	14
Oxford	4	28	55	2	0	11
Plymth	0	81	4	7	0	7
Ports	2	23	67	9	0	0
Prestn	2	23	71	0	0	4
Redng	1	36	37	19	0	7
Salford	4	29	53	7	0	7
Sheff	1	41	46	12	0	0
Shrew	2	52	34	11	0	0
Stevng	4	25	65	6	0	0
Sthend	4	86	0	11	0	0
Stoke	0	61	16	4	4	15
Sund	0	61	32	5	0	2
Truro	3	67	22	8	0	0
Wirral	0	46	48	0	0	6
Wolve	1	29	46	22	0	1
York	7	32	36	14	0	11
N Ireland						
Antrim	3	85	0	0	0	13
Belfast	0	93	0	0	0	7
Newry	0	89	0	0	0	11
Ulster	0	96	0	0	4	0
West NI	0	95	0	0	5	0
Scotland*						
Abrdn	0	93	0	7	0	0
Airdrie	0	91	0	6	0	2
D & Gall	6	50	0	19	0	25
Dundee	0	94	0	3	0	3
Edinb	0	91	0	1	0	7
Glasgw	3	89	0	3	0	5
Inverns	0	92	0	0	0	8
Klmarnk	0	87	0	3	0	10
Krkcldy	0	97	0	0	0	3
Wales						
Bangor	0	70	22	7	0	0
Cardff	8	12	72	7	0	2
Clwyd	0	95	0	5	0	0
Swanse	3	63	17	11	0	5
Wrexm	0	77	5	18	0	0
England	**2**	**34**	**51**	**6**	**0**	**7**
N Ireland	**1**	**91**	**0**	**0**	**1**	**7**
Scotland*	**1**	**90**	**0**	**4**	**0**	**5**
Wales	**4**	**44**	**40**	**9**	**0**	**2**
UK	**2**	**40**	**46**	**6**	**0**	**7**

Excluded one centre with ⩾40% primary renal diagnosis aetiology uncertain (Colchester)
Only patients with diabetes as their primary renal disease included in this table
*All haemodialysis patients in centres in Scotland are shown as receiving treatment at home or in centre as no data is available regarding satellite dialysis

Table F.2.13. Number of 2013 prevalent patients with diabetes by treatment modality

	HD	PD	Transplant
England	4,496	667	2,488
N Ireland	155	14	67
Scotland	400	40	235
Wales	265	34	191
UK	**5,316**	**755**	**2,981**

Excluded one centre with ⩾40% primary renal diagnosis aetiology uncertain (Colchester)
Only patients with diabetes as their primary renal disease included in this table

Table F.2.14. Demography of 2013 prevalent patients with diabetes

Centre	M : F ratio	Median age on 31/12/2013	Median age at start of treatment	Median time on RRT in days	Median time on RRT in years
England					
B Heart	1.6	67	63	962	2.6
B QEH	1.6	63	57	1,562	4.3
Basldn	2.0	62	57	935	2.6
Bradfd	1.9	62	56	1,266	3.5
Brightn	1.5	59	53	1,596	4.4
Bristol	1.7	63	56	1,394	3.8
Camb	2.3	49	40	2,136	5.8
Carlis	5.5	61	55	1,126	3.1
Carsh	1.6	64	57	1,428	3.9
Chelms	2.2	65	63	1,001	2.7
Covnt	1.6	61	54	1,568	4.3
Derby	1.4	64	60	998	2.7
Donc	2.0	60	55	1,223	3.3
Dorset	1.5	62	55	1,098	3.0
Dudley	2.1	65	59	1,274	3.5
Exeter	1.8	63	59	976	2.7
Glouc	1.7	62	53	1,273	3.5
Hull	1.5	61	56	1,478	4.0
Ipswi	2.2	61	55	1,145	3.1
Kent	1.7	59	56	1,035	2.8
L Barts	1.5	63	58	1,154	3.2
L Guys	1.4	56	49	2,145	5.9
L Kings	1.3	65	62	961	2.6
L Rfree	1.8	66	61	1,172	3.2
L St.G	1.1	67	62	1,608	4.4
L West	1.8	64	58	1,461	4.0
Leeds	1.6	62	56	1,403	3.8
Leic	1.5	61	57	1,229	3.4
Liv Ain	1.7	60	57	803	2.2
Liv Roy	1.2	57	50	1,605	4.4
M RI	1.5	58	52	1,362	3.7
Middlbr	1.3	56	52	938	2.6
Newc	1.4	55	49	1,665	4.6

