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20th Annual Report

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Foreword

The UK Renal Registry (UKRR) team have once again compiled an outstanding report for all to see. It is not only a report to aid the professionals within the renal community but also an excellent source of accurate and valid information for patients. This enables patients and patient groups such as the National Kidney Federation (NKF) to utilise, challenge and be empowered about the local and national issues which are faced during the difficult pathway of renal disease.

We endorse and encourage the need for precise data which is collected, collated and stored in an approved manner, so that full use can be made for the benefit of renal patients.

Research and any subsequent best practice can only be achieved by firstly identifying trends across the UK by using accurate data. This enables comparative measurements to be made by all including patients in an easy to read format. The amount of data collected from 71 adult renal centres is staggering and we would advise anyone who can to attend any presentations about the UKRR and the work undertaken as it is fascinating. The UKRR service is a unique service which we know other medical specialities view with total envy.

The NKF have been representing patients nationally and supporting kidney patients' associations since 1979. We are a charity which is solely run by patients and carers for the benefit of the whole renal community. We are thankful for having the support of the UKRR.

Also it is important to remember that the UKRR team are always open to collecting and collating new data and subsequently operate several forums, of which, one of our executive members, the late Mrs Denny Abbott, was fully involved and provided much needed insight from a patient and non-clinical perspective.

Finally a sincere thank you to Ron Cullen and his team, all those that are in collaboration with the UKRR including the individuals that make it happen. Without these very important people we would not have this wonderful resource which is ultimately guiding and shaping the treatment of renal disease for the future benefit of all patients.

David W Marshall

Chair – National Kidney Federation

Michael 'Bud' Abbott

Treasurer – National Kidney Federation

Chapters and appendices

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UK Renal Registry 20th Annual Report: Introduction

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Background

The UK Renal Registry (UKRR) was established by the Renal Association in 1995 with the primary aim of collating data centrally from all adult UK renal centres to improve the care of patients with end stage renal disease (ESRD). Although originally limited to patients on renal replacement therapies (RRT) – dialysis treatments and kidney transplant recipients – the UKRR has now started to collect all cases of acute kidney injury (AKI) in primary and secondary care and all cases of advanced chronic kidney disease (CKD) in secondary care not on dialysis. This will greatly improve understanding of how patients progress to ESRD. Children on RRT were initially captured by a separate registry established by the British Association for Paediatric Nephrology, but this activity passed over to the UKRR from 2009.

The Bristol-based UKRR team of 18 data analysts, systems developers, statisticians and researchers manage data collection, analysis and reporting on approximately 8,000 new patients and 63,000 existing patients on RRT each year. A regionally based team of six project managers and administrators deliver the three main Think Kidneys programmes as described in the *Improvements and innovations in patient care* section below.

The UKRR has an active and involved patient council of approximately 15 members who meet with representatives of the UKRR team four times a year in Birmingham. They discuss issues of importance to patients, such as clearer communication of the UKRR's work, how personal data are handled securely and ideas for research projects. A recent outcome is that plain English summaries of annual report chapters are now available on the UKRR website (https://www.renalreg.org/) and accompanying infographics are being developed.

The UKRR has entered an exciting phase with the development of clinical informatics and data now used not only for audit purposes, but also for randomised controlled trials and quality improvement and innovation in patient care.

Data collection

Most data are collected from renal centres via automatic quarterly downloads (figure 1). English, Welsh and Northern Irish renal centres send their data directly to the UKRR, where much work is undertaken to identify and resolve errors and inconsistencies before detailed statistical analyses are conducted. Scottish data are collected, validated and published by the Scottish Renal Registry before they are shared with the UKRR. AKI data, on the other hand, are sent directly from hospital laboratories to the UKRR on a monthly basis. The continuing development of the UK Renal Data Collaboration (UKRDC) is leading to significant changes in data collection as detailed in the *Clinical informatics* section below. Currently, for those patients signed up to PatientView (PV), data flow daily from renal centres through the UKRDC into PV. For enrolled patients, data also flow to the National Registry of Rare Kidney Diseases (RaDaR). PV is a mobile-friendly platform that gives

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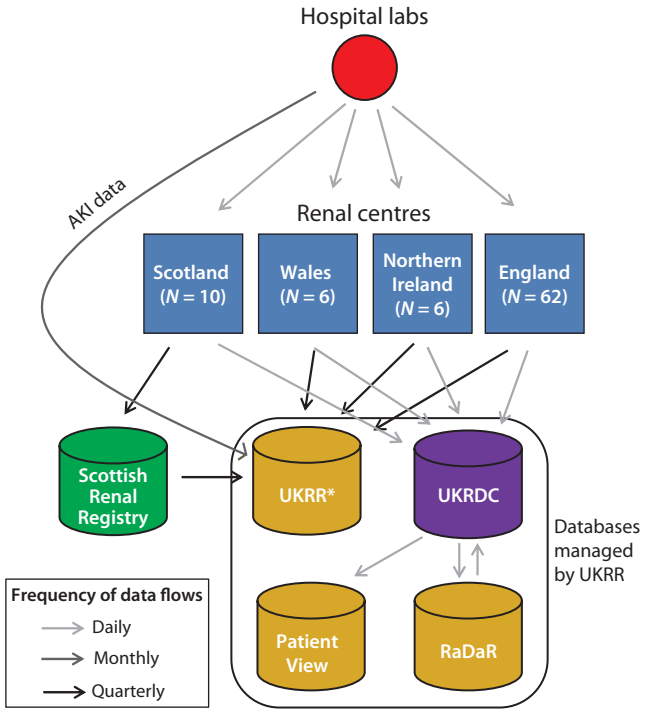

Fig. 1. Frequencies and directions of patient data flows between hospital laboratories, renal centres and databases

*The UKRR database includes the British Association for Paediatric Nephrology database

AKI – acute kidney injury; RaDaR – National Registry of Rare Kidney Diseases; UKRDC – UK Renal Data Collaboration; UKRR – UK Renal Registry

patients real-time access to much of the information in their renal electronic health record, including blood results, medication lists and letters. RaDaR is now a Renal Association initiative coordinated by the UKRR that collates data of recruited patients with certain rare kidney diseases. RaDaR provides clinicians with an invaluable resource to accelerate research and presents patients with opportunities to participate in research.

Information governance – the care of patient data

The UKRR continues to receive support under section 251 of the NHS Act (2006) to collect data without individual patient consent. This helps to ensure the robustness and validity of analyses. The fair processing of patient data remains a key principle of the General Data Protection Regulation (2016) which is soon to replace the Data Protection Act (1998). This requires organisations to be clear and open with individuals about how their information is used. The UKRR publishes this information on the UKRR website and in patient information leaflets and posters, which are distributed to all renal centres. Each year the UKRR completes NHS Digital's Information Governance Toolkit and for the 2017/2018 assessment period achieved a score of 94% (subject to audit) against the 'satisfactory' standard of 80%. Further information on information governance is available on the UKRR website.

Audit

Annual report

The UKRR collects data primarily for benchmarking each of the UK's 84 renal centres against Renal Association audit standards (https://renal.org/guidelines/). Each year the UKRR publishes an annual report comprising chapters that each focus on different aspects of renal care and patient outcomes. Centre comparisons, attainment of Renal Association audit standards, national averages and long term trends are all presented. Each year, new or revised chapters are usually added that focus on novel ways of analysing and presenting the data. To improve the timeliness of publication of this report of 2016 data, no new chapters are presented. Conversely, for next year's report three revamped chapters are planned, namely comorbidity, diabetes and ethnicity. A novel authorship approach will be taken to the ethnicity chapter, involving several members of the UKRR patient council in deciding the scope and writing of this chapter.

Data completeness

Data completeness of audit standards varied between renal centres as summarised in appendix 1 of this chapter, with more details provided in individual chapters. While poor completeness may reflect a failure to accurately record patient data, other contributing factors include the incompatibility of local renal IT systems and the loss of data during the transfer and validation processes on account of coding issues. Cambridge renal centre (Addenbrooke's Hospital) was unable to submit any patient level data for 2015 and 2016 prior to the UKRR closing the database and only provided summary numbers by treatment modality for incident and prevalent patients in 2015 and 2016. The UKRR is working closely with the renal team, the chief executive of Cambridge University NHS Foundation Trust and NHS England to address this and files are now being received again. Data completeness is likely to improve with the development of the UKRDC and increasing uptake of the latest UKRR dataset. The dataset has evolved and expanded over time in response to audit

guidelines, with an understandable variable lag in the ability of local renal IT systems to respond to those changes.

The UKRR started collecting data on CKD4/5 patients registered in renal centres in 2016 and a few renal centres are returning these data as part of their quarterly extract. These data will be analysed and reported on in the next annual report. The AKI master patient index, established as part of the NHS England safety alert, is progressing well with almost 90% of laboratories in England submitting data (see sections *Improvements and innovations in patient care* and *AKI national program* below for more details).

Crucially, comorbidity data completeness at the start of RRT remained poor, with more than half (33/62) of the adult renal centres in England, Wales and Northern Ireland having lower than 75% completeness for comorbidity data. Thirteen renal centres submitted comorbidity data on fewer than 10% of their incident patients. Two renal centres (London Guy's Hospital and St Thomas' Hospital, Lister Hospital) returned comorbidity data for incident patients in the new format as described in version 4.2 of the dataset, but the date associated with the comorbidity was not completed and comorbidities at start of RRT could not be ascertained. All of this makes it impossible for the UKRR to adjust survival analyses for case mix, something that is particularly relevant to outlying centres [1]. NHS Digital recently approved the linkage of the main UKRR database to the Hospital Episode Statistics (HES) and Office of National Statistics databases. This has the potential to enhance UKRR data in a number of ways, by:

- Enabling adjustment for case-mix in centre survival comparisons.
- Providing information about differences in rates of hospital admission between renal centres.
- Making it possible to study equity of access to other non-renal services, such as cardiology, stroke and orthopaedic.
- Transforming the AKI database from a master patient index of all cases of AKI in primary and secondary care into one with information about admissions to hospital, reasons for admission to hospital, admissions to intensive care units and mortality.

How to interpret centre-specific analyses and outlying centres

The UKRR continues to advise caution in the interpretation of the comparisons of centre-specific attainment of clinical audit measures provided in this report. As in previous reports, the UKRR does not test for 'significant difference' between centres and arbitrary 95% and 99% confidence intervals are created from the data to show compliance with an audit standard. For many of these analyses no adjustment can be made for the range of factors known to influence the measured variable. In the future, through obtaining more complete comorbidity data via the HES data linkage, as well as using CKD data to understand centre differences in the transition of patients onto both RRT and conservative non-dialytic pathways, centre comparisons will become more meaningful.

Despite these shortcomings, for a number of years de-anonymised centre specific reports on survival of RRT patients have been published in the annual report. The Francis [2] and Keogh [3] enquiries and the ongoing Care Quality Commission inspections of patient care and outcomes at a number of hospital trusts highlight the ongoing need for such transparency. This year (2016 data) four centres had to be contacted because of lower than expected survival in patients starting dialysis.

The UKRR has no statutory powers. However, because the UKRR provides centre-specific de-anonymised analyses of important clinical outcomes, including survival, it is important to define how the UKRR responds to apparent under-performance. The UKRR senior management team communicates survival outlier status with the renal centres prior to publication. Centres are asked to report their outlying status internally at trust level and to follow up with robust mortality and morbidity meetings. They are also 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 chief executive officer or medical director of the UKRR inform the president of the Renal Association, who then takes action to ensure that the findings are properly investigated.

Research

The UKRR research team welcomes contact from renal clinicians and other researchers wishing to access UKRR data and/or collaborate with the UKRR on research projects and grant applications. Data can be released in one of two formats:

- Aggregated, e.g. tables and figures and results of statistical analyses.
- Individual level (anonymised).

In line with the UKRR's ongoing section 251 permission, in April 2017, formal application processes were introduced to access data. Applications to access aggregated data can be submitted at any time during the year and a decision is made by the UKRR medical director and head statistician. In contrast, applications to access individual level data must be received before a quarterly deadline, be assessed for risk of re-identification, be approved for external review by two external experts and then discussed at a quarterly meeting of the UKRR's Research Methods Study Group, where a decision on whether to release the data is made. A data sharing agreement is then drawn up between the UKRR and the data recipient prior to delivery of the data. More information is available on the UKRR website (https://www.renalreg.org/about-us/working-with-us/).

The majority of applications to access individual level data are either retrospective or prospective cohort analyses, although the UKRR does also provide large data sets for epidemiological and exploratory analyses and efficient outcome data for clinical trials. The UKRR is currently leading two National Institute for Health Research–Health Technology Assessment funded randomised controlled trials: (i) the Prepare for Kidney Care study randomises older comorbid patients approaching ESRD to either prepare for responsive management or prepare for dialysis [4]; and (ii) the High-volume Haemodiafiltration vs. High-flux Haemodialysis Registry Trial randomises patients to two different types of dialysis [5].

Applications to access UKRR data that were approved in 2017–2018 are listed in table 1. Grant funding received by the UKRR is detailed in table 2. Recent publications by UKRR authors are listed in appendix 2 of this chapter.

Table 1. Applications to access UKRR data that were approved in 2017–2018, listed alphabetically by applicant

Applicant	Data type	Title/description of application
David Bagguley, NHS England Specialised Commissioning Team, Yorkshire and Humber	Aggregate	Local provision of RRT services
Jyoti Baharani, Birmingham Heartlands Hospital	Aggregate	Local incidence and prevalence of peritoneal dialysis
Michael Barrowman, University of Manchester	Anonymised	Multi-state clinical prediction models in RRT
Aric Bendorf, University of Sydney, Australia	Aggregate	International transplant wait-listing practices
Kate Birnie, University of Bristol	Anonymised	An instrumental variable analysis for investigating erythropoietin therapy for treating anaemia among haemodialysis patients
Ben Bray, London Borough of Redbridge	Aggregate	Local incidence of patients with diabetic nephropathy
Sheena Dungey, Kent Surrey Sussex Academic Health Science Network	Aggregate	Local AKI data for quality improvement
Katie Fielding, Royal Derby Hospital	Aggregate	Dialysis access and needling data
Hugh Gallagher, Epsom and St Helier University Hospitals	Aggregate	Identifying and monitoring people at greatest risk of progressive CKD (ASSIST-CKD) – quality improvement
George Greenhall, Barts Health NHS Trust	Anonymised	Clinical epidemiology of renal transplantation for rare renal diseases in the UK
Alex Hamilton, UKRR and University of Bristol	Anonymised	Risk factors for decline and loss of kidney transplant function among UK children and young adults
Kitty Jager, ERA-EDTA	Anonymised	Changes in clinical parameters related to the transition from dialysis to kidney transplantation
Kitty Jager, ERA-EDTA	Anonymised	Outcome of paediatric kidney transplantation in Europe – results from the ESPN/ERA-EDTA Registry
Kitty Jager, ERA-EDTA	Anonymised	Recovery of renal function in the ERA-EDTA Registry
Matthew Katz, Department of Health	Aggregate	Identifying and monitoring people at greatest risk of progressive CKD (ASSIST-CKD) – trial and cost-saving analysis for NHS Blood and Transplant on renal transplants

Table 1. Continued

Applicant	Data type	Title/description of application
Kate Lovibond, National Clinical Guideline Centre, Royal College of Physicians	Aggregate	To develop National Institute for Health and Care Excellence (NICE) RRT guideline
Stephanie MacNeill, UKRR and University of Bristol	Anonymised	Benefits of transplant
Lucy Plumb, UKRR and University of Bristol	Anonymised	BAPN/UKRR paediatric RRT mortality audit: what is the completeness and accuracy of UKRR data for causes of death?
Lucy Plumb, UKRR and University of Bristol	Anonymised	Does socioeconomic status or geographic location play a role in access to nephrology services for UK children with CKD?
Rishi Pruthi, Royal Free Hospital	Aggregate	Planning of CKD services in North Central London
Rhodri Pyart, UKRR	Anonymised	The management and survival of patients with failing and failed renal allografts within the UK
Joe Sheehan, University of Kent	Aggregate	Patient incidence dialysis data for a dialysis transport study
Manish Sinha, Evelina London Children's Hospital	Aggregate	Information on children who start RRT on haemodialysis

AKI – acute kidney injury; BAPN – British Association for Paediatric Nephrology; CKD – chronic kidney disease; ERA-EDTA – European Renal Association–European Dialysis and Transplant Association; ESPN – European Society for Paediatric Nephrology; RRT – renal replacement therapy

Table 2. Grant transactions 1 January 2017 to 31 December 2017

Description	Value
Cambridge – Access to Transplantation and Transplant Outcome Measures (ATTOM)	£2,039
Intensive Care National Audit and Research Centre (ICNARC) – risk modelling study	£7,209
Keele University – Bioimpedance guided fluid management in dialysis patients – the BioImpedance Spectroscopy to Maintain Renal Output (BISTRO) trial	£11,799
Kidney Research UK – the National Unified Renal Translational Research Enterprise (NURTuRE)	£52,260
Kidney Research UK – support for the continued maintenance of RaDaR	£5,000
North Bristol NHS Trust – Prepare for Kidney Care trial	£1,443
UK and Ireland Vasculitis Rare Disease Group – anti-neutrophil cytoplasm antibodies vasculitis workshop	£5,360
University of Leicester, International RaDaR work completed by UKRR	£5,000

RaDaR – National Registry of Rare Kidney Diseases

Improvements and innovations in patient care

A major component of UKRR work is delivering changes in practice that improve the care of people with, or at risk of, kidney disease. This work falls under the banner of the UKRR's Think Kidneys brand (https://www.thinkkidneys.nhs.uk/). All three Think Kidneys programmes have made significant progress over the past 12 months.

AKI national programme

This is a national NHS campaign to improve the care of people at risk of, or with, AKI. The programme was a partnership between the UKRR and NHS England, and then latterly, NHS Improvement. The programme has produced a wide range of guidance and information for people working in all healthcare sectors to help with the prevention, detection, management and treatment of AKI. Examples include education packages about AKI for a range of health professionals, updated sick-day rules and specific resources for patients and carers. The first programme of work concluded in March 2017 and the second phase is now underway. Think Kidneys and the wider UKRR team continue to develop resources on the Think Kidneys website, lead improvements in care and report on the impact of AKI across England.

A key success of the programme has been the establishment of a master patient index of people who have

had a blood test triggered AKI alert across England. Almost 90% of laboratories in England (143/160) now submit AKI data from primary and secondary care to the UKRR. This has enabled the UKRR to report quarterly AKI rates at a clinical commissioning group level since October 2017. The next steps for the master patient index include linkage to HES to allow hospital specific reporting of AKI rates. Further details on the master patient index and how it is being used can be accessed on the Think Kidneys website.

Patient Measures

The Patient Measures programme supports a person-centred approach to care where people are supported to build their skills, knowledge and confidence to better manage and make decisions about their own health to improve their quality of life.

This programme is a collaboration between the UKRR and NHS England and follows on from the work of the Transforming Participation in Chronic Kidney Disease (TP-CKD) programme which ended in December 2017. The TP-CKD programme aimed to establish the feasibility of the UKRR introducing and routinely collecting from kidney patients a series of person-centred measures such as symptom burden, quality of life and the ability to self-manage. Having successfully piloted the collection of these data from patients in 14 renal centres, the programme is continuing to collect patient reported measurements as well as testing interventions that might have a positive impact on an individual's outcome.

A development of this programme has been the introduction of an annual Patient Reported Experience Measures (PREM) survey. This is a joint collaboration between the UKRR and Kidney Care UK. This collaboration has enabled the expansion of this survey beyond the original programme and now every adult renal centre in England and Wales is invited to take part. The PREM has run annually since the first pilot in 2016, with last year's collection resulting in over 11,000 completed PREM surveys. The survey has been validated and a national report on the results is published each year. For further information see https://www.renalreg.org/projects/prem.

Kidney Quality Improvement Partnership

The Kidney Quality Improvement Partnership (KQuIP) is a dynamic network of kidney health professionals, patients and carers who are committed to developing, supporting and sharing quality improvement (QI) in kidney services to enhance outcomes and quality of life for patients with kidney disease. KQuIP supports healthcare professionals, renal centres, renal networks and commissioners across the UK to achieve the highest quality of care for patients.

Since its launch in 2016, KQuIP has established a clear structure and achieved major engagement within the UK renal community. KQuIP has set up three active workstreams, regional QI days and three robust national priority QI projects. In addition, a highly acclaimed leadership training course for clinical directors has been established, which will be extended to the multi professional team and could include patients.

KQuIP's three national priority projects identified by the renal community are:

- Transplant First: improving access to pre-dialysis transplant listing and kidney transplantation.
- Home Therapies: improving access to home dialysis therapies.
- Managing Access by Generating Improvements in Cannulation (MAGIC): improving arteriovenous fistula rates by improving needling techniques.

KQuIP has made excellent progress over the past year, collaborating with Kidney Care UK funded regional project managers, to deliver four successful QI days covering a population of almost 20 million people. KQuIP is now working with each of these four regions to deliver one of the three national QI projects over the next year. There have been expressions of interest for future KQuIP regional days, including a paediatric network day and links with the home countries. KQuIP are working to deliver these over 2018/19.

KQuIP have produced a central repository of resources called the KQuIP Hub (https://www.thinkkidneys.nhs.uk/kquip/kquip-hub/). This is a growing resource to make QI accessible to clinicians and multidisciplinary team members, as well as patients. Material includes QI tools, sharing of best practice, case studies, abstracts from UK Kidney Week and other major renal events. The feedback on the Hub has been very encouraging and content fit for the renal community will continue to be developed.

The Association of Renal Industries has provided funding to develop a renal e-Learning platform that will be free for all medical healthcare professionals and patients to access. This is a very exciting development that will be owned by the renal community and further input will be requested as it progresses. A number of modules have already been developed and these will be available shortly.

Moving forward, KQuIP has developed an in depth strategic QI delivery plan as well as a QI training plan for regional delivery of the national priority QI projects. Alongside the leadership training course, the training plan will focus on specific QI skills and sustainability to enable regions to embed QI on a day to day basis. KQuIP will link to the Getting It Right First Time (GIRFT) and regional Right Care programmes and other programmes planned by the Renal Association.

Clinical informatics

The UKRDC is a new process for collecting data for kidney patients, whereby data will flow into a central data repository and flow onto other databases including RaDaR and PV. Advantages of the UKRDC include real time data access and processing, standardised processing and nomenclature, and the ability to link quickly with other databases.

The implementation of the UKRDC requires IT developments, such as adopting standard terms using SNOMED CT and LOINC; adopting standard methods for labelling and formatting data via the creation of a data model and standard messaging system; and developing two way communications between all participants including patients via PV.

During testing over the past 12 months it became apparent that the current implementation of the UKRDC was hindering development and had a number of shortcomings, most notably excessive storage requirements. A decision was therefore taken to rebuild the UKRDC around a Mirth server, this being the most cost effective and simple way to reduce storage requirements and increase the speed of development of new data paths.

Currently, one pilot renal centre has successfully started sending UKRDC schema based files through the UKRDC and by the end of 2018 full quarterly returns will be returned via this route.

The new system is being developed with the view to providing better feedback to renal centres on problems with files and rejections, allowing corrections to be made to export routines/patient data, which will overcome some of the shortcomings in the current system.

Besides the live server there is now a staging site available with staging versions of RaDaR and PV. This new server configuration allows renal centres/suppliers to use the system as a test bed for development of the new UKRDC schema feeds (https://github.com/renalreg/ukrdc). Renal centres or suppliers interested in being given access to the system should contact the UKRR.

New pathways are in development this year to allow patients to enter surveys via PV and the survey results to be sent back for display in clinical systems against the patient record. This combined with the new mobile app for PV could provide new tools to gather more patient entered data.

The concept of the UKRDC has been proven and data are flowing through the UKRDC in both directions. Work with pilot sites is progressing, but the success of the UKRDC depends on support and commitment from renal centres and the renal community.