Table F.2.14. Continued

Centre	M : F ratio	Median age on 31/12/2013	Median age at start of treatment	Median time on RRT in days	Median time on RRT in years
Norwch	1.9	61	56	1,646	4.5
Nottm	1.4	58	53	1,755	4.8
Oxford	1.7	57	52	1,247	3.4
Plymth	1.7	60	54	1,685	4.6
Ports	2.1	59	55	1,273	3.5
Prestn	1.6	63	57	990	2.7
Redng	1.8	62	58	1,605	4.4
Salford	1.9	62	56	1,660	4.5
Sheff	2.3	62	56	1,124	3.1
Shrew	1.2	63	59	1,059	2.9
Stevng	1.9	64	60	1,147	3.1
Sthend	1.6	67	60	1,862	5.1
Stoke	1.4	66	61	1,223	3.3
Sund	2.0	60	56	879	2.4
Truro	1.3	59	54	1,673	4.6
Wirral	1.4	63	56	1,159	3.2
Wolve	1.7	61	58	1,750	4.8
York	1.2	59	53	1,621	4.4
N Ireland					
Antrim	1.2	62	59	1,477	4.0
Belfast	1.8	57	52	1,518	4.2
Newry	2.0	62	58	1,095	3.0
Ulster	1.9	63	59	1,203	3.3
West NI	1.1	66	61	1,632	4.5
Scotland					
Abrdn	1.4	58	52	1,380	3.8
Airdrie	1.5	61	56	876	2.4
D & Gall	1.5	57	54	741	2.0
Dundee	1.2	60	55	1,595	4.4
Edinb	1.1	52	48	1,222	3.3
Glasgw	1.3	59	55	1,241	3.4
Inverns	1.5	51	43	2,512	6.9
Klmarnk	2.1	53	49	1,173	3.2
Krkcldy	1.1	64	62	1,042	2.9
Wales					
Bangor	1.5	69	67	629	1.7
Cardff	1.8	59	54	1,264	3.5
Clwyd	1.0	65	58	1,699	4.7
Swanse	2.6	64	58	1,177	3.2
Wrexm	3.7	58	49	1,357	3.7
England	**1.6**	**61**	**56**	**1,344**	**3.7**
N Ireland	**1.6**	**61**	**57**	**1,374**	**3.8**
Scotland	**1.3**	**57**	**52**	**1,279**	**3.5**
Wales	**2.0**	**62**	**56**	**1,254**	**3.4**
UK	**1.6**	**61**	**56**	**1,334**	**3.7**

Excluded one centre with ⩾40% primary renal diagnosis aetiology uncertain (Colchester)
Only patients with diabetes as their primary renal disease included in this table

Table F.2.15. Transplant gender ratios in 2013 prevalent patients

	% male	% female	*N* male	*N* female	M : F ratio
England	60.8	39.2	15,069	9,713	1.6
N Ireland	62.3	37.7	508	307	1.7
Scotland	59.5	40.5	1,474	1,004	1.5
Wales	62.8	37.2	952	565	1.7
UK	**60.8**	**39.2**	**18,003**	**11,589**	**1.6**

UK Renal Registry 17th Annual Report: Appendix G UK Renal Registry dataset specification

This appendix is available on the UK Renal Registry website only. The current version of this document can be found under the Data menu at www.renalreg.org.

UK Renal Registry 17th Annual Report: Appendix H Coding: Ethnicity, EDTA Primary Renal Diagnoses, EDTA Causes of Death

H1: Ethnicity coding

Ethnicity data is recorded in the clinical information systems in the individual renal centres in the format of 9S... read codes. If extracted from local PAS systems in a different format, it is recoded to the 9S... format by the centre, before being sent to the UK Renal Registry (UKRR). For report analyses, ethnic categories are condensed into five groups (White, South Asian, Black, Chinese and Other). For some analyses Chinese are grouped into Other.

Read code	Ethnic category	Assigned group	Old PAS	New PAS
9S1.	White	White	0	A1
9SA9.	Irish (NMO)	White		B1
9SAA.	Greek Cypriot (NMO)	White		CG
9SAB.	Turkish Cypriot (NMO)	White		CJ
9SAC.	Other European (NMO)	White		C1
9S6.	Indian	S Asian	4	H1
9S7.	Pakistani	S Asian	5	J1
9S8.	Bangladeshi	S Asian	6	K1
9SA6.	East African Asian	S Asian		
9SA7.	Indian Subcontinent	S Asian		
9SA8.	Other Asian	S Asian		L1
9S2.	Black Caribbean	Black	1	M1
9S3.	Black African	Black	2	N1
9S4.	Black/Other/non-mixed origin	Black	3	P1
9S41.	Black British	Black		PD
9S42.	Black Caribbean	Black		
9S43.	Black North African	Black		
9S44.	Black other African country	Black		
9S45.	Black East African Asian	Black		
9S46.	Black Indian subcontinent	Black		
9S47.	Black Other Asian	Black		
9S48.	Black Black Other	Black		PE
9S5.	Black other/mixed	Black		
9S51.	Other Black – Black/White origin	Black		GC
9S52.	Other Black – Black/Asian origin	Black		GA
9S9.	Chinese	Chinese	7	R1
9T1C.	Chinese	Chinese		
9SA.	Other ethnic non-mixed (NMO)	Other		
9SA1.	British ethnic minority specified (NMO)	Other		
9SA2.	British ethnic minority unspecified (NMO)	Other		
9SA3.	Caribbean Island (NMO)	Other		

Read code	Ethnic category	Assigned group	Old PAS	New PAS
9SA4.	North African Arab (NMO)	Other		
9SA5.	Other African countries (NMO)	Other		
9SAD.	Other ethnic NEC (NMO)	Other		S1
9SB.	Other ethnic/mixed origin	Other	8	
9SB1.	Other ethnic/Black/White origin	Other		E1
9SB2.	Other ethnic/Asian/White origin	Other		F1
9SB3.	Other ethnic/mixed White origin	Other		
9SB4.	Other ethnic/Other mixed origin	Other		G1

NMO denotes non-mixed origin

H2: EDTA primary renal diagnoses

New primary renal diagnosis codes were produced in 2012 [1] but the data used for this report uses the old codes as detailed in the table below.

Code	Title	Group
0	Chronic renal failure; aetiology uncertain unknown/unavailable	Uncertain
10	Glomerulonephritis; histologically NOT examined	Glomerulonephritis*
11	Focal segmental glomerulosclerosis with nephrotic syndrome in children	Glomerulonephritis
12	IgA nephropathy (proven by immunofluorescence, not code 76 and not 85)	Glomerulonephritis
13	Dense deposit disease; membrano-proliferative GN; type II (proven by immunofluorescence and/or electron microscopy)	Glomerulonephritis
14	Membranous nephropathy	Glomerulonephritis
15	Membrano-proliferative GN; type I (proven by immunofluorescence and/or electron microscopy – not code 84 or 89)	Glomerulonephritis
16	Crescentic (extracapillary) glomerulonephritis (type I, II, III)	Glomerulonephritis
17	Focal segmental glomerulosclerosis with nephrotic syndrome in adults	Glomerulonephritis
19	Glomerulonephritis; histologically examined, not given above	Glomerulonephritis
20	Pyelonephritis – cause not specified	Pyelonephritis
21	Pyelonephritis associated with neurogenic bladder	Pyelonephritis
22	Pyelonephritis due to congenital obstructive uropathy with/without vesico-ureteric reflux	Pyelonephritis
23	Pyelonephritis due to acquired obstructive uropathy	Pyelonephritis
24	Pyelonephritis due to vesico-ureteric reflux without obstruction	Pyelonephritis
25	Pyelonephritis due to urolithiasis	Pyelonephritis
29	Pyelonephritis due to other cause	Pyelonephritis
30	Interstitial nephritis (not pyelonephritis) due to other cause, or unspecified (not mentioned above)	Other
31	Nephropathy (interstitial) due to analgesic drugs	Other
32	Nephropathy (interstitial) due to cis-platinum	Other
33	Nephropathy (interstitial) due to cyclosporin A	Other
34	Lead induced nephropathy (interstitial)	Other
39	Drug induced nephropathy (interstitial) not mentioned above	Other
40	Cystic kidney disease – type unspecified	Polycystic
41	Polycystic kidneys; adult type (dominant)	Polycystic
42	Polycystic kidneys; infantile (recessive)	Polycystic
43	Medullary cystic disease; including nephronophtisis	Other
49	Cystic kidney disease – other specified type	Other
50	Hereditary/Familial nephropathy – type unspecified	Other
51	Hereditary nephritis with nerve deafness (Alport's Syndrome)	Other
52	Cystinosis	Other
53	Primary oxalosis	Other
54	Fabry's disease	Other
59	Hereditary nephropathy – other specified type	Other
60	Renal hypoplasia (congenital) – type unspecified	Other