Summary

Medicine is evolving rapidly, as is the technology that clinicians and patients have become accustomed to using in their day-to-day lives. The challenge is to process, analyse and report data as quickly as possible to ensure outputs are clinically meaningful and to help engage patients in the ongoing management of their kidney conditions. The progress of the UKRDC and evolution of PV, as well as the great work of the Think Kidneys programmes, exemplify how the renal community can remain at the forefront of patient-centred care. Expanding data collection to AKI and CKD, as well as external data linkages, particularly to HES, will allow more detailed analyses and make inter-centre comparisons much more transparent.

This is all being done against an evolving information security backdrop, including how the General Data Protection Regulation will be written into UK Data Protection Act law. While there remains some uncertainty as to the exact implications of the new law in the UK, early signs are that it could make data sharing for public benefit easier, whilst maintaining high standards of guardianship of personal data. For the UKRR, after a number of years of backroom development, exciting opportunities are likely to emerge, including monitoring patient quality of life and real-time interrogation of national data for local audit and quality improvement. It is only with such developments that the UKRR can justify its ongoing privileged access to the data and work with the community to drive forward improvements in people-centred kidney care in the UK.

Conflicts of interest: the authors declare no conflicts of interest

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Appendix 1

Percentage completeness

Table 3. Percentage completeness of data returns for ethnicity, primary renal diagnosis, date first seen by a nephrologist, comorbidity at start of RRT (incident patients 2016) and cause of death (for deaths in 2016 amongst prevalent patients on 31/12/15), ordered by 2016 average completeness

Centre	Ethnicity	Primary diagnosis	Date first seen	Comorbidity	Cause of death	Average completeness	Country
Antrim	100.0	100.0	100.0	100.0	100.0	100.0	N Ireland
L Kings	100.0	100.0	99.3	98.7	98.1	99.2	England
Nottm	99.2	100.0	100.0	100.0	96.1	99.1	England
West NI	97.1	100.0	97.1	100.0	100.0	98.9	N Ireland
Bradfd	98.8	100.0	100.0	97.7	95.8	98.5	England
Ulster	100.0	100.0	100.0	90.0	100.0	98.0	N Ireland
B Heart	100.0	100.0	100.0	94.1	93.3	97.5	England
Cardff	96.3	100.0	99.4	97.5	93.5	97.3	Wales
Swanse	100.0	99.2	100.0	93.6	93.9	97.3	Wales
Newc	100.0	100.0	100.0	94.0	92.5	97.3	England
Leeds	99.4	100.0	98.6[b]	99.4	88.8	97.2	England
Dorset	98.6	100.0	97.1	95.7	93.2	96.9	England
Derby	98.8	98.8	100.0	91.9	93.4	96.6	England
Dudley	100.0	98.1	100.0	93.9	90.5	96.5	England
Wrexm	93.9	93.9	100.0	93.6	100.0	96.3	Wales
York	93.1	100.0	100.0	93.0	95.2	96.3	England
Middlbr	98.0	100.0	100.0	99.0	83.0	96.0	England
Bangor	88.0	92.0	100.0	100.0	100.0	96.0	Wales
Newry	100.0	100.0	100.0	96.0	80.0	95.2	N Ireland
Stoke	90.7	99.1	98.1	96.3	91.8	95.2	England
Redng	84.4	99.0	100.0	95.8	95.9	95.0	England
Basldn	95.0	95.0	95.0	85.0	91.4	92.3	England
Sund	100.0	100.0	98.9	68.1	91.5	91.7	England
Wolve	100.0	100.0	95.3	100.0	62.0	91.5	England
Exeter	98.6	98.6	97.2	70.9	89.1	90.9	England
Norwch	97.9	100.0	96.3[b]	99.0	61.2	90.9	England
Wirral	97.1	100.0	97.1	100.0	59.5	90.7	England
Hull	97.8	96.8	100.0	93.4	60.0	89.6	England
Plymth	98.4	92.1	100.0	60.7	92.0	88.6	England
Sthend	100.0	95.7	95.7	57.5	86.0	87.0	England
Donc	100.0	98.4	98.4	54.1	81.8	86.5	England
Glouc	98.5	98.5	93.9	44.6	78.6	82.8	England
Chelms	100.0	94.3	90.6	34.7	92.7	82.5	England
Oxford	79.8	87.6	99.5	67.9	75.4	82.0	England
Colchr	96.7	87.3[a]	46.7	100.0	78.3	81.8	England
Shrew	96.6	100.0	100.0	98.3	8.3	80.6	England
Truro	100.0	100.0	100.0	2.0	100.0	80.4	England
L West	100.0	100.0	99.5	1.0	98.9	79.9	England
B QEH	96.2	98.7	100.0	86.6	4.2	77.1	England
Carlis	97.1	57.3	94.3	48.6	85.3	76.5	England
Prestn	100.0	98.5	97.0	3.8	83.2	76.5	England
Brightn	89.3	100.0	98.0	1.3	91.9	76.1	England
L Guys	94.7	91.1	94.7	0.0	90.1	74.1	England
Liv Ain	98.1	100.0	98.1	62.3	10.0	73.7	England
Kent	97.9	61.2	100.0	2.1	100.0	72.2	England
Clwyd	81.3	62.5	81.3	43.8	92.3	72.2	Wales
Bristol	80.6	83.9	73.6	54.2	65.3	71.5	England
Sheff	97.4	92.7	99.3	55.0	0.0	68.9	England
Belfast	82.1	90.5	87.4	41.1	43.2	68.8	N Ireland

Table 3. Continued

Centre	Ethnicity	Primary diagnosis	Date first seen	Comorbidity	Cause of death	Average completeness	Country
Leic	91.0	76.5	98.8	0.3	50.0	63.3	England
M RI	95.9	89.0	94.5	34.4	1.4	63.0	England
L Rfree	95.0	91.6	96.6	3.8	16.0	60.6	England
Stevng	85.5	90.9	99.4	1.8	7.9	57.1	England
Covnt	96.9	64.2	96.1	7.9	1.9	53.4	England
L Barts	99.7	80.1	1.4	36.7	42.4	52.0	England
Liv Roy	97.3	33.3	99.1	12.6	4.5	49.4	England
Ports	84.3	46.6	41.4	12.0	24.0	41.6	England
Salford	96.8	88.3	5.9	0.0	0.9	38.4	England
L St.G	85.1	37.2	15.5[b]	21.5	26.8	37.2	England
Ipswi	92.9	50.0	23.8	0.0	5.9	34.5	England
Carsh	91.1	24.8	41.5	2.9	10.8	34.2	England
Camb							England
Abrdn		100.0			81.8		Scotland
Airdrie		100.0			92.2		Scotland
D & Gall		100.0			69.2		Scotland
Dundee		100.0			98.0		Scotland
Edinb		100.0			100.0		Scotland
Glasgw		100.0			92.2		Scotland
Inverns		100.0			85.7		Scotland
Klmarnk		100.0			100.0		Scotland
Krkcldy		62.5			80.5		Scotland

[a]Data from these centres included a high proportion of patients whose primary renal diagnosis was 'uncertain'. In some cases, this appears to have been because software in these centres was defaulting missing values to 'uncertain'. The value given for the completeness has been reduced in proportion to the amount by which the percentage of non-missing diagnoses being 'uncertain' exceeded 40%

[b]More than 10% of patients reported as starting RRT on the same date as first presentation, the percentage completeness shown excludes the amount by which this exceeded 10%

Appendix 2

Original research by UKRR staff involving UKRR data

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UK Renal Registry 20th Annual Report: Chapter 1 UK Renal Replacement Therapy Adult Incidence in 2016: National and Centre-specific Analyses

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Keywords

Incidence rates · 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 · Acute haemodialysis

Summary

- The incidence rate in the UK decreased from 120 per million population (pmp) in 2015 to 118 pmp in 2016 reflecting renal replacement therapy (RRT) initiation for 7,759 new patients.
- The median age of all incident patients was 64.3 years, but this was highly dependent on ethnicity (66.2 years for White incident patients, 58.7 years for non-White patients).
- Diabetic renal disease remained the single most common cause of renal failure treated by RRT (28.6%).
- By 90 days, 66.6% of patients were on haemodialysis (HD), 19.6% on peritoneal dialysis (PD), 9.3% had a functioning transplant (Tx) and 4.6% had died or stopped treatment.
- The percentage of RRT patients at 90 days who had a functioning transplant varied between centres from 0% to 31% (between 2% and 31% for transplanting centres and between 0% and 19% for non-transplanting centres).
- The mean eGFR at the start of RRT was 7.4 ml/min/1.73 m^2 by the CKD-EPI method and 8.5 ml/min/1.73 m^2 by the MDRD method, similar to the previous five years.
- Late presentation continued to fall from 23.9% in 2006 to 15.6% in 2016.
- Timeline codes indicated that 6,891 first-ever HD sessions were delivered in 2016 across 62 centres in England, Wales and Northern Ireland. Of these, 2,581 (37.5%) were classified as acute HD and the remaining 4,310 (62.5%) as HD for established renal failure (ERF). Data relating to the first HD session were available for 5,373 (78.0%) HD starts.
- After centre exclusions, 4,191 (79.7%) of 5,257 timeline and sessional HD start dates were on the same day and 97.2% were within two weeks of each other. These low levels of discordance are unlikely to meaningfully influence overall survival data for HD recipients.
- Of the 2,581 individuals who received acute HD, 790 (30.6%) developed ERF and 1,791 (69.4%) died, stopped RRT or recovered renal function.

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- It is vital that coding is consistent between centres. The UK Renal Registry (UKRR) asks clinicians to use the timeline to record the date of first dialysis and separately, the date on which the patient is deemed to have reached ERF. This allows patients who have an acute start to be distinguished from those whose start on RRT was planned.

Introduction

This chapter contains analyses of UK adults who started renal replacement therapy (RRT) in 2016. The methodology and results for these analyses are in four sections: geographical variations in incidence rates; the demographic and clinical characteristics of patients starting RRT; analyses of late presentation and delayed referral; and analyses of acute haemodialysis sessions. The data were analysed using SAS 9.3.

Definitions

The first three sections of this chapter consider individuals who received RRT as a treatment for established renal failure (ERF). These individuals are considered 'incident to RRT' throughout this report. The term ERF is used synonymously with the terms end stage renal failure/disease (ESRF/ESRD). Since the 19th Annual Report, data have also been published for individuals who received acute haemodialysis (HD), as coded by their reporting centre. Previously, such individuals were only reported if their dialysis was subsequently recoded as being for ERF, when they failed to recover native renal function. Recoding is automatically applied at 90 days for individuals still on RRT, but can also be applied at any point between days 0 and 90 by the reporting centre. Individuals who commenced HD for acute kidney injury (AKI) and subsequently recovered renal function, or died within the first 90 days of treatment without receiving an ERF code are reported in the fourth section of this chapter. These individuals do not feature elsewhere in the UKRR report. Figure 1.1 illustrates the terms used to categorise dialysis as being acute or for ERF. See appendix B: Definitions and Analysis Criteria (www.renalreg.org) for further details. Note that individuals with a failed renal transplant who returned to dialysis are not included.

NHS England now mandates the collection of data regarding acute HD sessions. These data will help to provide a more complete picture of dialysis use in the UK than has ever before been possible. Sessional HD data carry no information about whether the dialysis was for AKI or ERF. Distinguishing between these two indications depends entirely upon the accuracy of timeline data provided by centres.

Differences in incidence data may be seen in the 2011 to 2015 numbers now quoted when compared with previous publications because of retrospective updating of data in collaboration with renal centres. In addition, patients with acute kidney injury requiring dialysis may be coded in the subsequent year as having developed ERF, allowing the UKRR to backdate the start date of RRT.

Where applicable, pre-emptive transplant patients were allocated to their work-up centre, rather than their transplant centre. This was not possible for all patients as some centres did not supply the 'transfer out for pre-emptive transplant' timeline codes. Consequently, some patients remain allocated to their transplanting centre.

UK Renal Registry coverage

The UKRR received individual patient level data from 70 adult renal centres in the UK (five in Wales, five in Northern Ireland, nine in Scotland, 51 in England).

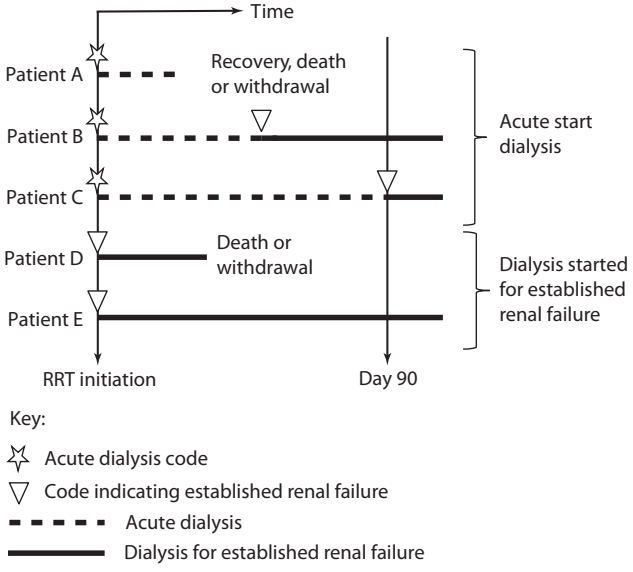

Fig. 1.1. Example histories for patients starting RRT, illustrating the use of timeline codes to define dialysis as being 'acute' or for established renal failure

Patients that follow patterns B–E receive RRT for ERF and are counted as 'incident to RRT' throughout this report. Patients that follow pattern A are not counted as 'incident to RRT' and feature only in section four of this chapter

Cambridge renal centre (Addenbrooke's) was unable to submit 2015 or 2016 data at patient level prior to the UKRR closing the database and only provided summary numbers of patients starting RRT by treatment modality. This centre is therefore excluded from most analyses in this chapter. 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 2016.

Renal Association Guidelines

Table 1.1 lists the relevant items from the Renal Association Guidelines on the Planning, Initiating and 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 are not included in the UKRR dataset. The UKRR is working with the renal community to improve reporting across all of these measures.

Table 1.1. Summary of Renal Association (RA) 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	UKRR 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	Yes	See chapter 9
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 were small, the UKRR will consider doing a combined years analysis in future reports
Proportion of incident patients commencing peritoneal or home haemodialysis	Partly	See appendix F for proportion starting on PD and see tables 1.12a and 1.12b for proportion on PD at 90 days. Not reported for home HD due to small numbers
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)	Yes	
Proportion of planned initiations with established access or pre-emptive transplantation	Yes	See appendix F for proportion of incident patients having 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	Partly	Reported but not at centre level due to poor data completeness

1. Geographical variation in incidence rates

Introduction

Incidence rates vary widely between renal centres. Equity of access to RRT is hard to assess, many variables (including medical, social and demographic factors) influence rates of ERF. Thus, comparisons of crude incidence rates by geographical area are misleading. To enhance comparisons, age and sex standardised rates for each clinical commissioning group/health board (CCG/HBs) are presented along with crude rates. Population ethnicity rates are presented but adjustment for ethnicity or comorbidity was not made due to incomplete data.

Methods

See appendix D: Methodology used for Analyses and appendix E: Methodology for Estimating Catchment Populations (www.renalreg.org) for a detailed description of methods used to calculate crude and age/sex standardised incidence ratios and to estimate catchment populations.

Only one centre (Cambridge) was unable to provide patient-level data. Aggregated data enabled estimation of incident numbers for 2015 and 2016. These estimates are presented in tables 1.2 and 1.4, but do not feature elsewhere in this chapter. The 2011 to 2014 data were used to decide which CCG/HBs should be excluded from the calculation of age and sex standardised rates due to missing patient-level data. Those CCG/HBs where greater than 15% of the incident RRT population from 2011 to 2014 were incident patients of the Cambridge renal centre were not included in the analysis for 2015 or 2016. These CCG/HBs are included for 2011–2014. CCG/HBs where less than 15% of the 2011–2014 data were from Cambridge were included in the analyses, and where the percentage was between 5% and 15% are flagged in table 1.3 as their results are likely to be underestimated.

Results

Overall

In 2016, the number of adult patients starting RRT in the UK was 7,759 equating to an incidence rate of 118 pmp (table 1.2), compared with 120 pmp in 2015. Scotland's rate was notably lower than the rest of the UK (figure 1.2). There continued to be very marked sex differences in incidence rates which were 151 pmp (95% CI 147–155) in males and 86 pmp (95% CI 83–90) 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 120 pmp.

Incidence rates at CCG/HB level

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

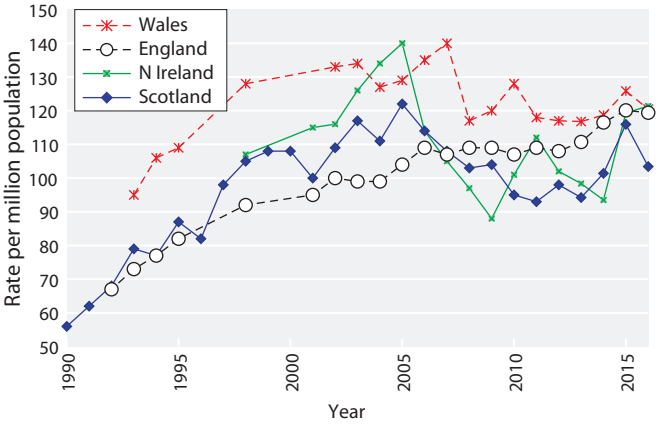

Fig. 1.2. RRT incidence rates in the countries of the UK 1990–2016

Table 1.2. Number of new adult patients starting RRT in the UK in 2016

	England[b]	N Ireland	Scotland[c]	Wales	**UK[b]**
Number starting RRT	6,599	226	559	375	**7,759**
Total estimated population mid-2016 (millions)[a]	55.3	1.9	5.4	3.1	**65.6**
Incidence rate (pmp)	119	121	103	120	**118**
(95% CI)	(117–122)	(106–137)	(95–112)	(108–133)	**(116–121)**

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

[b]Cambridge was unable to submit patient level data for 2015 or 2016 but provided the UKRR with information allowing their incident numbers for 2015 and 2016 to be estimated. These numbers have been used here and in table 1.4 but not elsewhere in this chapter

[c]The number starting RRT, and hence the RRT incidence rate, published in the Scottish Renal Registry report for the same period is slightly higher at 573 (106 pmp). This is explained by their inclusion of under 18 year olds and other differences in the definition of incident RRT patients between the two registries

Table 1.3. Crude adult incidence rates (pmp) and age/sex standardised incidence ratios 2011–2016

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
Areas with notably low incidence ratios over six years are italicised in lighter greyed areas, those with notably high incidence ratios over six years are bold in darker 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-2016 population data from the Office for National Statistics, National Records of Scotland and the Northern Ireland Statistics and Research Agency – based on the 2011 census
% non-White – percentage of the CCG/HB population that is non-White, from 2011 census

UK area	CCG/HB	Total population (2016)	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016 O/E	2016 Crude rate pmp	2011–2016 O/E	2011–2016 LCL	2011–2016 UCL	2011–2016 Crude rate pmp[a]	% non-White
Cheshire, Warrington and Wirral	*NHS Eastern Cheshire*	*196,900*	*0.75*	*0.71*	*0.65*	*0.72*	*0.91*	*0.51*	*71*	*0.71*	*0.59*	*0.85*	*92*	*3.7*
	NHS South Cheshire	179,800	0.74	0.58	1.14	1.07	0.85	0.69	89	0.85	0.70	1.02	103	2.9
	NHS Vale Royal	*103,700*	*0.87*	*0.78*	*1.26*	*0.24*	*0.45*	*0.31*	*39*	*0.64*	*0.48*	*0.85*	*76*	*2.1*
	NHS Warrington	*208,800*	*0.45*	*0.85*	*0.70*	*0.99*	*0.75*	*0.64*	*77*	*0.73*	*0.60*	*0.89*	*83*	*4.1*
	NHS West Cheshire	232,000	1.05	0.86	0.98	0.82	0.78	0.99	129	0.91	0.78	1.07	112	2.8
	NHS Wirral	321,200	0.91	0.63	0.99	0.68	1.08	0.94	121	0.88	0.76	1.00	106	3.0
Durham, Darlington and Tees	NHS Darlington	105,600	0.86	1.29	0.83	0.55	1.13	0.61	76	0.87	0.69	1.11	103	3.8
	NHS Durham Dales, Easington and Sedgefield	274,600	1.12	0.85	1.01	0.93	1.00	0.95	124	0.98	0.85	1.12	120	1.2
	NHS Hartlepool and Stockton-on-Tees	288,500	0.93	1.05	0.87	0.97	0.72	0.73	87	0.87	0.75	1.01	98	4.4
	NHS North Durham	*247,500*	*0.55*	*1.25*	*0.64*	*0.54*	*0.71*	*0.88*	*109*	*0.76*	*0.64*	*0.90*	*89*	*2.5*
	NHS South Tees	275,800	0.96	0.99	1.23	0.81	1.58	0.99	120	1.10	0.96	1.26	124	6.7
Greater Manchester	NHS Bolton	283,100	0.96	0.91	0.92	0.68	1.08	1.15	131	0.95	0.82	1.11	102	18.1
	NHS Bury	188,700	0.72	1.38	0.79	1.17	1.21	1.13	133	1.07	0.90	1.27	118	10.8
	NHS Heywood, Middleton & Rochdale	**216,200**	**1.23**	**1.27**	**1.24**	**1.39**	**1.03**	**1.37**	**153**	**1.25**	**1.08**	**1.46**	**131**	**18.3**
	NHS Manchester	**541,300**	**1.26**	**1.45**	**1.63**	**1.50**	**1.77**	**1.62**	**133**	**1.54**	**1.40**	**1.71**	**119**	**33.5**
	NHS Oldham	232,700	1.04	0.72	0.96	1.28	1.10	1.43	155	1.10	0.94	1.28	112	22.5
	NHS Salford	248,700	0.74	0.87	1.10	0.84	0.84	1.23	129	0.94	0.80	1.11	92	9.9
	NHS Stockport	*290,600*	*0.88*	*0.66*	*0.52*	*0.89*	*0.82*	*1.02*	*127*	*0.80*	*0.69*	*0.94*	*94*	*7.9*
	NHS Tameside and Glossop	256,400	0.98	0.60	1.09	0.82	1.01	1.22	144	0.96	0.82	1.12	107	8.2
	NHS Trafford	234,700	0.50	1.17	1.14	0.84	0.88	1.03	119	0.93	0.79	1.10	101	14.5
	NHS Wigan Borough	323,100	1.01	0.77	0.75	0.92	0.93	1.04	127	0.90	0.79	1.04	104	2.7
Lancashire	NHS Blackburn with Darwen	147,000	1.41	1.25	0.93	0.81	1.62	0.98	102	1.17	0.96	1.42	114	30.8
	NHS Blackpool	139,200	0.90	1.53	1.18	1.17	0.89	0.56	72	1.03	0.85	1.25	123	3.3
	NHS Chorley and South Ribble	174,300	0.95	0.73	1.27	0.86	1.10	0.65	80	0.93	0.77	1.11	108	2.9
	NHS East Lancashire	*375,800*	*0.93*	*0.55*	*0.87*	*1.07*	*0.65*	*0.86*	*104*	*0.82*	*0.72*	*0.94*	*94*	*11.9*
	NHS Fylde & Wyre	*169,000*	*0.55*	*0.77*	*0.79*	*0.96*	*0.87*	*0.84*	*124*	*0.80*	*0.67*	*0.96*	*111*	*2.1*
	NHS Greater Preston	203,500	0.53	1.02	0.85	0.93	1.02	0.69	79	0.84	0.70	1.01	91	14.7
	NHS Morecombe Bay	*348,500*	*0.70*	*0.82*	*0.70*	*0.64*	*0.55*	*0.49*	*66*	*0.64*	*0.55*	*0.75*	*82*	*4.0*
	NHS West Lancashire	113,400	0.85	0.77	0.67	0.63	1.21	0.61	79	0.79	0.62	1.01	97	1.9
Merseyside	NHS Halton	126,900	1.53	0.98	0.95	1.04	1.32	1.00	118	1.14	0.93	1.39	126	2.2
	NHS Knowsley	147,900	1.13	1.32	0.64	1.70	0.87	0.82	95	1.08	0.89	1.30	117	2.8
	NHS Liverpool	484,600	1.11	1.22	1.01	1.20	1.16	0.90	95	1.10	0.98	1.23	109	11.1
	NHS South Sefton	**158,900**	**1.41**	**1.06**	**1.31**	**1.28**	**1.03**	**1.23**	**157**	**1.22**	**1.03**	**1.44**	**146**	**2.2**
	NHS Southport and Formby	115,400	0.95	0.75	1.39	0.81	0.54	0.72	104	0.85	0.68	1.06	116	3.1
	NHS St Helens	178,500	0.76	0.90	0.58	0.96	0.96	0.97	123	0.86	0.71	1.04	103	2.0