Code	Title	Group
61	Oligomeganephronic hypoplasia	Other
63	Congenital renal dysplasia with or without urinary tract malformation	Other
66	Syndrome of agenesis of abdominal muscles (Prune Belly)	Other
70	Renal vascular disease – type unspecified	Renal vascular disease
71	Renal vascular disease due to malignant hypertension	Hypertension
72	Renal vascular disease due to hypertension	Hypertension
73	Renal vascular disease due to polyarteritis	Renal vascular disease
74	Wegener's granulomatosis	Other
75	Ischaemic renal disease/cholesterol embolism	Renal vascular disease
76	Glomerulonephritis related to liver cirrhosis	Other
78	Cryoglobulinemic glomerulonephritis	Other
79	Renal vascular disease – due to other cause (not given above and not code 84–88)	Renal vascular disease
80	Type 1 diabetes with diabetic nephropathy	Diabetes
81	Type 2 diabetes with diabetic nephropathy	Diabetes
82	Myelomatosis/light chain deposit disease	Other
83	Amyloid	Other
84	Lupus erythematosus	Other
85	Henoch-Schoenlein purpura	Other
86	Goodpasture's syndrome	Other
87	Systemic sclerosis (scleroderma)	Other
88	Haemolytic Ureaemic Syndrome (including Moschcowitz syndrome)	Other
89	Multi-system disease – other (not mentioned above)	Other
90	Tubular necrosis (irreversible) or cortical necrosis (different from 88)	Other
91	Tuberculosis	Other
92	Gout nephropathy (urate)	Other
93	Nephrocalcinosis and hypercalcaemic nephropathy	Other
94	Balkan nephropathy	Other
95	Kidney tumour	Other
96	Traumatic or surgical loss of kidney	Other
98	Not known	Missing
99	Other identified renal disorders	Other
199	Code not sent	Missing

*Prior to the 15th Annual Report categorised as 'uncertain'

H3: EDTA cause of death

EDTA code	Cause	UKRR category
0	Cause of death uncertain/not determined	Uncert
11	Myocardial ischaemia and infarction	Heart
12	Hyperkalaemia	Other
13	Haemorrhagic pericarditis	Other
14	Other causes of cardiac failure	Heart
15	Cardiac arrest/sudden death; other cause or unknown	Heart
16	Hypertensive cardiac failure	Heart
17	Hypokalaemia	Other
18	Fluid overload/pulmonary oedema	Heart
21	Pulmonary embolus	Other
22	Cerebro-vascular accident, other cause or unspecified	CVA
23	Gastro-intestinal haemorrhage (digestive)	Other
24	Haemorrhage from graft site	Other
25	Haemorrhage from vascular access or dialysis circuit	Other
26	Haemorrhage from ruptured vascular aneurysm (not code 22 or 23)	Other
27	Haemorrhage from surgery (not codes 23, 24, 26)	Other
28	Other haemorrhage, (not codes 23–27)	Other

EDTA code	Cause	UKRR category
29	Mesenteric infarction	Other
31	Pulmonary infection bacterial (not code 73)	Infect
32	Pulmonary infection (viral)	Infect
33	Pulmonary infection (fungal or protozoal; parasitic)	Infect
34	Infections elsewhere except viral hepatitis	Infect
35	Septicaemia	Infect
36	Tuberculosis (lung)	Infect
37	Tuberculosis (elsewhere)	Infect
38	Generalized viral infection	Infect
39	Peritonitis (all causes except for peritoneal dialysis)	Infect
41	Liver disease due to hepatitis B virus	Other
42	Liver disease due to other viral hepatitis	Other
43	Liver disease due to drug toxicity	Other
44	Cirrhosis – not viral (alcoholic or other cause)	Other
45	Cystic liver disease	Other
46	Liver failure – cause unknown	Other
47	Patient refused further treatment for end stage renal failure (ESRF)	Trt_stop
51	Patient refused further treatment for end stage renal failure (ESRF)	Trt_stop
52	Suicide	Other
53	ESRF treatment ceased for any other reason	Trt_stop
54	ESRF treatment withdrawn for medical reasons	Trt_stop
61	Uraemia caused by graft failure	Trt_stop
62	Pancreatitis	Other
63	Bone marrow depression (Aplasia)	Other
64	Cachexia	Other
66	Malignant disease in patient treated by immunosuppressive therapy	Malignant
67	Malignant disease: solid tumours except those of 66	Malignant
68	Malignant disease: lymphoproliferative disorders (Except 66)	Malignant
69	Dementia	Other
70	Peritonitis (sclerosing, with peritoneal dialysis)	Other
71	Perforation of peptic ulcer	Other
72	Perforation of colon	Other
73	Chronic obstructive pulmonary disease	Other
81	Accident related to ESRF treatment (not 25)	Other
82	Accident unrelated to ESRF treatment	Other
90	Uraemia caused by graft failure	Trt_stop
99	Other identified cause of death	Other*
100	Peritonitis (bacterial, with peritoneal dialysis)	Infect
101	Peritonitis (fungal, with peritoneal dialysis)	Infect
102	Peritonitis (due to other cause, with peritoneal dialysis)	Infect

*Prior to the 15th Annual Report categorised as 'uncertain'

References

1 Venkat-Raman G et al.: New Primary diagnosis codes for the ERA-EDTA. Nephrol Dial Transplant 2012;27(12):4414–9

UK Renal Registry 17th Annual Report: Appendix I Acronyms and Abbreviations used in the Report

AAB	Academic Affairs Board (Renal Association)
ACE (inhibitor)	Angiotensin converting enzyme (inhibitor)
AKI	Acute kidney injury
ANZDATA	Australia and New Zealand Dialysis and Transplant Registry
APD	Automated peritoneal dialysis
ADPKD	Autosomal dominant polycystic kidney disease
APKD	Adult polycystic kidney disease
ATTOM	Access to transplant and transplant outcome measures
AV	Arteriovenous
AVF	Arteriovenous fistula
AVG	Arteriovenous graft
BAPN	British Association of Paediatric Nephrology
BCG	Bromocresol green
BCP	Bromocresol purple
Bicarb	Bicarbonate
BMD	Bone mineral disease
BMI	Body mass index
BP	Blood pressure
BSI	Blood stream infection
BTS	British Transplant Society
Ca	Calcium
CAB	Clinical Affairs Board (Renal Association)
CABG	Coronary artery bypass grafting
CAPD	Continuous ambulatory peritoneal dialysis
CCG	Clinical Commissioning Group
CCL	Clinical Computing Limited
CCPD	Continuous cycling peritoneal dialysis
CDI	Clostridium difficile infection
Chol	Cholesterol
CHr	Reticulocyte Hb content
CI	Confidence interval
CK	Creatine kinase
CKD	Chronic kidney disease
CKD-EPI	Chronic kidney disease epidemiology collaboration
CK-MB	Creatine kinase isoenzyme MB
COPD	Chronic obstructive pulmonary disease
Creat	Creatinine
CRF	Chronic renal failure
cRF	Calculated antibody reaction frequency (HLA)
CRP	C-reactive protein
CRVF	Cardiovascular risk factor