Table 1.3. Continued

UK area	CCG/HB	Total population (2016)	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016		2011–2016				% non-White
								O/E	Crude rate pmp	O/E	LCL	UCL	Crude rate pmp[a]	
Cumbria, Northumberland, Tyne and Wear	*NHS Cumbria North*	*318,200*	*0.65*	*0.44*	*1.01*	*0.88*	*1.04*	*0.89*	*123*	*0.83*	*0.72*	*0.95*	*107*	*1.5*
	NHS Newcastle Gateshead	*498,100*	*0.82*	*0.85*	*0.62*	*0.85*	*1.05*	*0.93*	*102*	*0.86*	*0.76*	*0.97*	*89*	*10.1*
	NHS North Tyneside	*203,300*	*0.67*	*0.89*	*0.95*	*0.65*	*0.78*	*0.98*	*123*	*0.82*	*0.69*	*0.98*	*97*	*3.4*
	NHS Northumberland	*316,000*	*0.82*	*0.76*	*0.62*	*0.94*	*0.63*	*0.86*	*120*	*0.77*	*0.67*	*0.89*	*102*	*1.6*
	NHS South Tyneside	149,400	1.09	0.54	0.76	0.61	0.95	1.43	181	0.90	0.74	1.10	107	4.1
	NHS Sunderland	278,000	0.77	0.89	0.61	0.91	0.99	1.26	155	0.91	0.79	1.06	106	4.1
North Yorkshire and Humber	*NHS East Riding of Yorkshire*	*315,900*	*0.73*	*0.70*	*0.46*	*0.73*	*0.81*	*0.73*	*104*	*0.69*	*0.60*	*0.80*	*94*	*1.9*
	NHS Hambleton, Richmondshire and Whitby	*153,200*	*0.69*	*1.21*	*0.87*	*0.82*	*0.60*	*0.65*	*91*	*0.80*	*0.65*	*0.97*	*106*	*2.7*
	NHS Harrogate and Rural District	156,300	0.97	0.96	0.52	1.07	1.07	1.08	147	0.95	0.79	1.14	122	3.7
	NHS Hull	260,200	0.78	0.78	0.95	1.02	1.33	0.98	104	0.98	0.84	1.15	98	5.9
	NHS North East Lincolnshire	159,100	1.33	0.69	0.83	1.00	1.00	0.56	69	0.90	0.74	1.09	105	2.6
	NHS North Lincolnshire	170,800	1.51	1.14	1.00	0.47	1.00	0.82	105	0.98	0.82	1.17	118	4.0
	NHS Scarborough and Ryedale	*111,400*	*0.57*	*0.92*	*0.69*	*0.78*	*0.62*	*0.82*	*117*	*0.74*	*0.58*	*0.94*	*99*	*2.5*
	NHS Vale of York	*357,900*	*1.08*	*0.92*	*0.77*	*0.82*	*0.63*	*0.90*	*112*	*0.85*	*0.74*	*0.97*	*99*	*4.0*
South Yorkshire and Bassetlaw	NHS Barnsley	241,200	0.80	1.02	1.03	1.39	0.80	1.21	149	1.05	0.90	1.21	122	2.1
	NHS Bassetlaw	114,800	0.82	1.04	1.30	0.89	0.52	0.79	104	0.88	0.71	1.11	110	2.6
	NHS Doncaster	306,400	1.07	0.82	1.15	1.37	0.83	1.18	144	1.07	0.94	1.22	122	4.7
	NHS Rotherham	*261,900*	*0.67*	*0.84*	*0.75*	*0.90*	*1.04*	*0.77*	*95*	*0.83*	*0.71*	*0.98*	*97*	*6.4*
	NHS Sheffield	575,400	1.00	1.24	0.96	1.02	0.93	0.93	101	1.01	0.91	1.12	103	16.3
West Yorkshire	*NHS Airedale, Wharfedale and Craven*	*160,000*	*0.49*	*0.65*	*0.84*	*1.14*	*0.90*	*0.62*	*81*	*0.78*	*0.64*	*0.96*	*96*	*11.1*
	NHS Bradford City	**84,900**	**1.86**	**2.61**	**2.55**	**3.12**	**2.31**	**2.67**	**188**	**2.53**	**2.04**	**3.12**	**169**	**72.2**
	NHS Bradford Districts	**339,700**	**1.10**	**1.40**	**1.06**	**1.15**	**1.57**	**1.58**	**165**	**1.32**	**1.17**	**1.49**	**129**	**28.7**
	NHS Calderdale	*209,800*	*0.59*	*0.77*	*1.05*	*0.62*	*0.71*	*0.92*	*110*	*0.78*	*0.64*	*0.94*	*87*	*10.3*
	NHS Greater Huddersfield	245,000	0.91	1.10	0.92	1.01	0.76	0.63	73	0.88	0.75	1.04	97	17.4
	NHS Leeds North	201,200	0.84	0.79	0.86	0.90	0.65	0.99	119	0.84	0.70	1.01	95	17.4
	NHS Leeds South and East	253,700	0.93	0.75	0.95	0.98	0.62	0.94	95	0.86	0.72	1.03	81	18.3
	NHS Leeds West	*326,900*	*0.59*	*0.73*	*1.14*	*0.70*	*0.88*	*0.64*	*64*	*0.78*	*0.66*	*0.92*	*73*	*10.8*
	NHS North Kirklees	192,000	1.24	0.48	1.46	0.84	0.80	1.00	109	0.97	0.80	1.16	100	25.3
	NHS Wakefield	336,800	0.91	1.07	0.85	0.98	0.60	0.87	107	0.88	0.76	1.00	101	4.6
Arden, Herefordshire and Worcestershire	**NHS Coventry and Rugby**	**456,700**	**1.44**	**1.75**	**1.27**	**1.13**	**1.04**	**1.47**	**153**	**1.34**	**1.21**	**1.49**	**132**	**22.2**
	NHS Herefordshire	189,300	0.82	0.90	0.80	0.91	1.24	0.99	137	0.95	0.81	1.12	124	1.8
	NHS Redditch and Bromsgrove	181,700	0.80	1.18	0.72	0.82	0.78	0.70	88	0.83	0.69	1.00	98	6.0
	NHS South Warwickshire	*262,700*	*0.99*	*0.66*	*0.58*	*0.85*	*0.81*	*0.87*	*114*	*0.80*	*0.68*	*0.93*	*98*	*7.0*
	NHS South Worcestershire	*301,400*	*0.71*	*0.78*	*0.76*	*0.95*	*0.71*	*0.64*	*86*	*0.76*	*0.65*	*0.88*	*96*	*3.7*
	NHS Warwickshire North	190,200	1.10	0.80	0.74	1.56	1.08	1.25	158	1.10	0.93	1.29	130	6.5
	NHS Wyre Forest	99,900	1.07	0.81	0.64	1.35	0.43	0.87	120	0.86	0.67	1.09	112	2.8
Birmingham and the Black Country	**NHS Birmingham CrossCity**	**748,300**	**1.63**	**1.49**	**1.46**	**1.53**	**1.62**	**1.72**	**170**	**1.58**	**1.46**	**1.70**	**146**	**35.2**
	NHS Birmingham South and Central	**204,000**	**1.87**	**1.53**	**1.66**	**1.78**	**1.39**	**1.82**	**172**	**1.67**	**1.45**	**1.93**	**149**	**40.4**
	NHS Dudley	317,600	0.86	1.22	1.25	0.91	0.85	0.88	110	0.99	0.87	1.13	116	10.0
	NHS Sandwell and West Birmingham	**495,100**	**1.69**	**1.47**	**1.55**	**1.70**	**1.85**	**1.95**	**190**	**1.71**	**1.56**	**1.87**	**157**	**45.3**
	NHS Solihull	211,800	0.68	1.01	0.90	0.89	1.11	1.08	137	0.95	0.81	1.12	113	10.9
	NHS Walsall	**278,700**	**1.24**	**1.41**	**1.61**	**0.97**	**1.27**	**0.87**	**100**	**1.22**	**1.07**	**1.39**	**132**	**21.1**
	NHS Wolverhampton	**256,600**	**1.23**	**1.54**	**1.15**	**1.38**	**1.24**	**1.05**	**117**	**1.26**	**1.10**	**1.44**	**132**	**32.0**

Table 1.3. Continued

UK area	CCG/HB	Total population (2016)	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016		2011–2016				% non-White
								O/E	Crude rate pmp	O/E	LCL	UCL	Crude rate pmp[a]	
Derbyshire and Notting-hamshire	NHS Erewash	96,700	1.15	1.33	1.30	0.61	1.08	0.92	114	1.06	0.84	1.34	122	3.2
	NHS Hardwick	*111,400*	*0.70*	*0.85*	*0.76*	*0.85*	*0.82*	*0.55*	*72*	*0.75*	*0.59*	*0.97*	*93*	*1.8*
	NHS Mansfield & Ashfield	*197,900*	*0.75*	*0.83*	*0.81*	*1.02*	*0.81*	*0.65*	*81*	*0.81*	*0.68*	*0.98*	*94*	*2.5*
	NHS Newark & Sherwood	119,700	1.29	0.93	0.49	0.72	0.62	0.76	100	0.79	0.63	1.00	99	2.4
	NHS North Derbyshire	*273,200*	*0.94*	*0.78*	*0.76*	*0.66*	*0.61*	*0.75*	*102*	*0.75*	*0.64*	*0.87*	*96*	*2.5*
	NHS Nottingham City	**325,300**	**1.11**	**1.24**	**1.36**	**1.32**	**1.63**	**1.41**	**126**	**1.35**	**1.18**	**1.54**	**114**	**28.5**
	NHS Nottingham North & East	*150,300*	*0.85*	*0.72*	*0.70*	*0.55*	*0.79*	*0.95*	*120*	*0.76*	*0.61*	*0.95*	*90*	*6.2*
	NHS Nottingham West	112,700	0.55	1.10	1.30	0.87	0.83	0.90	115	0.92	0.74	1.16	111	7.3
	NHS Rushcliffe	*115,200*	*1.16*	*0.38*	*1.04*	*0.42*	*0.20*	*0.81*	*104*	*0.66*	*0.51*	*0.86*	*80*	*6.9*
	NHS Southern Derbyshire	527,400	1.03	1.13	0.87	0.99	0.79	1.05	125	0.97	0.88	1.08	109	11.0
East Anglia	*NHS Cambridgeshire and Peterborough*[c]	*884,600*	*0.90*	*0.66*	*1.05*	*0.78*				*0.85*	*0.76*	*0.95*	*89*	*9.5*
	NHS Great Yarmouth & Waveney	215,700	1.17	0.97	0.95	0.79	1.18	1.06	148	1.02	0.88	1.18	134	2.7
	NHS Ipswich and East Suffolk[b]	*401,000*	*0.62*	*0.89*	*0.91*	*0.72*	*1.06*	*0.77*	*102*	*0.83*	*0.74*	*0.94*	*104*	*5.6*
	NHS North Norfolk[b]	*171,900*	*0.55*	*0.76*	*0.82*	*0.89*	*0.96*	*0.75*	*116*	*0.79*	*0.66*	*0.95*	*116*	*1.5*
	NHS Norwich[b]	216,800	1.09	0.96	0.80	0.84	0.92	0.69	78	0.88	0.74	1.05	95	7.3
	NHS South Norfolk[c]	229,900	1.00	0.75	0.97	0.62				0.83	0.68	1.02	104	2.6
	NHS West Norfolk[c]	*175,100*	*0.63*	*0.67*	*0.61*	*0.86*				*0.70*	*0.55*	*0.89*	*91*	*2.6*
	NHS West Suffolk[c]	*227,800*	*0.70*	*0.89*	*0.82*	*0.60*				*0.75*	*0.60*	*0.93*	*88*	*4.6*
Essex	NHS Basildon and Brentwood	259,800	1.04	1.26	0.94	0.99	1.07	1.11	131	1.07	0.92	1.23	118	7.1
	NHS Castle Point, Rayleigh and Rochford	175,400	0.75	0.70	1.18	0.73	0.90	0.87	120	0.86	0.71	1.03	111	3.0
	NHS Mid Essex[b]	*388,400*	*0.98*	*0.81*	*0.72*	*0.87*	*0.69*	*0.73*	*93*	*0.80*	*0.70*	*0.91*	*94*	*4.4*
	NHS North East Essex[b]	329,200	1.24	0.95	0.85	1.11	0.74	0.79	103	0.94	0.83	1.07	115	5.5
	NHS Southend	179,800	0.84	0.94	1.07	0.72	1.01	1.29	156	0.98	0.82	1.17	111	8.4
	NHS Thurrock	167,000	1.19	0.78	0.96	1.15	1.09	0.64	66	0.97	0.79	1.18	94	14.1
	NHS West Essex[b]	302,500	0.73	1.19	1.04	1.10	0.94	0.89	106	0.98	0.85	1.12	110	8.2
Hertfordshire and the South Midlands	NHS Bedfordshire	447,700	0.72	0.95	0.98	0.93	0.81	1.03	121	0.90	0.80	1.02	100	11.2
	NHS Corby	68,200	1.11	0.78	0.61	1.01	1.64	1.38	147	1.10	0.82	1.48	110	4.5
	NHS East and North Hertfordshire	565,700	1.04	0.70	1.09	1.03	1.04	0.97	111	0.98	0.88	1.09	105	10.4
	NHS Herts Valleys	591,800	0.78	0.88	0.91	1.11	0.83	1.00	113	0.92	0.83	1.02	98	14.6
	NHS Luton	**216,800**	**1.38**	**1.21**	**1.98**	**1.52**	**1.30**	**1.85**	**175**	**1.54**	**1.33**	**1.79**	**138**	**45.3**
	NHS Milton Keynes	270,500	0.91	1.10	0.87	1.16	1.21	1.33	137	1.11	0.95	1.28	107	19.6
	NHS Nene	*648,600*	*0.88*	*1.06*	*0.96*	*0.90*	*0.80*	*0.84*	*99*	*0.90*	*0.82*	*1.00*	*100*	*9.1*
Leicestershire and Lincolnshire	*NHS East Leicestershire and Rutland*	*328,600*	*0.72*	*0.97*	*0.90*	*0.77*	*0.90*	*0.77*	*100*	*0.84*	*0.73*	*0.96*	*103*	*9.8*
	NHS Leicester City	**348,300**	**1.80**	**1.62**	**1.68**	**1.20**	**1.49**	**2.13**	**195**	**1.65**	**1.48**	**1.85**	**143**	**49.5**
	NHS Lincolnshire East	*233,400*	*0.89*	*0.75*	*1.09*	*0.57*	*0.75*	*0.84*	*124*	*0.81*	*0.69*	*0.95*	*113*	*2.0*
	NHS Lincolnshire West	*236,900*	*0.73*	*0.42*	*0.79*	*0.60*	*0.64*	*0.58*	*72*	*0.63*	*0.52*	*0.76*	*73*	*3.0*
	NHS South Lincolnshire[b]	147,800	0.96	0.90	0.66	0.67	0.89	0.85	115	0.82	0.67	1.00	105	2.3
	NHS South West Lincolnshire	*125,200*	*0.95*	*0.67*	*0.85*	*0.49*	*0.53*	*0.48*	*64*	*0.65*	*0.51*	*0.84*	*83*	*2.3*
	NHS West Leicestershire	*393,000*	*0.89*	*0.51*	*0.80*	*0.97*	*0.61*	*0.85*	*104*	*0.77*	*0.68*	*0.88*	*89*	*6.9*
Shropshire and Staffordshire	NHS Cannock Chase	135,100	1.15	0.80	1.17	0.80	0.88	1.07	133	0.98	0.80	1.20	115	2.4
	NHS East Staffordshire	*126,400*	*0.88*	*0.73*	*1.13*	*0.87*	*0.57*	*0.58*	*71*	*0.79*	*0.62*	*0.99*	*91*	*9.0*
	NHS North Staffordshire	218,300	1.11	0.59	0.96	1.01	1.03	1.11	147	0.97	0.83	1.14	121	3.5
	NHS Shropshire	313,400	0.97	0.75	1.03	0.90	0.86	0.80	112	0.88	0.77	1.01	116	2.0
	NHS South East Staffs and Seisdon and Peninsular	*225,200*	*0.99*	*0.72*	*0.63*	*0.76*	*0.73*	*0.84*	*111*	*0.78*	*0.65*	*0.92*	*97*	*3.6*
	NHS Stafford and Surrounds	154,000	0.82	0.92	0.84	0.84	1.28	1.15	156	0.98	0.82	1.18	126	4.7
	NHS Stoke on Trent	261,400	1.06	0.87	1.10	1.45	1.12	1.13	130	1.13	0.98	1.30	122	11.0
	NHS Telford & Wrekin	173,000	1.09	1.20	1.22	1.26	1.35	0.96	110	1.18	1.00	1.40	127	7.3

Table 1.3. Continued

UK area	CCG/HB	Total population (2016)	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016 O/E	2016 Crude rate pmp	2011–2016 O/E	2011–2016 LCL	2011–2016 UCL	2011–2016 Crude rate pmp[a]	% non-White
London	**NHS Barking & Dagenham**	**206,500**	**1.65**	**2.03**	**1.60**	**1.94**	**1.91**	**1.69**	**140**	**1.80**	**1.56**	**2.09**	**141**	**41.7**
	NHS Barnet	**386,100**	**1.41**	**1.46**	**1.23**	**1.29**	**1.41**	**1.27**	**130**	**1.34**	**1.20**	**1.50**	**129**	**35.9**
	NHS Camden	246,200	1.11	1.06	1.32	1.16	1.28	0.99	93	1.15	0.98	1.35	103	33.7
	NHS City and Hackney	**282,900**	**1.68**	**2.02**	**1.83**	**2.11**	**1.13**	**1.84**	**148**	**1.76**	**1.55**	**2.01**	**134**	**44.6**
	NHS Enfield	**331,400**	**1.98**	**1.59**	**1.58**	**1.53**	**1.55**	**1.59**	**157**	**1.63**	**1.46**	**1.83**	**151**	**39.0**
	NHS Haringey	**278,500**	**1.69**	**2.27**	**2.21**	**1.64**	**1.56**	**1.94**	**172**	**1.88**	**1.66**	**2.12**	**157**	**39.5**
	NHS Havering	252,800	1.20	1.04	0.83	0.92	1.08	0.78	91	0.97	0.83	1.13	106	12.3
	NHS Islington	**232,900**	**1.53**	**2.05**	**1.44**	**1.11**	**1.60**	**1.06**	**90**	**1.46**	**1.25**	**1.70**	**117**	**31.8**
	NHS Newham	**341,000**	**2.12**	**1.86**	**2.14**	**2.24**	**2.31**	**2.44**	**191**	**2.19**	**1.97**	**2.44**	**161**	**71.0**
	NHS Redbridge	**299,200**	**1.38**	**2.15**	**1.98**	**1.45**	**1.45**	**1.73**	**167**	**1.68**	**1.50**	**1.90**	**153**	**57.5**
	NHS Tower Hamlets	**304,900**	**1.61**	**1.82**	**2.02**	**2.26**	**2.33**	**1.84**	**134**	**1.99**	**1.76**	**2.25**	**137**	**54.8**
	NHS Waltham Forest	**275,800**	**1.81**	**1.26**	**1.62**	**2.08**	**1.70**	**1.51**	**138**	**1.66**	**1.47**	**1.89**	**143**	**47.8**
	NHS Brent	**328,300**	**2.08**	**2.43**	**1.95**	**2.51**	**2.23**	**2.02**	**195**	**2.20**	**1.99**	**2.43**	**200**	**63.7**
	NHS Central London (Westminster)	178,400	1.29	1.17	1.37	1.08	0.97	1.09	112	1.16	0.97	1.38	112	36.2
	NHS Ealing	**343,200**	**1.91**	**2.26**	**1.68**	**1.78**	**2.25**	**1.77**	**175**	**1.94**	**1.76**	**2.15**	**181**	**51.0**
	NHS Hammersmith and Fulham	**179,700**	**1.43**	**1.49**	**0.99**	**1.44**	**1.13**	**1.80**	**167**	**1.38**	**1.16**	**1.64**	**121**	**31.9**
	NHS Harrow	**248,800**	**2.23**	**1.59**	**1.06**	**1.54**	**1.43**	**1.70**	**185**	**1.59**	**1.40**	**1.80**	**162**	**57.8**
	NHS Hillingdon	**302,500**	**1.46**	**1.50**	**1.42**	**1.00**	**1.08**	**1.16**	**116**	**1.26**	**1.10**	**1.44**	**118**	**39.4**
	NHS Hounslow	**271,100**	**1.83**	**1.73**	**2.02**	**1.28**	**1.29**	**1.65**	**159**	**1.62**	**1.43**	**1.84**	**147**	**48.6**
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	226,000	1.20	0.91	0.98	1.50	0.67	1.23	128	1.08	0.92	1.27	106	33.4
	NHS Bexley	**244,800**	**1.17**	**0.87**	**1.01**	**1.11**	**1.24**	**1.65**	**184**	**1.19**	**1.03**	**1.37**	**124**	**18.1**
	NHS Bromley	326,900	0.69	0.72	0.85	0.99	1.50	0.82	95	0.94	0.82	1.08	102	15.7
	NHS Croydon	**382,300**	**1.26**	**2.00**	**1.95**	**1.79**	**1.93**	**1.64**	**167**	**1.76**	**1.60**	**1.95**	**169**	**44.9**
	NHS Greenwich	**279,800**	**1.03**	**1.15**	**2.38**	**1.23**	**1.68**	**1.62**	**147**	**1.52**	**1.33**	**1.74**	**130**	**37.5**
	NHS Kingston	176,100	0.96	1.08	1.11	1.11	0.78	0.96	97	1.00	0.82	1.21	95	25.5
	NHS Lambeth	**327,900**	**1.76**	**1.68**	**1.39**	**1.87**	**1.95**	**1.38**	**116**	**1.67**	**1.48**	**1.89**	**132**	**42.9**
	NHS Lewisham	**301,900**	**1.78**	**1.85**	**1.47**	**1.52**	**1.48**	**1.31**	**116**	**1.56**	**1.37**	**1.77**	**130**	**46.5**
	NHS Merton	**205,000**	**1.57**	**1.78**	**1.30**	**1.44**	**1.61**	**1.73**	**171**	**1.57**	**1.36**	**1.82**	**146**	**35.1**
	NHS Richmond	*195,800*	*0.69*	*0.79*	*0.98*	*0.78*	*0.60*	*0.65*	*71*	*0.74*	*0.61*	*0.92*	*77*	*14.0*
	NHS Southwark	**313,200**	**1.96**	**1.74**	**2.23**	**1.82**	**1.83**	**1.69**	**144**	**1.88**	**1.67**	**2.11**	**150**	**45.8**
	NHS Sutton	**202,200**	**1.30**	**1.54**	**0.80**	**1.66**	**1.40**	**1.41**	**153**	**1.36**	**1.17**	**1.58**	**138**	**21.4**
	NHS Wandsworth	**316,100**	**1.23**	**1.39**	**0.96**	**1.56**	**1.77**	**1.38**	**120**	**1.39**	**1.22**	**1.59**	**114**	**28.6**
Bath, Gloucestershire, Swindon and Wiltshire	*NHS Bath and North East Somerset*	*187,800*	*0.56*	*0.92*	*0.95*	*0.66*	*0.59*	*0.73*	*85*	*0.73*	*0.60*	*0.90*	*81*	*5.4*
	NHS Gloucestershire	*623,100*	*0.88*	*1.17*	*0.70*	*0.92*	*0.87*	*0.86*	*111*	*0.90*	*0.81*	*0.99*	*109*	*4.6*
	NHS Swindon	223,600	1.14	1.22	0.92	1.16	1.15	1.08	121	1.11	0.95	1.30	117	10.0
	NHS Wiltshire	*488,400*	*0.64*	*0.47*	*0.77*	*0.81*	*0.69*	*0.83*	*106*	*0.71*	*0.62*	*0.80*	*85*	*3.4*
Bristol, North Somerset, Somerset and South Gloucestershire	**NHS Bristol**	**454,200**	**1.44**	**1.26**	**1.38**	**1.16**	**1.20**	**1.30**	**125**	**1.29**	**1.15**	**1.44**	**117**	**16.0**
	NHS North Somerset	211,700	0.87	1.02	1.04	1.01	0.79	0.77	104	0.91	0.78	1.07	117	2.7
	NHS Somerset	*549,400*	*0.84*	*0.67*	*0.55*	*0.88*	*0.66*	*0.86*	*118*	*0.75*	*0.67*	*0.83*	*96*	*2.0*
	NHS South Gloucestershire	*277,600*	*0.61*	*0.81*	*1.15*	*0.68*	*0.74*	*0.81*	*97*	*0.80*	*0.68*	*0.94*	*91*	*5.0*
Devon, Cornwall and Isles of Scilly	*NHS Kernow*	*556,000*	*0.81*	*0.95*	*0.88*	*0.79*	*1.01*	*0.90*	*126*	*0.89*	*0.81*	*0.99*	*117*	*1.8*
	NHS North, East, West Devon	*898,000*	*0.92*	*1.00*	*0.84*	*0.92*	*0.90*	*0.87*	*115*	*0.91*	*0.84*	*0.98*	*112*	*3.0*
	NHS South Devon and Torbay	279,900	0.90	1.08	1.00	0.87	0.88	0.98	143	0.95	0.83	1.08	130	2.1