CVVH	Continuous veno-venous haemofiltration
CXR	Chest x-ray
DBP	Diastolic blood pressure
DCCT	Diabetes Control and Complications Trial
DH	Department of Health
DM	Diabetes mellitus
DOB	Date of birth
DOPPS	Dialysis Outcomes and Practice Patterns Study
E & W	England and Wales
E, W & NI	England, Wales and Northern Ireland
EBPG	European Best Practice Guidelines
ECD	Expanded Criteria Donor
ECG	Electrocardiogram
EDTA	European Dialysis and Transplant Association
EF	Error factor
eGFR	Estimated glomerular filtration rate
E_i	Expected cases in area i
eKt/V	Equilibrated Kt/V
EPO	Erythropoietin
ERA	European Renal Association
ERA-EDTA	European Renal Association – European Dialysis and Transplant Association
ERF	Established renal failure
ESA	Erythropoiesis stimulating agent
ESRD	End stage renal disease
ESRF	End stage renal failure
EWNI	England, Wales and Northern Ireland
Ferr	Ferritin
FEV1	Forced expiratory volume in 1 second
FVC	Forced vital capacity
GFR	Glomerular filtration rate
GH	Growth hormone
GN	Glomerulonephritis
HA	Health Authority
HB	Health board
Hb	Haemoglobin
HbA1c	Glycated Haemoglobin
HBeAg	Hepatitis B e antigen
HCAI-DCS	Healthcare-associated infection data collection system
HD	Haemodialysis
HDF	Haemodialysis filtration
HDL	High-density lipoprotein
HLA	Human leucocyte antigen
HPA	Health Protection Agency
HQIP	Health Quality Improvement Partnership
HR	Hazard ratio
HRC	Hypochromic red blood cells
Ht	Height
ICU	Intensive care unit
IDMS	Isotope dilution mass spectrometry
IDOPPS	International Dialysis Outcomes and Practice Patterns Study
IFCC	International Federation of Clinical Chemistry & Laboratory Medicine
IHD	Ischaemic heart disease
IMD	Index of Multiple Deprivation
IOTF	International Obesity Taskforce
IPD	Intermittent peritoneal dialysis
IQR	Inter-quartile range
ISPD	International Society for Peritoneal Dialysis
IT	Information technology
IU	International units
IV	Intra venous

KDIGO	Kidney Disease: Improving Global Outcomes
KDOQI	Kidney Disease Outcomes Quality Initiative
KM	Kaplan Meier
Kt/V	Ratio between the product of urea clearance (K, in ml/min) and dialysis session duration (t, in minutes) divided by the volume of distribution of urea in the body (V, in ml)
LA	Local Authority
LCL	Lower confidence limit
LDL	Low-density lipoprotein
LTFU	Lost to follow-up
M : F	Male:Female
MAP	Mean arterial blood pressure
MDRD	Modification of diet in renal disease
MI	Myocardial infarction
MMF	Mycophenolate mofetil
MRSA	Methicillin resistant Staphylococcal aureus
MSSA	Methicillin sensitive Staphylococcal aureus
N	Number
N Ireland	Northern Ireland
NE	North East
NEQAS	UK National External Quality Assessment Scheme
NHBPEP	National high blood pressure education programme
NHS	National Health Service
NHS BT	National Health Service Blood and Transplant
NI	Northern Ireland
NICE	National Institute for Health and Care Excellence
NISRA	Northern Ireland Statistic and Research Agency
NMO	Non-mixed origin
NRS	National Records of Scotland
NSF	National service framework
NTC	Non-tunnelled dialysis catheter
NTL	Non-tunnelled line
NW	North West
O/E	Observed/expected
ODT	Organ Donation and Transplantation (a Directorate of NHS Blood and transplant)
O_i	Observed cases in area i
ONS	Office for National Statistics
OR	Odds ratio
PAS	Patient Administration System
PCT	Primary Care Trust
PD	Peritoneal dialysis
PHE	Public Health England
Phos	Phosphate
PIAG	Patient Information Advisory Group
PKD	Polycystic kidney disease
PMARP	Per million age related population
PMCP	Per million child population
PMP	Per million population
PP	Pulse pressure
PRD	Primary renal disease
PTH	Parathyroid hormone
PUV	Posterior urethral valves
PVD	Peripheral vascular disease
QOF	Quality and Outcomes Framework
QUEST	Quality European Studies
RA	Renal Association
rhGH	Recombinant human growth hormone
RI	Royal Infirmary
RNSF	Renal National Service Framework (or NSF)
RR	Relative risk
RRDSS	Renal Registry data set specification