Table 1.3. Continued

UK area	CCG/HB	Total population (2016)	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016 O/E	2016 Crude rate pmp	2011–2016 O/E	2011–2016 LCL	2011–2016 UCL	2011–2016 Crude rate pmp[a]	% non-White
Kent and Medway	NHS Ashford	126,200	0.83	1.26	1.09	0.96	0.85	0.99	119	0.99	0.80	1.23	112	6.3
	NHS Canterbury and Coastal	210,500	0.83	0.57	0.94	1.16	0.88	1.00	124	0.90	0.76	1.07	105	5.9
	NHS Dartford, Gravesham and Swanley	260,600	0.87	0.98	1.47	0.93	0.96	1.13	130	1.06	0.91	1.22	114	13.0
	NHS Medway	278,500	0.90	0.81	1.08	0.92	1.17	0.59	65	0.91	0.78	1.07	94	10.4
	NHS South Kent Coast	207,600	1.01	0.56	0.74	1.00	0.88	1.07	145	0.88	0.75	1.04	112	4.5
	NHS Swale	114,800	0.59	1.33	0.81	1.15	0.88	1.18	139	0.99	0.79	1.24	110	3.8
	NHS Thanet	140,700	0.86	1.04	1.55	1.01	0.70	0.86	114	1.00	0.82	1.21	123	4.5
	NHS West Kent	*481,600*	*0.82*	*0.62*	*0.70*	*0.91*	*0.80*	*0.80*	*98*	*0.78*	*0.69*	*0.88*	*89*	*4.9*
Surrey and Sussex	NHS Brighton & Hove	289,200	0.92	1.16	0.79	1.06	1.05	1.40	142	1.07	0.92	1.24	102	10.9
	NHS Coastal West Sussex	*498,900*	*0.64*	*0.80*	*0.78*	*1.02*	*0.88*	*0.96*	*136*	*0.85*	*0.77*	*0.95*	*114*	*3.8*
	NHS Crawley	111,400	0.50	0.80	1.07	1.29	0.70	1.59	162	1.00	0.79	1.28	96	20.1
	NHS East Surrey	183,700	0.74	1.25	0.91	0.82	1.46	0.83	98	1.01	0.84	1.20	112	8.3
	NHS Eastbourne, Hailsham and Seaford	189,500	0.84	1.04	1.18	0.73	1.06	0.85	121	0.95	0.81	1.12	128	4.4
	NHS Guildford and Waverley	*207,800*	*0.74*	*1.16*	*0.54*	*0.77*	*0.94*	*0.58*	*67*	*0.79*	*0.65*	*0.95*	*87*	*7.2*
	NHS Hastings & Rother	185,800	0.96	0.73	1.22	0.63	0.99	0.72	102	0.87	0.73	1.04	116	4.6
	NHS High Weald Lewes Havens	*172,600*	*0.68*	*0.91*	*0.61*	*0.97*	*0.84*	*0.89*	*122*	*0.82*	*0.68*	*0.99*	*105*	*3.1*
	NHS Horsham and Mid Sussex	*233,500*	*0.78*	*0.51*	*0.76*	*0.82*	*0.51*	*0.76*	*94*	*0.69*	*0.57*	*0.83*	*81*	*4.9*
	NHS North West Surrey	344,600	1.31	0.91	0.94	1.22	0.87	1.20	142	1.08	0.95	1.22	120	12.5
	NHS Surrey Downs	288,200	0.97	0.90	1.02	0.94	0.84	0.82	104	0.91	0.79	1.05	109	9.1
	NHS Surrey Heath	*96,700*	*0.77*	*0.76*	*0.46*	*0.44*	*0.92*	*0.50*	*62*	*0.64*	*0.47*	*0.86*	*74*	*9.3*
Thames Valley	NHS Aylesbury Vale	211,400	1.01	0.73	0.67	0.80	0.72	1.21	142	0.86	0.72	1.03	95	9.7
	NHS Bracknell and Ascot	137,700	0.76	0.37	1.24	0.96	0.79	0.99	109	0.86	0.68	1.08	88	9.5
	NHS Chiltern	*325,900*	*0.69*	*0.74*	*1.00*	*0.78*	*0.77*	*0.73*	*89*	*0.78*	*0.68*	*0.91*	*90*	*15.8*
	NHS Newbury and District	107,100	0.62	0.62	1.03	0.89	0.70	1.01	121	0.82	0.63	1.05	92	4.4
	NHS North & West Reading	100,300	0.95	0.94	0.64	0.95	0.90	0.91	110	0.88	0.68	1.13	100	10.4
	NHS Oxfordshire	*668,700*	*1.01*	*0.98*	*0.88*	*0.83*	*0.81*	*0.75*	*87*	*0.87*	*0.79*	*0.96*	*95*	*9.3*
	NHS Slough	**147,200**	**2.20**	**1.74**	**1.78**	**1.69**	**1.91**	**1.62**	**143**	**1.82**	**1.54**	**2.16**	**151**	**54.3**
	NHS South Reading	**112,000**	**1.16**	**1.17**	**2.38**	**1.51**	**0.72**	**1.34**	**116**	**1.37**	**1.09**	**1.72**	**112**	**30.5**
	NHS Windsor, Ascot and Maidenhead	142,900	1.24	0.62	1.33	1.20	0.66	0.97	112	1.00	0.82	1.22	108	14.7
	NHS Wokingham	*161,900*	*1.31*	*0.47*	*0.81*	*0.76*	*0.57*	*0.73*	*86*	*0.77*	*0.62*	*0.95*	*85*	*11.6*
Wessex	*NHS Dorset*	*771,900*	*0.73*	*0.71*	*0.73*	*0.71*	*0.61*	*0.57*	*79*	*0.67*	*0.61*	*0.74*	*87*	*4.0*
	NHS Fareham and Gosport	200,800	0.78	0.78	0.97	1.07	0.87	0.88	115	0.90	0.76	1.06	110	3.4
	NHS Isle of Wight	139,800	0.77	0.87	1.22	0.85	0.67	0.58	86	0.82	0.67	1.00	114	2.7
	NHS North East Hampshire and Farnham	210,500	0.84	1.16	1.17	0.85	0.97	0.86	100	0.97	0.82	1.15	106	9.7
	NHS North Hampshire	*221,900*	*0.69*	*0.47*	*0.71*	*1.02*	*0.75*	*0.53*	*63*	*0.70*	*0.57*	*0.84*	*78*	*6.4*
	NHS Portsmouth	214,800	1.31	1.10	1.12	0.96	1.06	1.07	107	1.10	0.93	1.30	104	11.6
	NHS South Eastern Hampshire	*212,300*	*0.76*	*0.63*	*0.96*	*1.09*	*0.69*	*0.63*	*85*	*0.79*	*0.67*	*0.94*	*100*	*3.1*
	NHS Southampton	254,300	1.15	0.88	0.63	0.98	0.93	0.94	90	0.92	0.77	1.09	83	14.1
	NHS West Hampshire	*558,300*	*0.67*	*0.62*	*0.66*	*0.76*	*0.57*	*0.55*	*73*	*0.64*	*0.57*	*0.72*	*80*	*3.9*
Wales	Betsi Cadwaladr University	695,800	0.84	1.01	0.88	1.08	1.06	0.98	131	0.98	0.90	1.07	122	2.5
	Powys Teaching	132,200	1.28	1.27	0.73	0.58	0.96	0.92	136	0.95	0.79	1.15	132	1.6
	Hywel Dda	383,700	1.25	0.92	1.08	1.18	1.05	0.78	107	1.04	0.93	1.16	135	2.2
	Abertawe Bro Morgannwg University	**529,300**	**1.18**	**1.45**	**1.04**	**0.94**	**1.20**	**1.16**	**144**	**1.16**	**1.05**	**1.27**	**135**	**3.9**
	Cwm Taf	298,100	1.46	0.91	1.13	1.13	0.97	0.98	117	1.09	0.96	1.24	124	2.6
	Aneurin Bevan	584,100	1.21	1.18	1.05	1.16	0.97	0.91	113	1.07	0.98	1.18	126	3.9
	Cardiff and Vale University	489,900	1.01	0.99	1.11	0.93	0.93	1.15	122	1.02	0.91	1.14	103	12.2

Table 1.3. Continued

UK area	CCG/HB	Total population (2016)	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016 O/E	2016 Crude rate pmp	2011–2016 O/E	2011–2016 LCL	2011–2016 UCL	2011–2016 Crude rate pmp[a]	% non-White
Scotland	Ayrshire and Arran	370,600	0.83	0.96	1.00	0.80	0.90	1.21	162	0.95	0.85	1.07	120	1.2
	Borders	*114,500*	*0.56*	*0.56*	*0.47*	*0.57*	*0.67*	*0.31*	*44*	*0.52*	*0.39*	*0.69*	*70*	*1.3*
	Dumfries and Galloway	*149,500*	*0.58*	*1.05*	*0.41*	*1.20*	*0.64*	*0.51*	*74*	*0.73*	*0.59*	*0.90*	*99*	*1.2*
	Fife	370,300	1.17	0.87	1.01	0.91	1.04	0.71	89	0.95	0.84	1.07	113	2.4
	Forth Valley	304,500	0.82	0.88	1.00	0.92	1.01	0.61	76	0.87	0.75	1.01	101	2.2
	Grampian	*588,100*	*0.83*	*0.86*	*0.91*	*0.76*	*0.88*	*0.80*	*95*	*0.84*	*0.75*	*0.94*	*94*	*4.0*
	Greater Glasgow and Clyde	1,161,400	1.11	1.13	0.93	0.90	1.14	1.09	124	1.05	0.98	1.12	113	7.3
	Highland	*321,900*	*0.52*	*0.62*	*0.68*	*0.52*	*0.93*	*0.59*	*81*	*0.65*	*0.55*	*0.75*	*83*	*1.3*
	Lanarkshire	656,500	0.84	1.08	0.93	0.89	0.94	0.97	117	0.94	0.86	1.04	107	2.0
	Lothian	*880,000*	*0.71*	*0.74*	*0.60*	*0.75*	*0.70*	*0.72*	*81*	*0.70*	*0.64*	*0.78*	*74*	*5.6*
	Orkney	21,900	0.00	1.85	0.72	0.00	1.62	0.00	0	0.69	0.39	1.22	92	0.7
	Shetland	23,200	0.78	0.00	0.75	1.06	1.02	0.68	86	0.73	0.41	1.28	86	1.5
	Tayside	415,500	1.20	0.68	0.87	0.96	0.95	0.86	111	0.92	0.82	1.03	111	3.2
	Western Isles	26,900	0.00	0.00	0.85	1.60	1.79	1.03	149	0.91	0.59	1.42	124	0.9
Northern Ireland	**Belfast**	**354,700**	**1.08**	**1.71**	**1.17**	**0.88**	**1.24**	**1.46**	**155**	**1.25**	**1.11**	**1.41**	**125**	**3.2**
	Northern	473,100	1.24	1.12	1.03	1.01	0.93	1.09	125	1.07	0.96	1.19	115	1.2
	Southern	377,200	1.27	0.86	0.83	0.76	0.88	0.78	82	0.89	0.78	1.02	88	1.2
	South Eastern	356,700	0.92	0.80	0.91	0.76	1.27	1.02	121	0.95	0.84	1.09	106	1.3
	Western	300,400	0.97	0.59	0.97	1.05	1.15	1.10	120	0.98	0.85	1.13	100	1.0

[a] – per year
[b]CCGs where between 5% and 15% of the incident RRT population from 2011 to 2014 were incident patients of the Cambridge renal centre. In these CCGs the rates/ratios for 2015 and 2016 and for the combined years 2011–2016 are likely to be underestimated
[c]CCGs where >15% of the incident RRT population from 2011 to 2014 were incident patients of the Cambridge renal centre. These have not been included in the analysis for 2015 or 2016 but are included for 2011–2014 (and the combined years analysis for these areas uses only four years (2011–2014))

between areas, with ratios ranging from 0.52 to 2.53 (IQR 0.82, 1.09). From the analysis using all six years (where available), out of a total of 233 areas, 44 areas had notably high ratios and 67 notably low. The crude rates ranged from 70 pmp to 200 pmp (IQR 96 pmp, 121 pmp). These rates and ratios are not adjusted for population ethnicity, which correlates strongly with incidence at CCG/HB level (figure 1.3).

Centre level

The number of new patients starting RRT at each renal centre from 2011 to 2016 is shown in table 1.4. The table also shows centre level incidence rates (per million population) for 2016. 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. Variation incorporates chance fluctuation, the introduction of new centres, changes in catchment populations and completeness of reporting. Trends reflect changes in incidence of ERF (underlying disease prevalence, recognition and survival from comorbidity), and practice changes such as an emphasis

Fig. 1.3. Age/sex standardised incidence ratio (2011–2016) by percentage non-White

Table 1.4. Number of patients starting RRT by renal centre 2011–2016

Centre	Year						Estimated catchment population (millions)[a]	2016 crude rate pmp[b]	(95% CI)
	2011	2012	2013	2014	2015	2016			
England									
B Heart	113	101	100	100	123	135	0.74	183	(152–214)
B QEH	213	208	200	249	245	238	1.70	140	(122–158)
Basldn	44	53	34	45	48	40	0.42	96	(67–126)
Bradfd	60	71	63	83	91	86	0.65	132	(104–160)
Brightn	119	132	139	148	144	150	1.30	116	(97–134)
Bristol	141	149	174	149	146	155	1.44	108	(91–125)
Camb[c]	122	123	136	126	175[c]	120[c]	1.16	104	(85–122)
Carlis	27	19	42	37	46	35	0.32	109	(73–145)
Carsh	207	244	229	265	260	246	1.91	129	(113–145)
Chelms	47	46	47	55	51	53	0.51	104	(76–132)
Colchr	44	29	29	38	28	30	0.30	100	(64–136)
Covnt	110	114	90	126	111	128	0.89	143	(119–168)
Derby	74	80	74	77	64	86	0.70	122	(97–148)
Donc	43	40	61	54	39	62	0.41	151	(114–189)
Dorset	79	73	73	78	75	70	0.86	81	(62–100)
Dudley	43	56	52	42	51	53	0.44	120	(88–152)
Exeter	112	134	100	143	137	143	1.09	131	(110–153)
Glouc	58	75	53	74	72	66	0.59	112	(85–140)
Hull	108	94	90	98	121	93	1.02	91	(73–110)
Ipswi	29	44	40	34	67	42	0.40	105	(73–137)
Kent	120	114	143	148	143	141	1.22	115	(96–134)
L Barts	250	264	283	302	311	297	1.83	162	(144–181)
L Guys	121	130	134	159	179	169	1.08	156	(133–180)
L Kings	137	123	166	148	180	152	1.17	130	(109–150)
L Rfree	220	232	224	230	239	238	1.52	157	(137–177)
L St.G	72	95	85	92	114	94	0.80	118	(94–142)
L West	364	354	303	355	337	385	2.40	160	(144–177)
Leeds	153	151	183	169	147	166	1.67	99	(84–115)
Leic	266	235	288	251	270	324	2.44	133	(119–147)
Liv Ain	58	63	65	65	61	53	0.48	110	(80–139)
Liv Roy	111	104	93	136	141	111	1.00	111	(90–132)
M RI	154	161	198	164	198	219	1.53	143	(124–162)
Middlbr	100	119	110	102	134	101	1.00	101	(81–120)
Newc	98	102	92	109	125	135	1.12	120	(100–141)
Norwch	88	75	78	77	112	97	0.79	123	(99–148)
Nottm	115	100	116	111	120	120	1.09	110	(91–130)
Oxford	176	170	164	188	195	218	1.69	129	(112–146)
Plymth	60	54	65	54	53	63	0.47	134	(101–167)
Ports	187	159	193	230	200	191	2.02	94	(81–108)
Prestn	138	146	154	164	163	133	1.49	89	(74–104)
Redng	103	72	117	104	87	96	0.91	105	(84–127)
Salford	131	134	116	161	173	188	1.49	126	(108–144)
Sheff	134	156	136	164	146	151	1.37	110	(93–128)
Shrew	61	58	60	65	62	58	0.50	116	(86–146)
Stevng	110	109	156	150	136	165	1.20	137	(116–158)
Sthend	29	26	42	30	35	47	0.32	148	(106–191)
Stoke	91	74	103	117	116	107	0.89	120	(97–143)
Sund	57	71	51	63	63	94	0.62	152	(121–183)
Truro	39	49	47	40	70	50	0.41	121	(87–155)
Wirral	58	46	65	55	64	69	0.57	121	(92–149)
Wolve	78	88	93	74	85	64	0.67	96	(72–119)
York	53	55	37	64	61	72	0.49	146	(112–180)

Table 1.4. Continued

Centre	Year						Estimated catchment population (millions)[a]	2016 crude rate pmp[b]	(95% CI)
	2011	2012	2013	2014	2015	2016			
N Ireland									
Antrim	29	25	29	35	36	41	0.29	139	(97–182)
Belfast	68	97	72	65	94	95	0.64	149	(119–179)
Newry	36	17	23	20	28	25	0.26	96	(58–133)
Ulster	36	28	30	23	33	30	0.27	113	(72–153)
West NI	35	22	30	35	39	35	0.35	99	(67–132)
Scotland									
Abrdn	50	53	58	53	66	52	0.60	87	(63–110)
Airdrie	48	60	51	50	64	62	0.55	112	(84–140)
D & Gall	10	18	8	22	12	11	0.15	74	(30–118)
Dundee	59	38	42	50	46	45	0.46	97	(69–126)
Edinb	76	82	72	90	97	87	0.96	90	(71–109)
Glasgw	177	184	174	173	221	198	1.62	122	(105–139)
Inverns	12	16	21	22	35	19	0.27	70	(39–102)
Klmarnk	33	40	40	34	39	53	0.36	147	(107–186)
Krkcldy	43	30	38	36	44	32	0.32	101	(66–136)
Wales									
Bangor	20	21	24	22	29	25	0.22	115	(70–160)
Cardff	186	169	171	168	160	161	1.42	113	(96–131)
Clwyd	17	22	17	32	28	16	0.19	84	(43–126)
Swanse	118	118	109	120	136	124	0.89	140	(115–165)
Wrexm	26	34	35	42	45	49	0.24	204	(147–261)
							% increase since 2011		
England	**5,725**	**5,774**	**5,986**	**6,362**	**6,614**	**6,599**	**15.3**		
N Ireland	**204**	**189**	**184**	**178**	**230**	**226**	**10.8**		
Scotland	**508**	**521**	**504**	**530**	**624**	**559**	**10.0**		
Wales	**367**	**364**	**356**	**384**	**398**	**375**	**2.2**		
UK	**6,804**	**6,848**	**7,030**	**7,454**	**7,866**	**7,759**	**14.0**		

[a]See appendix E for details of estimation of catchment populations
[b]pmp – per million population
[c]Cambridge was unable to submit patient level data for 2015 or 2016 but provided the UKRR with information allowing their incident numbers for 2015 and 2016 to be estimated. These numbers have been used here and in table 1.2 but not elsewhere in this chapter

on pre-emptive transplantation or the introduction of conservative care programmes. Analysis of data from patients with chronic kidney disease (CKD) stage 5 who are not receiving RRT is required to explore these underlying mechanisms.

The number of people starting RRT in the UK increased between 2011 and 2016, with an overall rise of 14.0% over these six years.

2. Demographics and clinical characteristics of patients starting RRT

Methods

Age, sex, primary renal disease, ethnic origin and treatment modality were examined for patients starting RRT.

Crude CCG/HB incidence rates were calculated for the over 75 year age group. These are per million age related population (pmarp), i.e. the number of incident patients over 75 years old divided by the population over 75 years old.

A mixture of old and new (2012) ERA-EDTA codes for primary diagnoses [2] were received from centres. For those people without an old code, new codes (where available) were converted to old codes using the mapping available on the ERA-EDTA website. As recommended in the notes for users in the ERA-EDTA's primary renal diagnosis (PRD) code list document, this mapping is provided for guidance only and has not been validated. These codes were grouped into the same eight categories as in previous reports, 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 was based on self-reported ethnicity. For the

remaining centres, ethnicity coding was performed by clinical staff and recorded directly into the renal IT system (using a variety of coding systems). 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.

Data were withheld from some tables due to small numbers of patients in a category that increase the possibility of identifying patients. Primary suppression is the withholding of information from risky cells for publication, which means that their value is not shown in the table but replaced by a symbol such as '×' to indicate the suppression. According to the definition of a risky cell, in frequency count tables all cells containing small counts and in tables of magnitudes all cells containing small counts or presenting a case of dominance have to be primary suppressed. To reach the desired protection for risky cells, it is necessary to suppress additional non-risky cells, which is called complementary (secondary) suppression. The pattern of complementary suppressed cells has to be carefully chosen to provide the desired level of ambiguity for the risky cells with the least amount of suppressed information.

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 CKD-EPI equation [3]. The abbreviated four variable MDRD study equation was also used to allow comparison with values published in previous years. 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 due to their skewed distribution and geometric means calculated.

Results

Incidence rates appear to have plateaued in the over 65 age group, but continued to rise amongst individuals between 45 and 64 years of age (figure 1.4). Figure 1.5 shows RRT incidence rates for 2016 by age group and sex. The peak rate was in the 80–84 age group for men and 75–79 for women. Figure 1.6 shows the numbers of people starting HD and PD by age group. The age group with the highest number of HD and PD starters was 65–74. Haemodialysis was used proportionately more, with increasing age above the age of 35.

Age

In 2016, the median age of patients starting RRT was 64.3 years (table 1.5) and this has changed little over recent years. Per modality, the median age at start was 66.8 years for patients starting on HD, 60.5 for patients starting on PD and 50.5 for those having a pre-emptive transplant (table 1.6). The median age at start, of non-White patients, was 58.7, considerably lower than that for White patients (66.2 years) reflecting differences in CKD frequency and progression 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

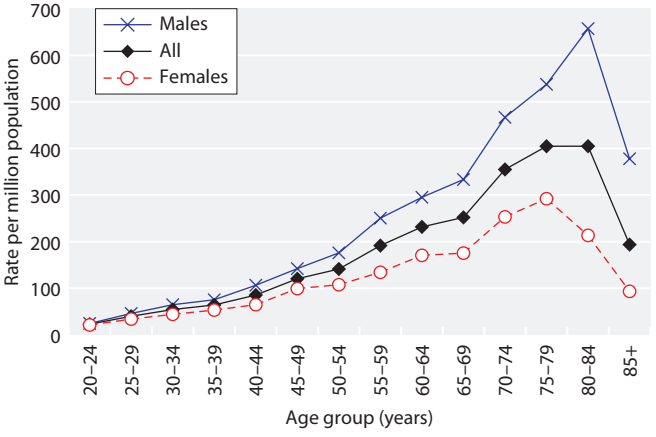

Fig. 1.5. RRT incidence rates in 2016 by age and sex

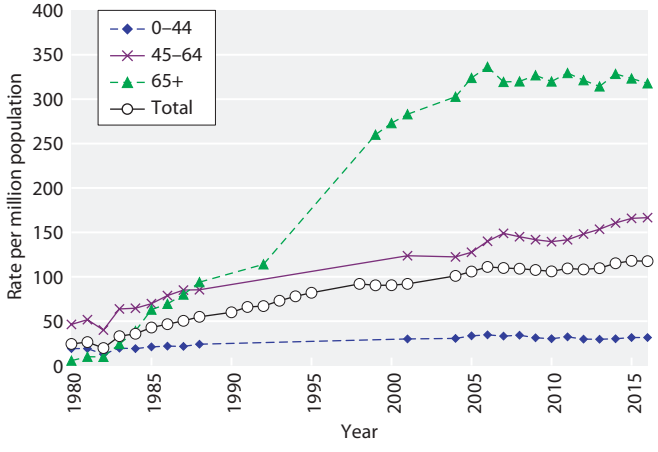

Fig. 1.4. RRT incidence rates between 1980 and 2016

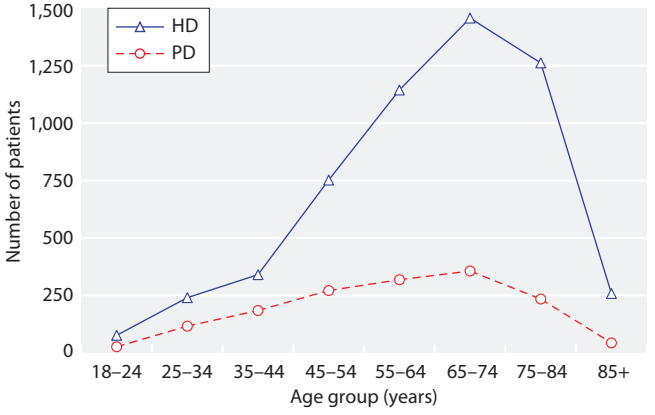

Fig. 1.6. Number of incident dialysis patients in 2016, by age group and initial dialysis modality

were over 65 years old compared to 18.3% of Whites) [4]. The median age of new patients with diabetes was similar to the overall median and has not varied greatly over recent years.

There were large differences between centres in the median age of incident patients (figure 1.7). This is likely to reflect differences in the age and ethnic structure of the catchment populations (for which these data were not adjusted) along with chance, particularly in centres with small numbers of incident patients. Nevertheless, true practice variation may exist. The median age of patients starting treatment at transplant centres was 62.8 years (IQR 50.3, 73.3) and at non-transplanting centres 66.0 years (IQR 52.7, 75.5).

Averaged over 2011–2016, crude CCG/HB incidence rates in the over 75 year age group varied from 57 per million age related population (pmarp) in Borders to 1,048 pmarp in NHS Brent (IQR 259 pmarp, 400 pmarp, data not shown). The variation between CCG/HBs seen in the over 75 year age group was much greater than the variation seen in the overall analysis. Some of this difference is likely to be due to the smaller numbers included in the over 75 analysis.

Table 1.5. Median, inter-quartile range and 90% range of the age of patients starting renal replacement therapy in 2016 by country

Country	Median	IQR	90% range
England	64.3	(51.5–74.5)	(31.4–84.1)
N Ireland	66.0	(51.3–74.2)	(34.5–82.9)
Scotland	62.4	(49.9–72.9)	(32.4–81.9)
Wales	66.3	(55.4–76.5)	(34.3–85.8)
UK	**64.3**	**(51.6–74.5)**	**(31.9–84.0)**

IQR – interquartile range

Table 1.6. Median, inter-quartile range and 90% range of the age of patients starting renal replacement therapy in 2016 by initial treatment modality

Treatment	Median	IQR	90% range
HD	66.8	(54.7–76.0)	(34.0–84.7)
PD	60.5	(47.3–72.0)	(30.2–82.5)
Transplant	50.5	(41.1–60.3)	(26.6–70.5)

IQR – interquartile range

Sex

More men than women started RRT in every age group and this sex effect appeared to increase with age (figure 1.8). The overall breakdown was 62.9% male, 37.1% female.

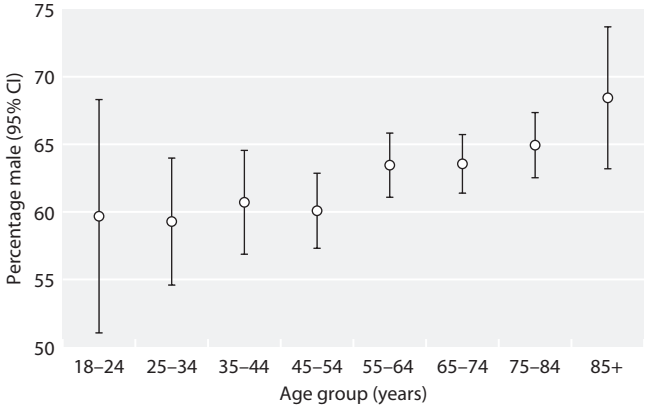

Fig. 1.8. Percentage of patients starting RRT in 2016 who were male, by age group

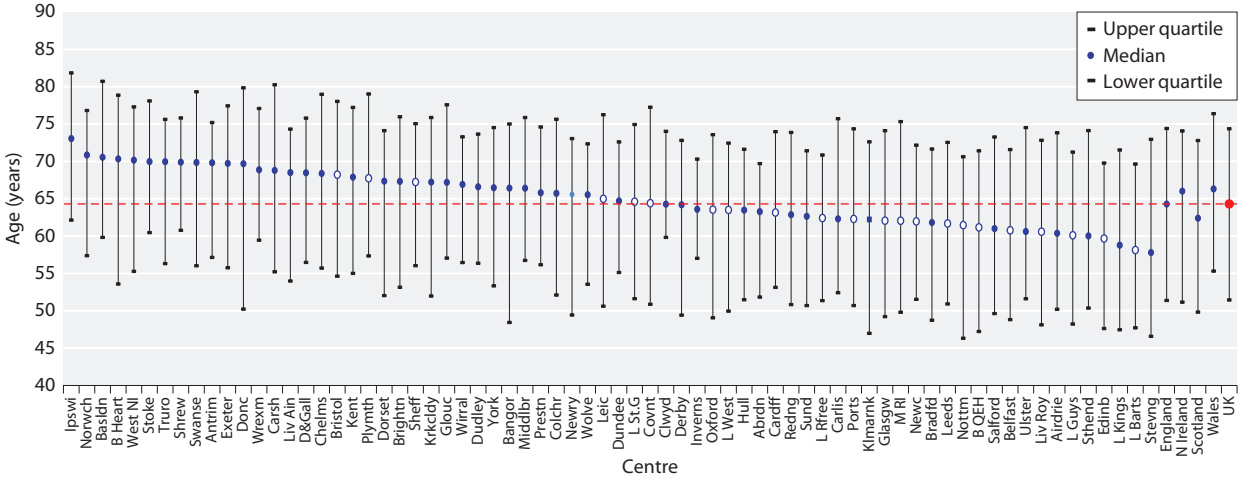

Fig. 1.7. Median age of incident RRT patients by centre in 2016
White points indicate transplant centres

Ethnicity

As in previous reports, Scotland is not included in this section as completeness of ethnicity data was low. Across centres in England, Wales and Northern Ireland the average completeness was 94.9% for 2016 incident patients, similar to the 95.8% seen last year and the 94.8% the year before. Data completeness and the percentage in minority ethnic groups are shown by centre in table 1.7a. Table 1.7b shows the overall detailed ethnicity breakdown for England, Wales and Northern Ireland.

Table 1.7a. Percentage of incident patients (2016) in minority ethnic groups (South Asian, Black, Chinese or Other) by centre

Centre	Percentage with data not available	*N* with data	Percentage non-White
England			
B Heart	0.0	135	34
B QEH	3.8	229	40
Basldn	5.0	38	18
Bradfd	1.2	85	40
Brightn	10.7	134	*
Bristol	19.4	125	12
Carlis	2.9	34	*
Carsh	8.9	224	29
Chelms	0.0	53	*
Colchr	3.3	29	*
Covnt	3.1	124	19
Derby	1.2	85	11
Donc	0.0	62	*
Dorset	1.4	69	*
Dudley	0.0	53	25
Exeter	1.4	141	*
Glouc	1.5	65	*
Hull	2.2	91	*
Ipswi	7.1	39	26
Kent	2.1	138	*
L Barts	0.3	296	69
L Guys	5.3	160	43
L Kings	0.0	152	48
L Rfree	5.0	226	53
L St.G	14.9	80	54
L West	0.0	385	59
Leeds	0.6	165	25
Leic	9.0	295	23
Liv Ain	1.9	52	*
Liv Roy	2.7	108	11
M RI	4.1	210	30
Middlbr	2.0	99	*
Newc	0.0	135	*
Norwch	2.1	95	*
Nottm	0.8	119	19
Oxford	20.2	174	20
Plymth	1.6	62	*
Ports	15.7	161	*
Prestn	0.0	133	16
Redng	15.6	81	23
Salford	3.2	182	21
Sheff	2.6	147	*
Shrew	3.4	56	*
Stevng	14.5	141	26
Sthend	0.0	47	19
Stoke	9.3	97	*
Sund	0.0	94	*
Truro	0.0	50	*
Wirral	2.9	67	*
Wolve	0.0	64	30
York	6.9	67	*
N Ireland			
Antrim	0.0	41	*
Belfast	17.9	78	*
Newry	0.0	25	*
Ulster	0.0	30	*
West NI	2.9	34	*
Wales			
Bangor	12.0	22	*
Cardff	3.7	155	*
Clwyd	18.8	13	*
Swanse	0.0	124	*
Wrexm	6.1	46	*
England	**5.0**	**6,153**	**25**
N Ireland	**8.0**	**208**	*
Wales	**4.0**	**360**	*
E, W & NI	**5.1**	**6,721**	**23**

*<10% in minority ethnic group

Table 1.7b. Percentage of incident RRT patients (2016) in different ethnic groups (England, Wales and Northern Ireland)

Country	% data not available	*N* with data	Percentage in each ethnic group				
			White	South Asian	Black	Chinese	Other
E, W & NI	**5.1**	**6,721**	**76.8**	**12.1**	**7.4**	**0.5**	**3.2**

E, W & NI – England, Wales, Northern Ireland

Table 1.8a. Distribution of primary renal diagnosis by country in the 2012–2016 incident RRT cohort

Centre	Percentage with 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	2	546	16	37	10	9	14	4	7	3
B QEH	0	1,137	16	24	13	6	21	6	5	9
Basldn	3	213	6	30	18	7	12	4	8	15
Bradfd	0	394	18	29	15	8	15	5	5	5
Brightn	1	709	22	22	14	4	19	8	6	6
Bristol	5	733	13	24	14	5	20	10	8	7
Carlis	7	167	*	20	17	17	*	12	8	11
Carsh	58	521								
Chelms	2	246	17	27	15	5	20	5	7	4
Colchr	2	56	32	34	*	*	*	*	*	*
Covnt	7	530	14	23	15	12	14	5	7	10
Derby	1	377	11	32	18	2	17	6	7	6
Donc	1	254	21	20	14	10	20	5	6	5
Dorset	0	369	11	26	13	10	15	11	8	6
Dudley	1	252	25	21	11	7	25	6	*	*
Exeter	1	651	10	23	14	9	18	7	7	13
Glouc	0	339	30	22	14	3	12	8	6	5
Hull	1	493	20	21	17	6	15	11	7	4
Ipswi	50	21								
Kent	1	683	23	23	15	5	17	5	8	4
L Barts	8	1,342	13	36	11	10	15	5	8	3
L Guys	25	459								
L Kings	0	769	10	36	10	18	13	4	5	3
L Rfree	3	1,123	11	32	12	9	23	4	4	6
L St.G	31	331								
L West	0	1,734	11	40	13	3	17	6	5	5
Leeds	0	814	12	23	14	9	19	9	9	4
Leic	19	1,108	22	22	13	6	15	9	8	5
Liv Ain	0	307	15	22	15	10	15	5	8	11
Liv Roy	29	413								
M RI	7	870	10	30	13	13	20	6	6	3
Middlbr	1	563	16	26	13	6	16	8	7	7
Newc	0	561	13	23	15	4	22	8	6	9
Norwch	2	429	26	20	16	4	17	7	6	5
Nottm	0	566	22	22	12	5	20	7	7	5
Oxford	3	905	13	28	16	6	17	9	6	5
Plymth	11	258	7	20	18	7	16	8	6	18
Ports	20	782	9	25	15	9	18	10	8	7
Prestn	1	756	13	25	15	11	16	6	8	6
Redng	1	470	18	30	13	3	18	6	6	6
Salford	27	564								
Sheff	2	737	18	25	19	5	12	7	7	8
Shrew	3	293	22	24	10	4	22	5	6	6
Stevng	9	653	20	24	11	2	29	7	3	4
Sthend	1	178	19	19	15	6	19	10	7	6
Stoke	9	468	7	28	12	8	22	8	5	10
Sund	1	338	5	23	11	19	17	8	9	8
Truro	1	253	9	26	20	8	17	6	7	7
Wirral	11	266	7	32	9	14	25	5	3	5
Wolve	1	398	26	20	12	3	28	4	5	4
York	1	287	8	20	18	10	22	8	7	6

Table 1.8a. Continued

Centre	Percentage with 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	166	33	27	10	*	17	3	7	*
Belfast	8	390	15	20	15	3	21	12	11	3
Newry	0	113	17	26	11	*	21	7	5	*
Ulster	0	144	12	27	10	12	16	4	7	13
West NI	0	161	6	25	12	11	19	5	13	9
Scotland										
Abrdn	0	282	10	31	17	7	18	8	6	4
Airdrie	0	287	18	29	16	3	14	8	7	5
D & Gall	0	71	*	42	14	14	14	*	*	*
Dundee	0	221	12	22	14	9	24	9	5	5
Edinb	0	428	13	26	17	4	20	10	5	5
Glasgw	0	950	11	30	17	2	17	9	6	9
Inverns	1	112	20	19	14	*	25	10	6	*
Klmarnk	0	206	4	30	13	5	17	8	10	14
Krkcldy	7	168	16	24	14	*	17	5	6	*
Wales										
Bangor	2	118	16	27	10	8	15	6	4	13
Cardff	0	828	22	26	18	2	12	9	5	6
Clwyd	11	102	17	27	12	11	21	*	*	*
Swanse	1	601	7	29	17	2	17	4	7	16
Wrexm	1	202	13	23	16	4	15	9	9	9
England	**8**	**27,686**	**15**	**27**	**14**	**8**	**18**	**7**	**7**	**6**
N Ireland	**3**	**974**	**16**	**24**	**12**	**6**	**19**	**7**	**9**	**6**
Scotland	**0**	**2,725**	**12**	**28**	**16**	**4**	**18**	**8**	**6**	**8**
Wales	**1**	**1,851**	**16**	**27**	**17**	**3**	**15**	**7**	**6**	**10**
UK	**7**	**33,236**	**15**	**27**	**14**	**7**	**18**	**7**	**7**	**6**

*values suppressed due to small numbers (primary or secondary suppression – see methods)
The percentage in each category has been calculated after excluding those patients with data not available
Blank cells – centres with >25% missing primary diagnoses, the percentages in the other diagnostic categories have not been calculated
For those centres judged to have high % uncertain aetiology for a year (arbitrarily defined as >45%), their data has not been used for that year

Primary renal diagnosis

The breakdown of PRD by centre is shown for a 2012–2016 incident cohort in table 1.8a. The breakdown by country is shown for 2016 incident patients in table 1.8b. For completeness data for 2016 by centre see the Introduction chapter of this report. Fifty-four centres provided data on over 90% of incident patients and 31 of these centres had 100% completeness. There was only a small amount of missing data for Northern Ireland, Scotland and Wales, whilst England had 12.5% missing. The overall percentage missing was 11.1% and this was similar in the under 65–year olds and those aged 65 and over (10.8% and 11.3% respectively). Eight centres had missing PRD for more than 25% of incident patients.

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 patients with uncertain aetiology. The proportion of these patients will vary between clinicians and centres in part because the diagnostic criteria of conditions such as hypertensive renal disease permit subjectivity. Many of the new ERA-

Table 1.8b. Distribution of primary renal diagnosis by country in the 2016 incident RRT cohort

Country	% data not available	*N* with data	Percentage							
			Uncertain aetiology	Diabetes	Glomerulo-nephritis	Hyper-tension	Other	Polycystic kidney	Pyelo-nephritis	Renal vascular disease
England	12.5	5,669	14.9	28.7	13.0	7.0	17.0	6.9	6.4	6.1
N Ireland	4.0	217	16.6	25.4	12.0	2.3	22.1	6.5	6.9	8.3
Scotland	2.2	547	10.2	30.5	17.0	3.8	17.4	7.3	5.3	8.4
Wales	3.2	363	14.9	26.5	16.5	3.0	16.5	7.2	6.6	8.8
UK	**11.1**	**6,796**	**14.6**	**28.6**	**13.5**	**6.3**	**17.2**	**7.0**	**6.4**	**6.5**

The percentage in each category has been calculated after excluding those patients with data not available

EDTA codes allow clinicians to indicate the basis for the diagnosis of the PRD (e.g. biopsy-proven, or not). Adoption of these codes should reduce 'uncertain' PRD coding. There was wide variation in all PRD codes between centres.

The UK age distribution of PRDs is shown in table 1.9. Diabetic nephropathy was the most common renal diagnosis overall and in all age groups except the under 35s and those over 85. Glomerulonephritis and autosomal dominant polycystic kidney disease (ADPKD) made up much higher proportions of the younger than the older incident cohorts, whilst patients with renal vascular disease comprised a much higher percentage of the older rather than the younger patients. Aetiological uncertainty increased with age.

Table 1.10 shows the incidence rates for each PRD per million population for the 2016 cohort. As there were some missing data, the rates for at least some of the diagnoses will be underestimates.

First established treatment modality

In 2016, the first treatment recorded, irrespective of any later change, was haemodialysis in 72.4% of patients, peritoneal dialysis in 20.3% and pre-emptive transplant in 7.4% (table 1.11). The percentage having a pre-emptive transplant fell in 2015, however, about half of the apparent drop was due to Cambridge (a transplant centre) not being included in the data for 2015 or 2016. Table F.1.3 in appendix F: Additional Data Tables for 2016 new and existing patients gives the treatment breakdown at start of RRT by centre.

Many patients undergo a period of HD before switches to other modalities are, or can be, considered. The modality in use at 90 days may be more representative of the first elective modality and is adopted for the remainder of this section. For these analyses, the incident cohort from 1 October 2015 to 30 September 2016 was used so that follow up to 90 days was possible for all patients. By 90 days, 4.0% of incident patients had died

Table 1.9. Percentage distribution of primary renal diagnosis by age in the 2016 incident RRT cohort

Diagnosis	Percentage with diagnosis								Percentage male
	Age group							All	
	18–<35	35–<45	45–<55	55–<65	65–<75	75–<85	85+		
Diabetes	17.3	26.1	30.7	37.6	30.3	23.1	12.9	28.6	65
Glomerulonephritis	27.0	19.8	17.0	13.5	11.1	7.5	4.7	13.5	69
Pyelonephritis	8.5	6.7	4.2	4.4	7.0	7.6	9.4	6.4	60
Hypertension	3.9	5.4	6.9	5.1	6.3	8.2	8.6	6.3	69
Polycystic kidney	2.2	11.0	13.8	8.8	5.2	2.7	2.0	7.0	51
Renal vascular disease	0.6	1.1	1.5	3.5	8.1	13.0	21.1	6.5	67
Other	25.4	16.8	15.5	16.4	17.1	17.2	14.1	17.2	58
Uncertain aetiology	15.0	13.2	10.4	10.6	14.8	20.7	27.3	14.6	61

Percentages calculated after excluding those patients with data not available

Table 1.10. Primary renal diagnosis RRT incidence rates (2016) per million population (unadjusted)

Diagnosis	England	N Ireland	Scotland	Wales	UK
Diabetes	30.0	29.5	30.9	30.8	30.1
Glomerulonephritis	13.6	14.0	17.2	19.3	14.2
Pyelonephritis	6.7	8.1	5.4	7.7	6.7
Hypertension	7.3	2.7	3.9	3.5	6.7
Polycystic kidney	7.3	7.5	7.4	8.4	7.3
Renal vascular disease	6.4	9.7	8.5	10.3	6.8
Other	17.9	25.8	17.6	19.3	18.1
Uncertain aetiology	15.7	19.3	10.4	17.3	15.4
Data not available	15.0	4.8	2.2	3.9	13.1
All	**120**	**121**	**103**	**120**	**119**

The overall rates per country may be slightly different to those in table 1.2 as Cambridge (due to missing data) and Colchester (due to high percentage with uncertain aetiology) have been excluded from both the numerator and the denominator here

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

Start	HD (%)	PD (%)	Transplant (%)
Day 0 treatment			
2011	72.7	20.4	6.9
2012	72.8	19.5	7.7
2013	71.9	19.3	8.8
2014	71.9	19.9	8.3
2015	73.0	19.3	7.7
2016	72.4	20.3	7.4
Day 90 treatment			
Oct 2010 to end Sept 2011	70.9	20.5	8.6
Oct 2011 to end Sept 2012	70.9	20.1	9.0
Oct 2012 to end Sept 2013	70.0	19.9	10.2
Oct 2013 to end Sept 2014	69.7	20.1	10.2
Oct 2014 to end Sept 2015	71.3	19.4	9.3
Oct 2015 to end Sept 2016	69.8	20.5	9.7

and a further 0.6% had stopped treatment, leaving 95.4% of the original cohort still on RRT. Table 1.12a 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, 66.5% were on HD at 90 days, 19.6% were on PD and 9.3% had received a transplant. Expressed as percentages of those still receiving RRT at 90 days, 69.8% were on HD, 20.5% on PD and 9.7% had received a transplant.

Figure 1.9 shows the modality breakdown with the HD patients further subdivided. Of those still on RRT at 90 days, 41% were treated with hospital HD, 28% with satellite HD, and only 0.4% were receiving home HD at this early stage, equating to 32 patients (across 15 centres).