RRT	Renal replacement therapy
RVD	Renovascular disease
SAR	Standardised acceptance ratio (=O/E)
SAS	Statistical Analysis System
SBP	Systolic blood pressure
SD	Standard deviation
SES	Socio-economic status
SHA	Strategic health authority
SHARP	Study of Heart and Renal Protection
SI	System International (units)
SMR	Standardised mortality ratios
spKt/V	Single pool Kt/V
SPR	Standardised prevalence ratio (=O/E)
SR	Standardised ratio (used to cover either SAR or SPR)
SUS	Secondary uses service
SW	South West
TC	Tunnelled dialysis catheter
TL	Tunnelled line
TSAT	Transferrin saturation
TWL	Transplant waiting list
Tx	Transplant
UCL	Upper confidence limit
UK	United Kingdom
UKRR	UK Renal Registry
UKT	UK Transplant (now ODT)
URR	Urea reduction ratio
US	United States
USA	United States of America
USRDS	United States Renal Data System
WHO	World health organization
Wt	Weight

UK Renal Registry 17th Annual Report: Appendix J Laboratory Conversion Factors

	Conversion factors from SI units
Albumin	g/dl = g/L × 0.1
Aluminium	μg/L = μmol/L × 27.3
Bicarbonate	mg/dl = mmol/L × 6.1
Calcium	mg/dl = mmol/L × 4
Calcium × phosphate	$mg^2/dl^2 = mmol^2/L^2 \times 12.4$
Cholesterol	mg/dl = mmol/L × 38.6
Creatinine	mg/dl = μmol/L × 0.011
Glucose	mg/dl = mmol/L × 18.18
Phosphate	mg/dl = mmol/L × 3.1
PTH	ng/L = pmol/L × 9.5
Urea	mg/dl = mmol/L × 6.0
Urea nitrogen	mg/dl = mmol/L × 2.8

UK Renal Registry 17th Annual Report: Appendix K Renal Centre Names and Abbreviations used in the Figures and Data Tables

Adult Centres

City	Hospital	Abbreviation
England		
Basildon	Basildon Hospital	Basldn
Birmingham	Heartlands Hospital	B Heart
Birmingham	Queen Elizabeth Hospital	B QEH
Bradford	St Luke's Hospital	Bradfd
Brighton	Royal Sussex County Hospital	Brightn
Bristol	Southmead Hospital	Bristol
Cambridge	Addenbrooke's Hospital	Camb
Carlisle	Cumberland Infirmary	Carlis
Carshalton	St Helier Hospital	Carsh
Chelmsford	Broomfield Hospital	Chelms
Colchester	Colchester General Hospital	Colchr
Coventry	University Hospital Coventry	Covnt
Derby	Royal Derby Hospital	Derby
Doncaster	Doncaster Royal Infirmary	Donc
Dorset	Dorset County Hospital	Dorset
Dudley	Russells Hall Hospital	Dudley
Exeter	Royal Devon and Exeter Hospital	Exeter
Gloucester	Gloucestershire Royal Hospital	Glouc
Hull	Hull Royal Infirmary	Hull
Ipswich	Ipswich Hospital	Ipswi
Kent	Kent and Canterbury Hospital	Kent
Leeds	St James's University Hospital and Leeds General Infirmary	Leeds
Leicester	Leicester General Hospital	Leic
Liverpool	Aintree University Hospital	Liv Ain
Liverpool	Royal Liverpool University Hospital	Liv Roy
London	St. Bartholomew's Hospital and The Royal London Hospital	L Barts
London	St George's Hospital and Queen Mary's Hospital	L St. G
London	Guy's Hospital and St Thomas' Hospital	L Guys
London	Hammersmith, Charing Cross,St Mary's	L West
London	King's College Hospital	L Kings
London	Royal Free, Middlesex and UCL Hospitals	L Rfree
Manchester	Manchester Royal Infirmary	M RI
Middlesbrough	The James Cook University Hospital	Middlbr
Newcastle	Freeman Hospital and Royal Victoria Infirmary	Newc
Norwich	Norfolk and Norwich University Hospital	Norwch