Table 1.12b shows the treatment breakdown at 90 days by centre for a five year cohort (1 October 2011 to 30 September 2016). Using just 2016 incident patients, the percentage of patients receiving RRT at 90 days with a functioning transplant varied between centres from 0% to 31% (between 2% and 31% for transplanting centres and between 0% and 19% 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 (12.1% vs 6.7%).

Table 1.12a. RRT modality at 90 days by country (incident cohort 1/10/2015 to 30/09/2016)

		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	Recovered/ discontinued	Died	HD	PD	Tx
England	6,414	65.8	20.1	9.3	0.6	4.1	69.1	21.1	9.8
N Ireland	245	65.3	15.9	14.7	2.0	2.0	68.1	16.6	15.3
Scotland	603	72.4	14.9	8.8	0.0	3.8	75.3	15.5	9.1
Wales	387	70.0	19.6	5.7	*	*	73.4	20.6	6.0
UK	**7,649**	**66.6**	**19.6**	**9.3**	**0.6**	**4.0**	**69.8**	**20.5**	**9.7**

*Values suppressed due to small numbers (primary or secondary suppression)

Table 1.12b. RRT modality at 90 days by centre (incident cohort 1/10/2011 to 30/09/2016)

Centre	*N*	Percentage who had died by 90 days	Percentage of patients still on RRT at 90 days, by modality		
			HD	PD	Tx
England					
B Heart	560	5	74	23	3
B QEH	1,147	2	73	18	9
Basldn	218	4	*	25	*
Bradfd	399	4	77	13	10
Brightn	703	6	70	23	7
Bristol	765	5	71	18	11
Camb	418	3	64	10	26
Carlis	179	*	54	40	6
Carsh	1,237	6	74	20	7
Chelms	244	*	*	20	*
Colchr	157	7	*	*	*
Covnt	574	8	62	28	10
Derby	383	3	56	41	2
Donc	258	4	73	24	2
Dorset	374	1	68	27	4
Dudley	256	2	*	34	*
Exeter	657	3	74	20	6
Glouc	339	2	71	26	3
Hull	492	4	60	32	8
Ipswi	219	3	64	29	7
Kent	676	5	72	18	11
L Barts	1,459	4	64	29	7
L Guys	763	2	73	10	17
L Kings	764	2	71	25	4
L Rfree	1,142	4	61	27	11
L St.G	462	5	76	14	10
L West	1,736	2	82	7	10
Leeds	815	5	66	15	19
Leic	1,335	5	71	17	13
Liv Ain	306	10	69	28	3
Liv Roy	590	8	57	25	18
M RI	939	5	62	19	19
Middlbr	573	5	79	8	13
Newc	551	6	69	20	10
Norwch	437	5	79	18	4
Nottm	560	5	55	30	15
Oxford	913	4	59	23	17
Plymth	280	6	64	22	14
Ports	975	3	71	17	12
Prestn	760	4	72	16	12
Redng	486	5	60	32	8
Salford	754	4	63	25	11
Sheff	739	4	78	14	8
Shrew	296	6	69	28	3
Stevng	699	6	79	12	9
Sthend	181	6	69	26	5
Stoke	519	6	71	26	3
Sund	335	2	83	11	6
Truro	252	8	74	18	9
Wirral	296	14	74	21	5
Wolve	403	6	61	37	2
York	293	3	62	24	14

Table 1.12b. Continued

Centre	*N*	Percentage who had died by 90 days	Percentage of patients still on RRT at 90 days, by modality		
			HD	PD	Tx
N Ireland					
Antrim	169	4	80	16	4
Belfast	427	2	58	13	29
Newry	117	5	*	32	*
Ulster	144	8	*	13	*
West NI	162	3	77	17	5
Scotland					
Abrdn	277	4	*	20	*
Airdrie	292	*	*	16	*
D & Gall	70	*	60	40	0
Dundee	218	2	*	17	*
Edinb	422	4	70	11	19
Glasgw	940	3	76	11	13
Inverns	108	*	71	24	5
Klmarnk	202	6	*	22	*
Krkcldy	180	3	*	16	*
Wales					
Bangor	114	4	*	21	*
Cardff	844	5	72	17	11
Clwyd	114	6	74	22	5
Swanse	611	5	75	20	5
Wrexm	197	4	66	27	6
England	**30,868**	**4**	**70**	**21**	**10**
N Ireland	**1,019**	**4**	**69**	**16**	**14**
Scotland	**2,709**	**3**	**76**	**15**	**8**
Wales	**1,880**	**5**	**73**	**20**	**8**
UK	**36,476**	**4**	**70**	**20**	**10**

*Values suppressed due to small numbers (primary or secondary suppression)

Table 1.13 gives the HD/PD breakdown by age group for patients receiving dialysis at 90 days (incident cohort 1/10/2013 to 30/09/2016). The percentage on PD at 90 days was about 50% higher in patients aged under 65 years than in older patients (27% vs 18%). In both age groups there was a lot of variability between centres in the percentage on PD. There were a small number of centres where the percentage of patients treated with PD was the same as, or higher in the over 65s than the under 65s. Not all of these were centres with a high use of PD.

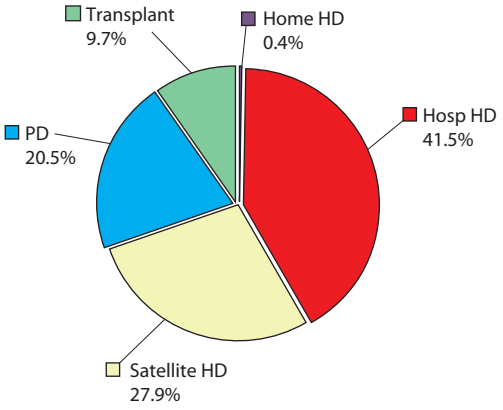

Fig. 1.9. RRT modality at 90 days (incident cohort 1/10/2015 to 30/09/2016)

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 2011. Fifty-three percent of patients who started on HD had died within five years of starting. This compared to 35% and 5% for those starting on PD or transplant respectively. Of the patients starting on PD, 91% were on PD at 90 days but this percentage dropped sharply at the later time

Table 1.13. Modality split of patients on dialysis at 90 days (incident cohort 1/10/2013 to 30/09/2016)

	Age <65 (%)		Age ⩾65 (%)	
Centre	HD	PD	HD	PD
England				
B Heart	65	35	80	20
B QEH	74	26	86	14
Basldn	69	31	76	24
Bradfd	84	16	93	8
Brightn	76	24	79	21
Bristol	74	26	84	17
Carlis	60	40	54	46
Carsh	72	28	85	16
Chelms	75	25	78	22
Colchr	100	0	100	0
Covnt	65	36	73	27
Derby	49	51	69	32
Donc	74	26	78	22
Dorset	71	29	75	25
Dudley	54	46	72	28
Exeter	68	32	82	18
Glouc	61	39	78	22
Hull	56	44	74	26
Ipswi	67	33	67	33
Kent	74	26	86	14
L Barts	67	33	74	26
L Guys	89	11	90	10
L Kings	70	30	78	22
L Rfree	61	39	70	30
L St.G	88	12	83	18
L West	90	10	91	9
Leeds	75	25	88	12
Leic	80	20	85	15
Liv Ain	58	42	79	21
Liv Roy	68	32	76	24
M RI	74	26	83	17
Middlbr	85	15	93	7
Newc	74	26	76	24
Norwch	75	26	88	12
Nottm	56	44	79	21
Oxford	62	38	79	21
Plymth	72	28	76	24
Ports	76	24	86	14
Prestn	80	20	83	17
Redng	56	44	72	28
Salford	67	33	74	26
Sheff	84	16	88	12
Shrew	52	48	81	19
Stevng	84	16	94	6
Sthend	69	31	67	33
Stoke	63	37	80	21
Sund	86	14	94	7
Truro	76	24	89	11
Wirral	71	29	87	13
Wolve	59	41	74	26
York	61	39	80	20
N Ireland				
Antrim	72	28	91	9
Belfast	75	25	84	16
Newry	78	22	65	36
Ulster	80	20	87	13
West NI	85	15	85	15
Scotland				
Abrdn	71	29	96	4
Airdrie	84	17	84	16
D & Gall	57	44	59	41
Dundee	81	19	83	17
Edinb	86	14	85	15
Glasgw	85	15	90	10
Inverns	72	28	84	16
Klmarnk	76	24	79	21
Krkcldy	73	27	88	12
Wales				
Bangor	74	26	77	23
Cardff	74	26	87	13
Clwyd	63	38	86	14
Swanse	69	31	90	10
Wrexm	51	49	85	16
England	**73**	**27**	**82**	**18**
N Ireland	**78**	**22**	**85**	**16**
Scotland	**80**	**20**	**86**	**14**
Wales	**69**	**31**	**87**	**13**
UK	**73**	**27**	**82**	**18**

points. In contrast, 90% of patients starting with a transplant were also transplant patients at the five year time point.

Renal function at the time of starting RRT

The mean eGFR at initiation of RRT in 2016 was 7.4 ml/min/1.73 m^2. This was markedly lower than the 8.5 ml/min/1.73 m^2 reported last year. This difference is due to the use of the CKD-EPI rather than the MDRD formula. By the MDRD method the mean eGFR was 8.5 ml/min/1.73 m^2 in 2016. The mean eGFR at initiation of RRT is shown by age group in figure 1.10.

Figure 1.11 shows serial data from centres reporting to the UKRR every year since 2007. There has been a tendency for patients to start PD at higher eGFRs than HD recipients, seen again in 2016 (7.5 vs 7.1 ml/min/1.73 m^2).

Some caution should be applied to the analysis of eGFR at the start of RRT as data were only available for less than half of the incident patients (approximately

Table 1.14. Initial and subsequent modalities for patients starting RRT in 2011*

First treatment	*N*	Later modality	Percentage			
			90 days	1 year	3 years	5 years
HD	4,864	HD	90	73	47	28
		PD	2	4	1	1
		Transplant	1	5	13	17
		Recovered/discontinued	0	1	2	1
		Died	6	18	37	53
PD	1,370	HD	6	15	20	17
		PD	91	67	28	10
		Transplant	1	10	30	37
		Recovered/discontinued	0	0	1	1
		Died	2	7	22	35
Transplant	448	HD	0	1	4	5
		PD	1	0		
		Transplant	98	97	92	90
		Died	1	1	4	5

*Cambridge excluded as five year follow up not available
Light grey shading indicates proportion of individuals maintained on their initial modality

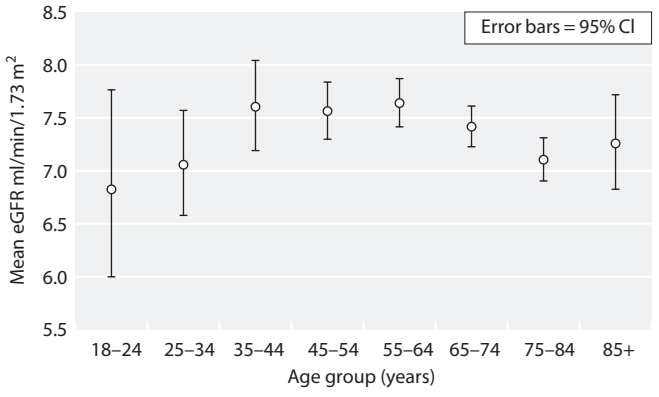

Fig. 1.10. Mean eGFR at start of RRT (2016) by age group
Note, for this report the CKD-EPI method was used for the first time rather than the MDRD method
CKD-EPI estimated mean GFR at start approximately 1 ml/min/1.73 m^2 lower than MDRD

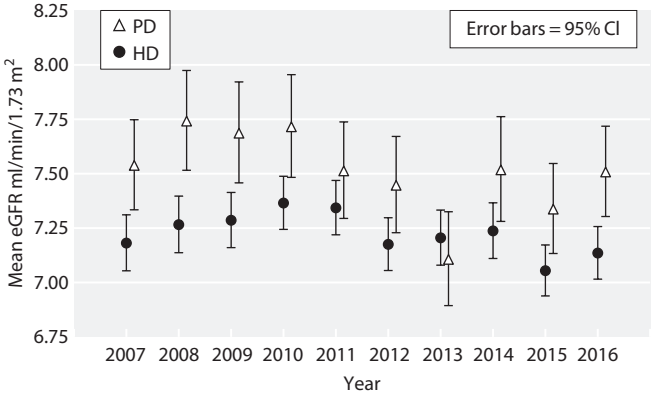

Fig. 1.11. eGFR on starting RRT 2007 to 2016, PD and HD (restricted to centres reporting since 2007)
Note, for this report the CKD-EPI method was used for the first time rather than the MDRD method
CKD-EPI estimated mean GFR at start approximately 1 ml/min/1.73 m^2 lower than MDRD

3,100 for 2016) and almost half of these came from only ten centres. Three-quarters of the values came from 20 centres. Further caution should be applied as some patients may have an incorrect date of starting RRT allocated and thus, the eGFR used for analysis may have been taken whilst they were already receiving RRT. This analysis is presented despite these deficiencies for comparision with historical data. Completeness of eGFR data and accuracy of start date are anticipated to improve with the introduction of realtime data downloads and more complete collection of HD sessional data.

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 CKD who are regularly monitored in primary or secondary care and whose referral to nephrology services is delayed (delayed or

late referral). Other patients present late to medical services with either such slowly progressive disease as to have remained asymptomatic for many years or with rapidly progressive kidney disease. 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 for ERF as 'late presentation'. One analysis attempts to capture 'late referrals': it shows the percentage presenting within 90 days of starting RRT after excluding conditions that are likely to present with rapid decline in renal function.

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 for incident patients in English, Welsh or Northern Irish centres in the years 2015 to 2016. 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 was 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 more than 10% of 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 10,966 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.

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 CKD-EPI equation and the abbreviated 4 variable MDRD study equation to allow comparison with previously reported values. For the purpose of the eGFR calculation, patients who had missing ethnicity, but a valid serum creatinine measurement were classed as White. Due to their skewed distribution the eGFR values were log transformed.

A mixture of old and new (2012) EDTA codes for primary diagnoses were received from centres. For those people without an old code, new codes (where available) were mapped back to old codes. These codes were grouped into the same eight categories as in previous reports, the details are given in appendix H: Ethnicity and ERA-EDTA Coding (www.renalreg.org).

People with the following conditions were allocated to an 'acute' group in some analyses: crescentic (extracapillary) glomerulonephritis (type I, II, III), nephropathy (interstitial) due to cisplatinum, 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).

Results

Data completeness

Table 1.15 shows the percentage completeness of data for 2015 and 2016.

Late presentation by centre

Figure 1.12 shows that late presentation varied between centres from 5% to 34% in patients starting RRT in 2015 to 2016. The overall rate of late presentation was 15.9% and reduced to 11.2% once those people with diseases likely to present acutely were excluded. Table 1.16 shows the overall percentage presenting late for the combined 2015/2016 incident cohort, the percentages presenting late amongst those patients defined as

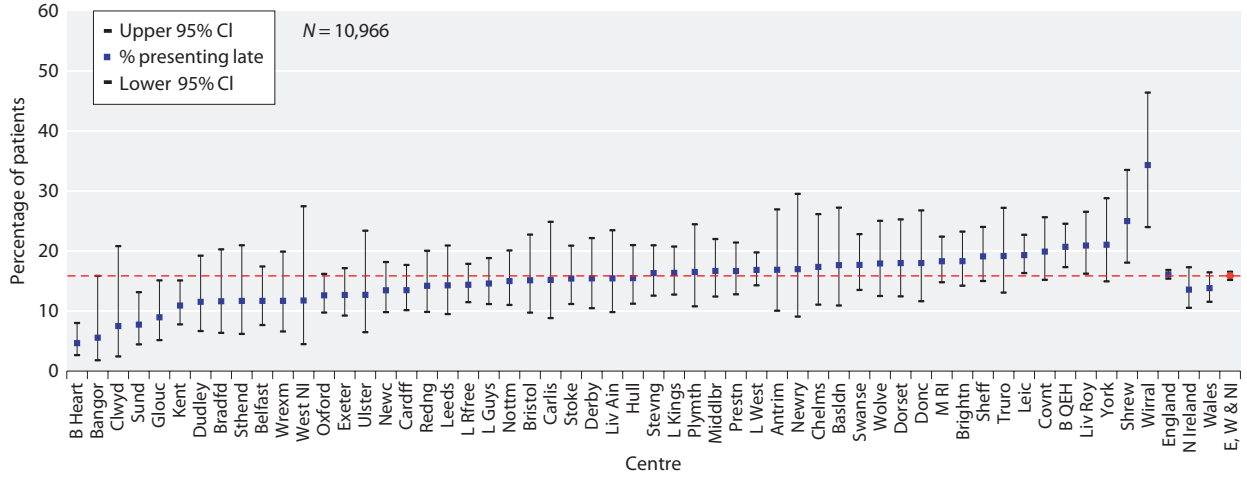

Fig. 1.12. Percentage presenting late (2015/2016)

Table 1.15. Percentage completeness of time of presentation data (2015 and 2016 incident RRT patients) by centre

	N		Percentage completeness	
Centre	2015	2016	2015	2016
England				
B Heart	123	135	100.0	100.0
B QEH	245	238	100.0	100.0
Basldn	48	40	97.9	95.0
Bradfd	91	86	100.0 *	100.0
Brightn	144	150	95.1	98.0
Bristol	146	155	81.5	73.6
Carlis	46	35	100.0	94.3
Carsh	260	246	46.9	41.5
Chelms	51	53	98.0	90.6
Colchr	28	30	67.9	46.7
Covnt	111	128	92.8	96.1
Derby	64	86	98.4	100.0
Donc	39	62	100.0	98.4
Dorset	75	70	94.7	97.1
Dudley	51	53	100.0	100.0
Exeter	137	143	100.0	97.2
Glouc	72	66	100.0	93.9
Hull	121	93	99.2	100.0
Ipswi	67	42	16.4	23.8
Kent	143	141	100.0	100.0
L Barts	311	297	1.9*	1.4
L Guys	179	169	94.4	94.7
L Kings	180	152	99.4	99.3
L Rfree	239	238	98.7	96.6
L St.G	114	94	69.3	16.0
L West	337	385	99.4	99.5
Leeds	147	166	100.0	100.0*
Leic	270	324	100.0	98.8
Liv Ain	61	53	95.1	98.1
Liv Roy	141	111	91.5	99.1
M RI	198	219	97.0	94.5
Middlbr	134	101	99.3	100.0
Newc	125	135	100.0	100.0
Norwch	112	97	100.0*	96.9*
Nottm	120	120	100.0	100.0
Oxford	195	218	100.0	99.5
Plymth	53	63	98.1	100.0
Ports	200	191	70.5	41.4
Prestn	163	133	97.6	97.0
Redng	87	96	100.0	100.0
Salford	173	188	11.6*	5.9
Sheff	146	151	98.0	99.3
Shrew	62	58	100.0	100.0
Stevng	136	165	100.0	99.4
Sthend	35	47	91.4	95.7
Stoke	116	107	94.0	98.1
Sund	63	94	98.4	98.9
Truro	70	50	100.0	100.0
Wirral	64	69	98.4*	97.1
Wolve	85	64	98.8	95.3
York	61	72	100.0	100.0
N Ireland				
Antrim	36	41	100.0	100.0
Belfast	94	95	93.6	87.4
Newry	28	25	100.0	100.0
Ulster	33	30	100.0	100.0
West NI	39	35	100.0*	97.1
Wales				
Bangor	29	25	100.0	100.0
Cardff	160	161	99.4	99.4
Clwyd	28	16	96.4	81.3
Swanse	136	124	100.0	100.0
Wrexm	45	49	100.0	100.0
England	**6,439**	**6,479**	**82.0**	**80.6**
N Ireland	**230**	**226**	**80.4**	**94.2**
Wales	**398**	**375**	**99.5**	**98.9**
E, W & NI	**7,067**	**7,080**	**83.0**	**82.0**

*Completeness data shown but data not used as >10% of patients with data reported as starting RRT on same date as first presentation

not having an 'acute diagnosis' and the percentages amongst non-diabetics (as PRD).

Considerable differences exist between centres in late presentation rates. One centre (Birmingham Heartlands) attained a late presentation rate of just under 5%. Two centres (Wirral, York) reported that over 40% of their incident patients were referred late. These differences have implications for their regions and referral pathways.