City	Hospital	Abbreviation
Nottingham	Nottingham City Hospital	Nottm
Oxford	John Radcliffe Hospital and Churchill Hospital	Oxford
Plymouth	Derriford Hospital	Plymth
Portsmouth	Queen Alexandra Hospital	Ports
Preston	Royal Preston Hospital	Prestn
Reading	Royal Berkshire Hospital	Redng
Salford	Salford Royal Hospital	Salford
Sheffield	Northern General Hospital	Sheff
Shrewsbury	Royal Shrewsbury Hospital	Shrew
Southend	Southend Hospital	Sthend
Stevenage	Lister Hospital	Stevng
Stoke	Royal Stoke University Hospital	Stoke
Sunderland	Sunderland Royal Hospital	Sund
Truro	Royal Cornwall Hospital	Truro
Wirral	Arrowe Park Hospital	Wirral
Wolverhampton	New Cross Hospital	Wolve
York	The York Hospital	York
Wales		
Bangor	Ysbyty Gwynedd	Bangor
Cardiff	University Hospital of Wales	Cardff
Clwyd	Glan Clwyd Hospital	Clwyd
Swansea	Morriston Hospital	Swanse
Wrexham	Wrexham Maelor Hospital	Wrexm
Scotland		
Aberdeen	Aberdeen Royal Infirmary	Abrdn
Airdrie	Monklands Hospital	Airdrie
Dumfries	Dumfries & Galloway Royal Infirmary	D & Gall
Dundee	Ninewells Hospital	Dundee
Edinburgh	Royal Infirmary of Edinburgh	Edinb
Glasgow	Western Infirmary, Glasgow Royal Infirmary and Stobhill Hospitals	Glasgw
Inverness	Raigmore Hospital	Inverns
Kilmarnock	University Hospital Crosshouse	Klmarnk
Kirkcaldy	Victoria Hospital	Krkcldy
Northern Ireland		
Antrim	Antrim Area Hospital	Antrim
Belfast	Belfast City Hospital	Belfast
Londonderry & Omagh	Altnagelvin Area and Tyrone County Hospitals	West NI
Newry	Daisy Hill Hospital	Newry
Ulster	Ulster Hospital	Ulster

Paediatric Centres

City	Hospital	Abbreviation	Country
Belfast	Royal Belfast Hospital for Sick Children	Blfst_P	N Ireland
Birmingham	Birmingham Children's Hospital	Bham_P	England
Bristol	Bristol Royal Hospital for Children	Brstl_P	England
Cardiff	KRUF Children's Kidney Centre	Cardf_P	Wales
Glasgow	Royal Hospital for Sick Children	Glasg_P	Scotland
Leeds	Leeds Children's Hospital	Leeds_P	England
Liverpool	Alder Hey Children's Hospital	Livpl_P	England
London	Guy's Hospital – Paediatric	L Eve_P	England
London	Great Ormond Street Hospital for Children	LGOSH_P	England
Manchester	Royal Manchester Children's Hospital	Manch_P	England
Newcastle	Great North Children's Hospital	Newc_P	England
Nottingham	Nottingham Children's Hospital	Nottm_P	England
Southampton	Southampton General Hospital – Paediatric	Soton_P	England