Late presentation in 2016 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. In 2016, 72.1% of incident patients presented to nephrology services over a year before they started RRT. The remaining patients presented within a year of start, with 7.8% of patients presenting within the 6–12 month window before RRT, 4.5% within 3–6 months and 15.6% within three months of RRT start. Figure 1.13 shows this breakdown by year for those 37 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 increase was even more marked in the years before those shown in the figure. In 2005,

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 (2015/2016 incident patients) by centre

Centre	*N* with data	Percentage presenting <90 days before start				Percentage presenting <1 year before start[b]	
		Overall	(95% CI)	Non-acute[a]	Non-diab PRD		(95% CI)
England							
B Heart	258	4.7	(2.7–8.0)	3.9	6.2	13.2	(9.6–17.9)
B QEH	483	20.7	(17.3–24.6)	15.7	23.3	34.6	(30.5–38.9)
Basldn	85	17.7	(10.9–27.2)	14.1	23.7	31.8	(22.8–42.4)
Bradfd	86	11.6	(6.4–20.3)	10.7	16.0	16.3	(9.9–25.6)
Brightn	284	18.3	(14.2–23.2)	11.9	21.5	35.2	(29.9–40.9)
Bristol	119	15.1	(9.7–22.7)	9.6	18.4	22.7	(16.0–31.1)
Carlis	79	15.2	(8.8–24.9)	9.8	16.7	24.1	(15.9–34.7)
Chelms	98	17.4	(11.1–26.2)	15.7	19.2	38.8	(29.7–48.7)
Covnt	226	19.9	(15.2–25.6)	14.4	22.9	33.6	(27.8–40.0)
Derby	149	15.4	(10.5–22.2)	9.0	21.9	25.5	(19.2–33.1)
Donc	100	18.0	(11.6–26.8)	10.5	23.1	30.0	(21.8–39.7)
Dorset	139	18.0	(12.5–25.3)	11.7	21.2	32.4	(25.1–40.6)
Dudley	104	11.5	(6.7–19.2)	8.2	13.9	24.0	(16.8–33.2)
Exeter	276	12.7	(9.3–17.2)	8.5	14.3	23.2	(18.6–28.5)
Glouc	134	9.0	(5.2–15.1)	6.5	12.0	16.4	(11.1–23.7)
Hull	213	15.5	(11.2–21.0)	13.4	17.5	35.7	(29.5–42.3)
Kent	284	10.9	(7.8–15.1)	7.4	12.2	16.9	(13.0–21.7)
L Guys	329	14.6	(11.2–18.8)	10.6	18.3	27.1	(22.5–32.1)
L Kings	330	16.4	(12.8–20.8)	12.9	21.2	29.1	(24.4–34.2)
L Rfree	466	14.4	(11.5–17.9)	11.4	16.2	26.0	(22.2–30.1)
L West	718	16.9	(14.3–19.8)	13.8	21.0	31.3	(28.1–34.8)
Leeds	147	14.3	(9.5–20.9)	9.1	15.9	27.9	(21.2–35.7)
Leic	590	19.3	(16.3–22.7)	10.5	22.4	32.0	(28.4–35.9)
Liv Ain	110	15.5	(9.8–23.5)	9.3	20.2	21.8	(15.1–30.5)
Liv Roy	239	20.9	(16.2–26.5)			28.5	(23.1–34.5)
M RI	399	18.3	(14.8–22.4)	10.1	23.9	34.3	(29.8–39.1)
Middlbr	234	16.7	(12.4–22.0)	13.0	20.5	29.5	(24.0–35.6)
Newc	260	13.5	(9.8–18.2)	9.9	15.9	26.5	(21.5–32.2)
Nottm	240	15.0	(11.0–20.1)	9.1	18.1	23.8	(18.8–29.5)
Oxford	412	12.6	(9.8–16.2)	7.4	15.8	23.8	(19.9–28.1)
Plymth	115	16.5	(10.8–24.5)	12.9	19.1	29.6	(22.0–38.5)
Prestn	288	16.7	(12.8–21.4)	11.3	20.9	28.1	(23.2–33.6)
Redng	183	14.2	(9.9–20.1)	9.8	19.1	26.8	(20.9–33.7)
Sheff	293	19.1	(15.0–24.0)	13.2	23.6	30.4	(25.4–35.9)
Shrew	120	25.0	(18.1–33.5)	21.9	28.9	34.2	(26.3–43.1)
Stevng	300	16.3	(12.6–21.0)	9.5	21.1	22.3	(18.0–27.4)
Sthend	77	11.7	(6.2–21.0)	8.6	12.7	27.3	(18.5–38.2)
Stoke	214	15.4	(11.2–20.9)	8.1	17.8	35.1	(29.0–41.7)
Sund	155	7.7	(4.5–13.1)	5.3	9.2	25.2	(19.0–32.6)
Truro	120	19.2	(13.1–27.2)	16.8	24.4	32.5	(24.7–41.4)
Wirral	67	34.3	(24.0–46.4)	32.8	42.5	58.2	(46.2–69.4)
Wolve	145	17.9	(12.5–25.0)	15.4	22.2	32.4	(25.3–40.4)
York	133	21.1	(15.0–28.8)	19.1	22.4	42.1	(34.0–50.6)
N Ireland							
Antrim	77	16.9	(10.1–26.9)	11.8	22.6	22.1	(14.2–32.7)
Belfast	171	11.7	(7.7–17.4)	6.2	13.6	20.5	(15.1–27.2)
Newry	53	17.0	(9.1–29.5)	15.2	21.4	26.4	(16.3–39.8)
Ulster	63	12.7	(6.5–23.4)	9.1	15.6	22.2	(13.6–34.1)
West NI	34	11.8	(4.5–27.5)	9.4	16.0	14.7	(6.3–30.8)

Table 1.16. Continued

Centre	*N* with data	Percentage presenting <90 days before start				Percentage presenting <1 year before start[b]	
		Overall	(95% CI)	Non-acute[a]	Non-diab PRD		(95% CI)
Wales							
Bangor	54	5.6	(1.8–15.9)	5.8	7.0	11.1	(5.1–22.6)
Cardff	319	13.5	(10.2–17.7)	10.5	16.3	23.5	(19.2–28.5)
Clwyd	40	7.5	(2.4–20.8)	[c]	0.0	10.0	(3.8–23.8)
Swanse	260	17.7	(13.5–22.8)	12.1	23.2	28.9	(23.7–34.7)
Wrexm	94	11.7	(6.6–19.9)	7.1	13.9	21.3	(14.2–30.7)
England	**9,801**	**16.1**	**(15.4–16.9)**	**11.4**	**19.3**	**28.7**	**(27.8–29.6)**
N Ireland	**398**	**13.6**	**(10.5–17.3)**	**9.4**	**16.7**	**21.4**	**(17.6–25.7)**
Wales	**767**	**13.8**	**(11.6–16.5)**	**10.2**	**17.0**	**23.5**	**(20.6–26.6)**
E, W & NI	**10,966**	**15.9**	**(15.2–16.6)**	**11.2**	**19.0**	**28.0**	**(27.2–28.9)**
Min		**4.7**		**3.9**	**0.0**	**10.0**	
Quartile 1		**12.7**		**9.0**	**15.9**	**22.7**	
Quartile 3		**17.9**		**13.1**	**22.3**	**32.0**	
Max		**34.3**		**32.8**	**42.5**	**58.2**	

Blank cells – data for PRD not used due to high % with missing data or high % with uncertain aetiology
[a]Non-acute group excludes those diagnoses defined as acute (see methods)
[b]The remaining patients starting RRT therefore presented over 1 year beforehand
[c]Value suppressed due to small numbers

only 52.6% of incident patients presented over a year before they started RRT.

Characteristics of patients presenting late versus those presenting early

In the combined 2015/2016 incident cohort, the median age was a little lower in those presenting late than those presenting early (table 1.17). The percentage who were male was higher in the group presenting late than those presenting early. There were large differences in the percentages starting on PD and in haemoglobin and eGFR at start with all three of these being lower in late presenters than in early presenters. More detailed analyses of haemoglobin at start of RRT and late presentation can be found in chapter 7: Haemoglobin, Ferritin and Erythropoietin in UK Adult Dialysis Patients in 2016. The finding of lower average eGFR in those presenting late is in contrast to some of the studies in the literature but many of those studies pre-date the era of routine use of eGFR [5, 6]. A Cochrane review [7] showed that eGFR was lower in RRT patients referred

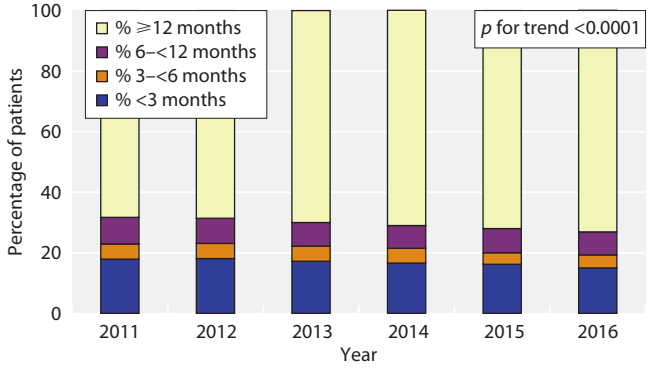

Fig. 1.13. Late presentation rate by year (2011–2016)
Restricted to centres reporting continuous data for 2011–2016

Table 1.17. Patient characteristics amongst patients presenting late (<90 days) compared with those presenting early (⩾90 days) (2015/2016 incident patients)

	<90 days	⩾90 days	*p*-value
Median age	63.8	64.9	0.01
Percentage male	65.8	62.3	0.01
Percentage starting on PD	9.7	22.4	>0.0001
Percentage on PD at 90 days	12.0	22.2	>0.0001
Mean haemoglobin at RRT start (g/L)[a]	91	100	>0.0001
Mean eGFR at RRT start (ml/min/1.73 m^2)[ab]	6.7	7.5	>0.0001

[a]Data only available for about 50% of patients
[b]Note, for this report the CKD-EPI method was used for the first time rather than the MDRD method
CKD-EPI estimated mean GFR at start approximately 1 ml/min/1.73 m^2 lower than MDRD

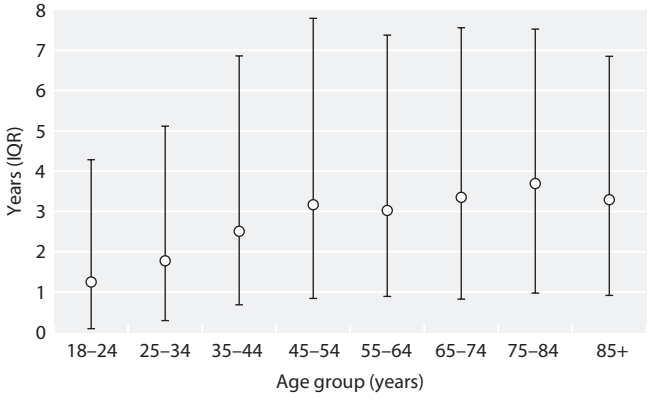

Fig. 1.14. Median duration of pre-RRT care by age group (incident patients 2015/2016)

late (mean difference of 0.42 ml/min/1.73 m^2) compared to those presenting early (definition: more than six months before starting RRT) consistent with UKRR data.

In the 2015/2016 cohort, the percentage of non-White patients presenting late (<90 days) was lower than in Whites (13.8% vs 16.3%: $p = 0.005$). The high incidence of diabetes in non-Whites (patients with diabetes tended to present earlier) explains some of the difference in presentation time between the groups. When patients with diabetes were excluded, the percentages presenting late (<90 days) became 18.3% in non-White patients vs 19.5% in Whites ($p = 0.3$). Above age 45, the median duration of pre-RRT care did not vary greatly with age group (figure 1.14).

Primary renal disease and late presentation

In the 2015/2016 cohort, there were large differences in late presentation rates between PRDs (Chi-squared test $p < 0.0001$) (table 1.18). Patients with conditions likely to present with rapid decline in renal function or without available data had high rates of late presentation, as anticipated. Those with diabetes and adult polycystic kidney disease or pyelonephritis had low rates, in keeping with the natural histories of these conditions.

Comorbidity and late presentation

In the 2015/2016 cohort, the percentage of patients with no recorded comorbidity was similar amongst early and late presenters (50.2% vs 51.8%: $p = 0.4$). However, cardiovascular disease was less common and liver disease and malignancy more common in patients who presented late, compared with those who presented early (table 1.19). This is in keeping with findings from other studies [5–6, 8].

International comparisons

Figure 1.15 shows the crude RRT incidence rates (including children) for 2015 for various countries. The non-UK data are from the USRDS [9]; 2015 was the latest year available at the time of writing. The UK incidence rate was comparable with other Northern European countries, Australia and New Zealand, but remained markedly lower than other countries, most 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 [10].

Survival of incident patients

See chapter 5: Survival and Causes of Death of UK Adult Patients on Renal Replacement Therapy in 2016.

Table 1.18. Late presentation by primary renal diagnosis (2015/2016 incident patients)

		Late presentation	
Diagnosis	*N*	*N*	%
Uncertain aetiology	1,514	273	18.0
Diabetes	2,811	194	6.9
Glomerulonephritis	1,390	184	13.2
Other identified category	921	163	17.7
Polycystic kidney or pyelonephritis	1,353	100	7.4
Renal vascular disease	1,227	121	9.9
Acute group	968	524	54.1
Data not available	361	105	29.1

Unlike elsewhere in the report: (i) the RVD group includes hypertension, and (ii) polycystic kidney and pyelonephritis are grouped together
For definition of acute group see methods

Table 1.19. Percentage prevalence of specific comorbidities amongst patients presenting late (<90 days) compared with those presenting early (⩾90 days) (2015/2016 incident patients)

Comorbidity	<90 days	⩾90 days	*p*-value
Ischaemic heart disease	13.0	20.6	<0.0001
Cerebrovascular disease	5.9	10.4	<0.0001
Peripheral vascular disease	8.3	11.5	0.003
Diabetes (not a cause of ERF)	10.6	10.7	0.9
Liver disease	5.6	3.4	0.001
Malignancy	19.3	12.4	<0.0001
COPD	8.4	7.9	0.6
Smoking	10.7	13.0	0.05

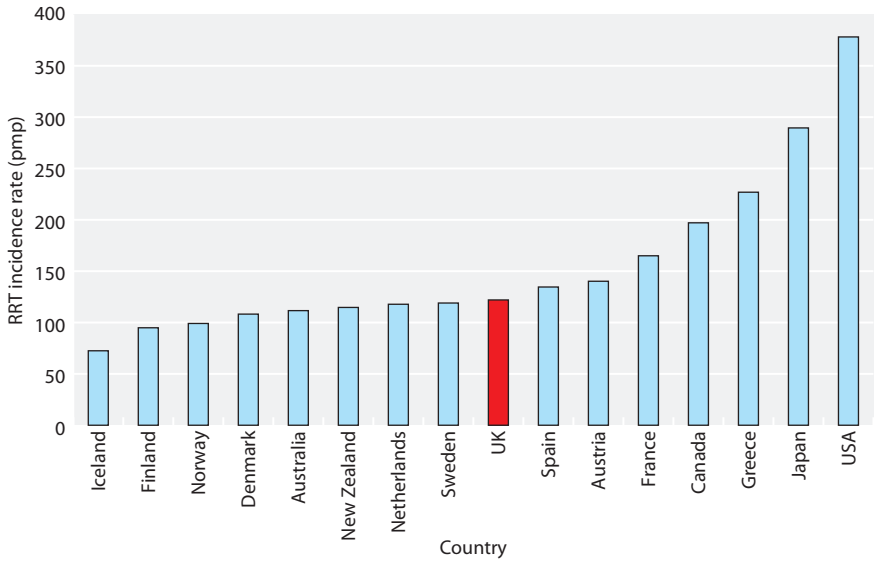

Fig. 1.15. International comparison of RRT incidence rates in 2015
Non-UK data from USRDS [9]

4. Acute haemodialysis

Methods

This section utilises sessional HD data alongside treatment timeline codes. HD sessional data were submitted to the UKRR by renal centres in England, as mandated by NHS England. Centres in Northern Ireland and Wales provided data voluntarily. Centres in Scotland did not provide HD sessional data. Centres were asked to report details related to each HD session, including vascular access used and blood pressure before and after the session (data not shown).

The approach used to define HD as acute or for ERF was based purely on timeline codes (figure 1.16). Sessional HD data were used to check for individuals who received HD without a timeline entry and to check start dates. Where timeline and sessional dates were inconsistent, it was not possible to determine whether this was due to a missing acute HD code or an inaccurate first timeline entry. As such, neither the dates nor content of timelines were corrected using sessional HD data.

Results

Timeline data from 2016 show 6,891 people received their first-ever HD session across 61 centres in England, Wales and Northern Ireland. Of these HD starts, 2,581 (37.5%) were coded as acute and 4,310 (62.5%) as being for ERF (figure 1.16).

Forty-one of the 52 (78.8%) adult renal centres in England submitted HD sessional data. Of these, four submitted only acute HD sessions and one submitted data for only 16.8% of patients. Five centres in Northern Ireland and five in Wales also submitted data, of which two centres did not submit acute HD sessions. A table of completeness of the HD sessional data is available in appendix F: Additional Data Tables for 2016 new and existing patients.

Of the 2,581 individuals who started acute HD, sessional data were available for 2,332 (90.4%). Fifty-three

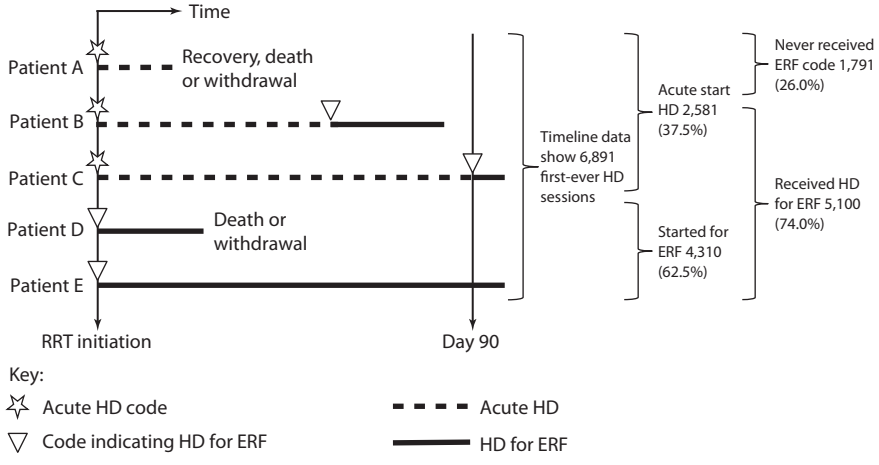

Fig. 1.16. Timeline codes and renal outcomes for all 6,891 people who received their first-ever HD session in England, Northern Ireland and Wales in 2016

Table 1.20. Centre-level acute and chronic haemodialysis initiation

Centre	% of incident patients who started HD acutely	% of HD recipients with ERF who started on acute HD	% of acute HD recipients who developed ERF	Percentage of each category for which sessional HD data were available			
				AHD	ACHD	CHD	Total
Antrim	27.3	5.9	16.7	90.0	100.0	100.0	97.7
B Heart	25.6	24.7	95.5	0.0	100.0	100.0	98.8
B QEH	48.1	44.6	86.7	100.0	98.7	100.0	99.5
Bangor	26.3	12.5	40.0	66.7	100.0	100.0	94.7
Basldn	49.0	16.7	20.8	84.2	100.0	100.0	93.9
Belfast	34.8	27.1	69.6	85.7	100.0	100.0	98.5
Bradfd	47.4	24.2	35.6	86.2	68.8	0.0	37.9
Brightn	46.7	29.2	47.1	94.6	100.0	100.0	98.7
Bristol	43.9	20.0	32.0	98.0	95.8	100.0	98.8
Carlis	67.5	35.0	25.9	75.0	100.0	100.0	87.5
Carsh	48.9	23.8	32.6	100.0	100.0	99.3	99.6
Chelms	43.1	25.6	45.5	100.0	100.0	100.0	100.0
Colchr	25.0	10.0	33.3	100.0	100.0	100.0	100.0
Covnt	37.9	10.3	18.9	90.7	100.0	97.7	95.7
Derby	57.0	21.6	20.8	92.9	100.0	100.0	96.8
Donc	22.4	13.6	54.5	60.0	100.0	100.0	95.9
Dorset	40.0	16.7	30.0	100.0	100.0	100.0	100.0
Dudley	70.8	31.6	19.0	98.0	100.0	96.2	97.8
Exeter	53.4	19.8	21.6	95.0	100.0	98.9	97.4
Glouc	48.7	9.3	10.8	100.0	100.0	100.0	100.0
Hull	56.5	11.3	9.8	98.2	100.0	0.0	55.6
Ipswi	30.3	14.8	40.0	100.0	100.0	100.0	100.0
Kent	33.9	29.6	82.1	100.0	100.0	98.7	99.1
L Barts	1.6	0.5	33.3	0.0	0.0	0.0	0.0
L Guys	3.7	0.8	20.0	100.0	100.0	99.2	99.3
L Kings	39.4	19.6	37.5	94.3	100.0	100.0	98.6
L Rfree	48.0	37.2	64.0	96.8	100.0	98.9	98.9
L St.G	25.8	5.5	16.7	0.0	0.0	0.0	0.0
L West	1.6	1.0	60.0	100.0	100.0	99.0	99.0
Leeds	62.1	30.3	26.5	97.0	94.4	0.0	59.8
Leic	38.4	11.4	20.6	97.1	100.0	99.0	98.5
Liv Ain	15.7	2.3	12.5	0.0	0.0	0.0	0.0
Liv Roy	25.8	8.3	26.1	0.0	0.0	0.0	0.0
M RI	27.9	8.4	23.6	0.0	15.4	21.8	16.8
Middlbr	44.1	12.0	17.3	95.3	100.0	100.0	98.3
Newc	52.6	7.8	7.6	91.8	100.0	100.0	96.0
Newry	36.0	15.8	33.3	83.3	100.0	100.0	96.0
Norwch	10.8	10.8	100.0	0.0	0.0	0.0	0.0
Nottm	66.4	32.4	24.2	96.0	100.0	98.0	97.3
Oxford	18.1	5.4	25.9	60.0	100.0	95.1	90.6
Plymth	47.1	12.2	15.6	100.0	80.0	100.0	98.5
Ports	35.9	15.9	33.8	100.0	100.0	100.0	100.0
Prestn	7.6	3.0	37.5	0.0	0.0	0.0	0.0
Redng	43.6	22.8	38.2	100.0	100.0	100.0	100.0
Salford	36.5	10.8	21.1	100.0	100.0	99.0	99.4
Sheff	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Shrew	67.9	27.0	17.5	95.7	100.0	100.0	97.6
Stevng	52.8	23.9	28.1	100.0	100.0	98.0	99.1
Sthend	36.2	3.2	5.9	100.0	100.0	100.0	100.0
Stoke	16.7	10.3	57.1	0.0	0.0	0.0	0.0
Swanse	75.8	49.5	31.3	95.5	100.0	100.0	97.6
Truro	37.1	4.9	8.7	81.0	100.0	100.0	93.5
Ulster	55.0	14.3	13.6	73.7	100.0	100.0	87.5

Table 1.20. Continued

Centre	% of incident patients who started HD acutely	% of HD recipients with ERF who started on acute HD	% of acute HD recipients who developed ERF	Percentage of each category for which sessional HD data were available			
				AHD	ACHD	CHD	Total
West NI	18.2	12.9	66.7	50.0	100.0	100.0	97.0
Wirral	12.1	0.0	0.0	0.0	0.0	0.0	0.0
Wolve	61.2	16.7	12.7	94.5	100.0	100.0	97.1
Wrexm	29.8	5.7	14.3	83.3	100.0	100.0	95.7
York	54.1	23.5	26.1	100.0	100.0	0.0	54.1
Total	**37.5**	**15.5**	**30.6**	**89.0**	**93.4**	**69.8**	**77.5**

Ten centres supplied no HD sessional data and four supplied acute sessional data only. Three centres do not use acute timeline codes and are not included in this table
HD – haemodialysis; ERF – established renal failure; AHD – started acute HD but never coded as ERF; ACHD – started acute HD and recoded as ERF; CHD – started HD with ERF

acute HD recipients (2.3%) had one or more HD sessions preceding their timeline date of dialysis initiation. A further 47 (2.0%) had sessional data available by at least two weeks after the date of reaching ERF.

Of the 4,310 individuals who started HD for ERF, sessional data were available for 3,010 (69.8%). One hundred and forty-five individuals starting HD for ERF (4.8%) had one or more HD sessions preceding the timeline date of dialysis initiation. Only seven individuals were identified who had sessional HD data, but no timeline entry for acute or chronic HD. These seven individuals were excluded from all analyses. It is not possible to further quantify how many individuals received RRT in 2016 without a timeline code to indicate this.

Acute and chronic HD starts and progression to ERF

Of the 6,891 people who received their first-ever HD session in England, Northern Ireland and Wales in 2016, 5,100 (74.0%) received an ERF code. Of these, 4,310 (84.5%) started HD for ERF, whilst 790 (15.5%) started HD acutely and were subsequently recoded as having ERF. HD sessional data were available for 3,748 (73.5%). A further 1,791 individuals (26.0%) commenced acute HD, but did not develop ERF. Sessional data were available for 1,594 (89.0%) of these individuals. Data relating to death and recovery will be presented in a future report.

Excluding centres that contributed very incomplete or no HD sessional data, 4,191 (79.7%) of 5,257 timeline and sessional HD start dates were identical and 97.2% were within two weeks of each other. Only 31 (0.6%) of the timeline start dates were preceded by two or more weeks of HD sessions.

Table 1.20 presents data for all HD starters at centre level. There was large variation in acute HD use reported by centres, with the percentage of HD starters who received acute HD ranging between 1.6% and 75.8%. The proportion of patients who developed ERF after starting acute HD ranged between 0.0% and 49.5%.

Demography and clinical details of individuals who received only acute HD

Table 1.21 presents demographic and clinical data for the 1,791 individuals who commenced acute HD, but did not progress to ERF. Overall, 62.5% were male and the median age was 70.1 years. Forty-six percent had no cause for AKI coded and a further 16.9% had the cause of their AKI coded non-specifically as 'acute kidney injury'. Seventy-one percent were white and 6.1% were of minority ethnic background. Centres are anonymised in table 1.21 due to the small numbers of patients in some sub-categories and the potential risk of identification.

Discussion

The UK RRT incidence rate for 2016 was 118 pmp, reflecting RRT initiation for 7,759 new patients with ERF. This rate was lower than in 2015 (120 pmp), with significantly lower incidence in Scotland compared with England. Diabetic renal disease remained the single most common cause of renal failure treated by RRT (28.6%), despite late presentation with this condition being the lowest of all PRDs. More men than women

Table 1.21. Demographic and clinical data for individuals who commenced acute haemodialysis, sorted by number of patients

			Cause of acute kidney injury (%)								Ethnicity (%)			
Centre	*N*	% male	AKI	Hypvol	Circ. fail	Sepsis	Rhabdo	Toxicity	Other	Missing	Non-White	White	Missing	Median age
1	10	60	10	0	10	10	0	10	60	0	0	100	0	64
2	12	42	8	0	0	8	0	0	17	67	17	83	0	70
3	12	75	8	0	0	0	0	0	0	92	8	67	25	68
4	12	67	0	17	0	33	0	0	17	33	0	67	33	74
5	16	63	38	0	0	6	0	6	19	31	13	88	0	71
6	17	59	0	0	0	0	0	0	0	100	6	94	0	57
7	19	47	5	0	5	16	0	11	21	42	5	68	26	71
8	19	58	16	0	21	16	0	11	37	0	0	100	0	76
9	20	55	5	0	5	10	0	0	15	65	0	100	0	68
10	20	80	0	0	0	0	0	0	5	95	20	60	20	62
11	20	65	0	0	0	10	10	5	0	75	10	80	10	68
12	21	76	38	5	0	0	0	0	57	0	0	91	10	74
13	21	52	5	0	0	10	5	5	29	48	14	67	19	72
14	21	67	81	0	0	0	0	0	5	14	0	100	0	65
15	27	63	7	4	4	15	0	0	33	37	0	100	0	70
16	29	59	0	0	0	0	0	0	3	97	3	0	97	65
17	31	58	7	0	0	0	3	0	45	45	23	61	16	72
18	33	58	21	3	0	21	0	0	39	15	6	91	3	73
19	34	59	0	0	0	0	0	0	0	100	0	0	100	69
20	35	71	0	3	3	3	0	0	23	69	14	54	31	67
21	37	76	35	0	0	8	11	11	27	8	3	81	16	70
22	42	69	12	2	2	2	2	0	36	43	10	74	17	68
23	42	45	60	0	2	7	7	0	10	14	19	76	5	61
24	43	51	0	0	0	0	0	0	21	79	9	84	7	73
25	43	70	0	0	0	0	0	0	5	95	0	100	0	64
26	43	58	0	0	0	0	0	0	12	88	2	77	21	75
27	45	71	56	0	0	22	9	4	9	0	7	93	0	68
28	47	79	62	0	2	2	4	0	6	23	4	94	2	76
29	51	65	0	0	0	2	0	0	28	71	6	78	16	74
30	51	57	31	2	0	14	4	0	24	26	4	88	8	74
31	55	62	2	0	0	0	0	0	0	98	0	4	96	72
32	55	66	16	6	9	20	2	2	42	4	6	89	6	68
33	75	64	63	0	0	4	0	1	29	3	13	83	4	69
34	80	58	15	13	3	19	4	11	21	15	0	71	29	72
35	82	61	16	6	1	12	5	5	26	29	10	74	16	71
36	85	65	17	8	8	20	7	9	28	2	2	94	4	67
37	91	57	0	0	0	0	0	0	2	98	9	71	20	73
38	100	58	0	0	0	0	0	1	2	97	0	3	97	69
39	104	67	3	0	0	3	1	0	21	72	10	79	12	72
40	110	64	30	2	4	15	6	2	42	1	1	76	23	72
Total	**1,791**	**63**	**17**	**2**	**2**	**8**	**3**	**2**	**21**	**46**	**6**	**71**	**23**	**70**

Centres where $N < 10$ are not shown and centres are anonymised due do the small numbers of patients in some sub-categories and the potential risk of identification

N – number of individuals starting acute haemodialysis at centre; Hypvol. – hypovolaemia; Circ. fail – circulatory failure; Rhabdo.- rhabdomyolysis; Toxicity – nephrotoxicity; AKI – acute kidney injury

The category 'Other' for cause of AKI, groups all of the following answers: pyelonephritis, diabetic kidney disease, renovascular disease, glomerulonephritis, hypertension, uncertain or 'other'

started RRT in every age group (overall 62.9% male, 37.1% female). Incidence amongst the over-65s, which more than tripled between 1990 and 2005, appears to have plateaued at approximately 320 pmp for the past decade. Incidence amongst those aged under 45 has also been stable. Meanwhile, incidence amongst 45 to 64-year olds continued to rise, albeit marginally between 2015 and 2016.

Whilst overall incidence has stabilised, both incidence rates and the total number of new starters was highest in older people. With ongoing population growth and ageing, the incident RRT population is likely to expand and age over the coming decades. The median age of all incident patients in 2016 was 64.3 years, but this was highly dependent on ethnicity (66.2 years for White incident patients; 58.7 years for non-White patients). There was marked variation between CCG/HBs in the rates of older people (>75) starting RRT. This may signify true practice variation, reflective of uncertainty within the renal community about the benefits of dialysis for the oldest patients. However, these data are not adjusted for factors such as rates of comorbid illness or ethnicity that differ between CCG/HBs, or the life-expectancy of the general population, which varies across the UK. A proportion of individuals who developed ERF received comprehensive conservative care in place of renal replacement therapy. Inclusion of CKD data will allow estimation of this population in the near future and will enhance the interpretation of RRT incidence rates.

The percentage of RRT patients at 90 days who had a functioning transplant varied between centres from 0% to 31% (between 2% and 31% for transplanting centres and between 0% and 19% for non-transplanting centres). These data might be seen to represent that transplantation was more likely for an individual who was primarily looked after at a transplant centre. An alternative explanation is that some patients transplanted preemptively were attributed to the incident cohort of their transplanting centre, rather than that from which they were referred.

Although large numbers of patients continued to present late to renal centres, this proportion has dropped substantially in the last decade, from 23.9% in 2006 to 15.6% in 2016. This may be a consequence of CKD guidelines published by NICE [11], 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. Late presentation continued to fall and some centres reported rates of <10%. The proportion of late presenting individuals who have acute or undetected disease is unknown. Correspondingly, the amount of truly avoidable late presentation is unquantified. The Health Foundation has funded an initiative that flags people with declining kidney function to their GP, to ensure they have considered referral to a nephrologist (ASSIST-CKD [12]). This initiative is being managed through Kidney Research UK and the UKRR is leading the evaluation to establish effectiveness.

In 2016, 1,791 individuals in England, Northern Ireland and Wales commenced acute HD, but did not develop ERF. These individuals made up 26% of those

Table 1.22. Instructions for reporting centres regarding use of timeline codes to indicate dialysis initiation

1) Coding must be consistent between centres

2) The timeline should be used to record the date of first dialysis or haemofiltration:

Acute dialysis codes:		**Example dialysis codes indicating ERF (not an exhaustive list)***	
81	Acute HD	1	HD
82	Acute haemofiltration	3	Haemodiafiltration
83	Acute PD	11	CAPD
		12	APD

3) For those who start with an acute code, a separate code must subsequently indicate:

ARF recovered – code 84
ARF stopped dialysis (without recovery of function) – code 85
Development of ERF (codes as listed above plus transplantation)
This code must not be backdated

*For a full list of treatment modality codes see: https://www.renalreg.org/datasets/the-uk-renal-registry-dataset/
CAPD – continuous ambulatory peritoneal dialysis; APD – automated peritoneal dialysis; ARF – acute renal failure

who received HD for the first time during this period. This summary statistic masks striking variation in the reported use of and outcomes from acute HD between centres. Clinical explanations for variation include case mix, case selection and thresholds for initiating dialysis, and the proportion of individuals treated with acute PD or haemofiltration in intensive care units. It seems likely, however, that inconsistent use of timeline codes contributes substantially to inter-centre variation.

Whether an individual is receiving dialysis for AKI or ERF leaves considerable room for clinical interpretation, especially amongst those with advanced CKD. It may be that even a uniform approach to timeline coding cannot adequately distinguish between these groups. Significant input from all contributing renal centres is necessary to ensure data of adequate quality are returned to permit accurate and meaningful conclusions. Since 2009, the UKRR has asked clinicians to use the timeline field on their renal IT system to record the date of first dialysis or haemofiltration and separately, the date on which the patient was deemed to have reached ERF. This allows the distinction between patients who have an acute start and those whose start on RRT was planned. If the patient recovers renal function, an entry should be made in the timeline (table 1.22). Centres should not backdate ERF codes to the date of dialysis initiation, as this negatively influences the quality of survival analyses.

Reassuringly, sessional HD data suggested that start dates are precise for 79.7% and within two weeks for 97.2% of incident HD recipients. These low levels of discordance are unlikely to meaningfully influence overall survival analyses for all HD recipients, although the effect on other analyses (such as eGFR at start) may be greater. The UKRR hopes to improve such analyses with the introduction of realtime data downloads for individuals with advanced CKD and more complete collection of HD sessional data.

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Conflicts of interest: the authors declare no conflicts of interest

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UK Renal Registry 20th Annual Report: Chapter 2 UK Renal Replacement Therapy Adult Prevalence in 2016: National and Centre-specific Analyses

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Keywords

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 63,162 adult patients receiving renal replacement therapy (RRT) in the UK on 31 December 2016, an absolute increase of 3.1% from 2015.
- The actual number of patients increased by 0.9% for haemodialysis (HD), 5.1% for those with a functioning transplant and less than 0.1% for peritoneal dialysis (PD).
- The UK adult prevalence of RRT was 962 per million population (pmp). The reported prevalence in 2000 was 523 pmp.
- The number of patients receiving home HD increased slightly from 1,175 patients in 2015 to 1,256 patients in 2016.
- In 2016 the median age of prevalent patients was 59 years (HD 67 years, PD 64 years, transplant 54 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 75 years in 2016 was 16.0%.
- For all ages, RRT prevalence in men exceeded that in women, peaking in age group 80–84 years at 3,072 pmp in men and in the 70–74 years age group at 1,657 pmp in women.
- The most common identifiable renal diagnosis was glomerulonephritis (19%), followed by diabetes (17%), other (17%) and aetiology uncertain (15%).
- Transplantation continued as the most common treatment modality (54%), HD was used in 40% and PD in 6% of RRT patients.

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Introduction

This chapter presents data on all adult patients on RRT in the UK at the end of 2016. The UK Renal Registry (UKRR) received data returns for 2016 from all five renal centres in Wales, all five in Northern Ireland and 51 in England. Cambridge renal centre (Addenbrooke's) was unable to submit 2015 or 2016 data at patient level prior to the UKRR closing the database and only provided summary numbers of patients starting RRT by treatment modality. This centre is therefore excluded from most analyses in this chapter. 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 capacity 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 ratios were calculated pmp and age/sex 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, HD 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 (see appendix B2 for the allocation procedure). Thus the number of patients allocated to a transplant centre is often lower than that recorded by the centre itself and conversely, pre-emptively transplanted patients were 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 2016 were examined by time on RRT, age group, sex, 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 and denominator.

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 totalling the number of patients in each renal centre located in the country. These numbers differ marginally from those quoted elsewhere in this report when patients are allocated to geographical areas by their individual post codes, because some centres treat patients from across national boundaries.

Table 2.1. Prevalence of adult RRT in the UK on 31/12/2016

	England	N Ireland	Scotland	Wales	UK
Number of prevalent patients	53,361	1,780	4,955	3,066	63,162
Total estimated population, mid-2016 (millions)*	55.3	1.9	5.4	3.1	65.6
Prevalence ratios HD (pmp)	390	340	352	373	385
Prevalence ratios PD (pmp)	56	41	42	66	55
Prevalence ratios dialysis (pmp)	446	382	395	439	440
Prevalence ratios transplant (pmp)	519	574	522	545	522
Prevalence ratios total (pmp)	965	956	917	985	962
95% confidence intervals total (pmp)	957–974	912–1,000	891–942	950–1,020	955–970

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

Pmp – per million population

There were 63,162 adult patients receiving RRT in the UK at the end of 2016, giving an adult UK population prevalence of 962 pmp (table 2.1) compared with 941 pmp in 2015. RRT prevalence increased in all UK countries in 2016. Since 2015 the prevalence of dialysis in the UK remained steady at 440 pmp and there were increases in the prevalence of transplant from 501 pmp in 2015 to 522 in 2016. There had been a slow decline in PD prevalence in previous years, but prevalence in 2016 remained at the same level as in 2015. As observed in the previous year, Northern Ireland exhibited a higher RRT prevalence for patients aged 75 years and older compared with the other UK countries (figure 2.1). In the UK, RRT prevalence in patients aged 80–84 continued to rise from 2,044 per million age related population (pmarp) in 2015 to 2,098 pmarp in 2016 and in patients aged ⩾85 years from 1,084 pmarp in 2015 to 1,129 pmarp in 2016. This trend has been remarked upon over a number of years and the observed aging of the prevalent population is likely due in part to improving patient survival.

Prevalent patients by RRT modality and centre

There was a marked variation in the number of prevalent patients across renal centres and the distribution of their treatment modalities also varied widely (table 2.2).

Changes in prevalence

The prevalent UK RRT population grew by 3.2% between 2015 and 2016 (table 2.3), an annual growth rate which has been fairly consistent over the last 10–15 years (figure 2.2).

The increase in prevalence was greatest in Northern Ireland (4.6%) and most modest in Wales (0.9%).

The number of prevalent HD patients increased by 0.1% in 2016 compared with 2015, which was a much smaller increase than that seen between 2014 and 2015 (2.7% growth in prevalence pmp). There continued to be an increase in prevalent transplant patients (4.2% pmp) and very little change in prevalent PD patients (0.6% pmp decrease).

The average annual change in prevalent patients between 2012 and 2016 was a 1.0% pmp increase in HD, 2.1% pmp fall in PD and 4.6% pmp growth in prevalent transplant patients (table 2.4). In the same period there was an average annual 15.5% pmp growth (an absolute increase of 451 from 737 to 1,188) in the use of home haemodialysis (data not shown).

The long-term (1997–2016) UK prevalence pattern by treatment modality is shown in figure 2.2. The steady growth in transplant numbers was maintained in 2016.

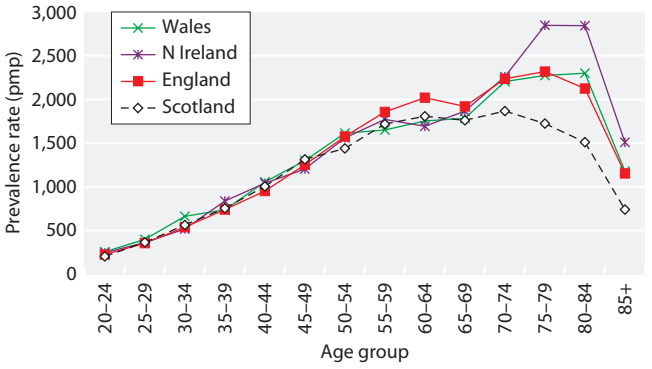

Fig. 2.1. RRT prevalence pmp by age group and UK country on 31/12/2016

The increase in home haemodialysis patient numbers over this period has been associated with more than a doubling in prevalence, from 1.9% of the dialysis population in 2006 ($N = 445$) to 4.4% in 2016 ($N = 1,256$). In contrast, PD has fallen by 4.9% between 2006 and 2016.

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

There were substantial variations in the crude CCG/HB prevalence ratios pmp (table 2.5), from 639 pmp in Lincolnshire (NHS South West Lincolnshire, population 125,200) and 641 pmp in Orkney (Orkney, population 21,900) to 1,773 pmp in Brent (NHS Brent, population 328,300). However, as described in table 2.5, estimates for some CCGs (denoted with an [a,b] in table 2.5, including NHS South West Lincolnshire) may be underestimated given that 5–15% of patients from these CCGs were estimated to be treated at the Cambridge renal centre, which was unable to provide patient-level data in 2015 or 2016.

There were similar variations in the SPRs (ratio of observed: expected prevalence given the age/sex breakdown of the CCG/HB) from 0.57 (Orkney) to 2.37 (NHS Bradford City) (table 2.5). Confidence intervals are not presented for the crude ratios pmp for 2016 but

Table 2.2. Number of prevalent RRT patients by treatment modality and centre on 31/12/2016

Centre	*N*					Catchment population (millions)	2016 crude rate pmp	(95% CI)
	HD	PD	Dialysis	Transplant	RRT			
England								
B Heart	395	88	483	171	654	0.74	886	(818–954)
B QEH[a]	1,009	143	1,152	1,242	2,394	1.70	1,409	(1,352–1,465)
Basldn	162	34	196	80	276	0.42	665	(587–743)
Bradfd	250	25	275	360	635	0.65	974	(898–1,050)
Brightn	459	65	524	472	996	1.30	768	(720–816)
Bristol[a]	510	53	563	907	1,470	1.44	1,021	(969–1,074)
Camb[a,b]	429	23	452	1,099	1,551	1.16	1,339	(1,273–1,406)
Carlis	94	35	129	150	279	0.32	870	(768–972)
Carsh	848	113	961	680	1,641	1.91	858	(816–899)
Chelms	133	33	166	112	278	0.51	545	(481–609)
Colchr	124		124		124	0.30	414	(341–487)
Covnt[a]	377	66	443	534	977	0.89	1,095	(1,027–1,164)
Derby	241	77	318	225	543	0.70	773	(708–838)
Donc	194	27	221	109	330	0.41	805	(718–892)
Dorset	281	37	318	369	687	0.86	797	(738–857)
Dudley	203	50	253	93	346	0.44	783	(701–866)
Exeter	455	84	539	478	1,017	1.09	934	(876–991)
Glouc	244	42	286	184	470	0.59	800	(728–873)
Hull	329	72	401	457	858	1.02	841	(785–897)
Ipswi	146	36	182	229	411	0.40	1,030	(931–1,130)
Kent	430	56	486	584	1,070	1.22	874	(822–926)
L Barts[a]	1,030	202	1,232	1,140	2,372	1.83	1,296	(1,244–1,348)
L Guys[a]	693	39	732	1,366	2,098	1.08	1,938	(1,855–2,021)
L Kings	581	91	672	436	1,108	1.17	946	(890–1,002)
L Rfree[a]	729	160	889	1,288	2,177	1.52	1,434	(1,374–1,494)
L St.G[a]	354	45	399	464	863	0.80	1,082	(1,010–1,154)
L West[a]	1,471	101	1,572	1,845	3,417	2.40	1,424	(1,377–1,472)
Leeds[a]	525	48	573	979	1,552	1.67	929	(883–975)
Leic[a]	965	89	1,054	1,256	2,310	2.44	948	(910–987)
Liv Ain	187	26	213	14	227	0.48	469	(408–530)
Liv Roy[a]	366	72	438	882	1,320	1.00	1,320	(1,249–1,391)
M RI[a]	526	62	588	1,406	1,994	1.53	1,302	(1,245–1,359)
Middlbr	332	27	359	532	891	1.00	887	(829–946)
Newc[a]	320	53	373	680	1,053	1.12	939	(883–996)
Norwch	331	49	380	394	774	0.79	984	(915–1,053)
Nottm[a]	393	82	475	677	1,152	1.09	1,059	(998–1,120)
Oxford[a]	450	95	545	1,222	1,767	1.69	1,045	(997–1,094)
Plymth[a]	144	40	184	329	513	0.47	1,092	(998–1,187)
Ports[a]	636	75	711	982	1,693	2.02	837	(797–876)
Prestn	564	40	604	602	1,206	1.49	808	(762–853)
Redng	303	56	359	435	794	0.91	872	(812–933)
Salford	402	107	509	513	1,022	1.49	686	(644–728)
Sheff[a]	616	55	671	756	1,427	1.37	1,040	(986–1,094)
Shrew	205	39	244	131	375	0.50	749	(673–825)
Stevng	532	22	554	350	904	1.20	751	(702–800)
Sthend	114	30	144	93	237	0.32	748	(653–843)
Stoke	346	79	425	402	827	0.89	930	(866–993)
Sund	251	17	268	239	507	0.62	820	(749–891)
Truro	170	18	188	240	428	0.41	1,036	(938–1,134)
Wirral	199	22	221	116	337	0.57	589	(526–652)
Wolve	314	70	384	185	569	0.67	851	(781–921)
York	198	33	231	304	535	0.49	1,087	(995–1,179)

Table 2.2. Continued

Centre	N					Catchment population (millions)	2016 crude rate pmp	(95% CI)
	HD	PD	Dialysis	Transplant	RRT			
Northern Ireland								
Antrim	123	16	139	102	241	0.29	818	(714–921)
Belfast[a]	194	24	218	611	829	0.64	1,302	(1,213–1,390)
Newry	87	21	108	129	237	0.26	907	(792–1,023)
Ulster	102	6	108	58	166	0.27	624	(529–719)
West NI	128	10	138	169	307	0.35	873	(775–970)
Scotland								
Abrdn	231	21	252	305	557	0.60	928	(851–1,006)
Airdrie	185	24	209	231	440	0.55	797	(723–872)
D & Gall	50	10	60	71	131	0.15	883	(731–1,034)
Dundee	179	21	200	220	420	0.46	907	(820–993)
Edinb[a]	289	37	326	454	780	0.96	809	(752–866)
Glasgw[a]	593	54	647	1,107	1,754	1.62	1,080	(1,030–1,131)
Inverns	93	11	104	156	260	0.27	963	(846–1,080)
Klmarnk	141	33	174	144	318	0.36	880	(783–977)
Krkcldy	144	18	162	133	295	0.32	931	(825–1,038)
Wales								
Bangor	75	16	91	0	91	0.22	417	(331–503)
Cardff[a]	517	75	592	1,038	1,630	1.42	1,148	(1,092–1,204)
Clwyd	73	15	88	90	178	0.19	939	(801–1,076)
Swanse	373	67	440	328	768	0.89	867	(806–929)
Wrexm	124	33	157	153	310	0.24	1,290	(1,147–1,434)
England	**21,560**	**3,103**	**24,663**	**28,698**	**53,361**			
N Ireland	**634**	**77**	**711**	**1,069**	**1,780**			
Scotland	**1,905**	**229**	**2,134**	**2,821**	**4,955**			
Wales	**1,162**	**206**	**1,368**	**1,698**	**3,066**			
UK	**25,261**	**3,615**	**28,876**	**34,286**	**63,162**			

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, because some centres treat patients from across national boundaries
[a]Transplant centre
[b]Cambridge was unable to submit 2016 data at patient level but provided summary numbers of patients still on RRT at the end of 2016, by treatment modality and prevalent numbers. This centre is therefore excluded from all centre level prevalent analyses. Tables 2.1, 2.2, 2.3 and 2.4 reflect these revisions: Camb (+1,551)

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.

Factors associated with variation in SPRs in CCGs in England, Health and Social Care Trust Areas in Northern Ireland (HBs), Local Health Boards in Wales (HBs) and Health Boards in Scotland (HBs)

In 2016, there were 77 CCGs/HBs with a significantly low SPR, 103 with a 'normal' SPR and 45 with a significantly high SPR (table 2.5). Prevalence ratios were not estimated for eight CCGs where more than 15% of patients were estimated to be treated at the Cambridge renal centre which was unable to provide patient-level data.

As seen in previous years, SPRs tended to reflect the demographics of the regions in question such that urban, ethnically diverse populations in areas of high social deprivation had the highest prevalence of RRT. For example, the association with the level of ethnic diversity is illustrated by the fact that mean SPRs were significantly higher in the 84 CCGs/HBs with an ethnic minority population greater than 10% than in those with lower ethnic minority populations ($p < 0.001$). There was a strong, positive correlation between the

Table 2.3. Number of prevalent patients on RRT by centre at year end 2012–2016

Centre	Date					% change 2015–2016	% annual change 2012–2016
	31/12/2012	31/12/2013	31/12/2014	31/12/2015	31/12/2016		
England							
B Heart	668	654	635	654	654	0.0	−0.5
B QEH	1,970	2,045	2,134	2,247	2,394	6.5	5.0
Basldn	258	270	278	274	276	0.7	1.7
Bradfd	504	520	548	584	635	8.7	5.9
Brightn	829	870	914	950	996	4.8	4.7
Bristol	1,338	1,424	1,458	1,477	1,470	−0.5	2.4
Camb	1,111	1,191	1,241	1,539	1,551	0.8	8.7
Carlis	216	227	250	281	279	−0.7	6.6
Carsh	1,455	1,479	1,551	1,582	1,641	3.7	3.1
Chelms	225	241	261	288	278	−3.5	5.4
Colchr	117	115	119	120	124	3.3	1.5
Covnt	899	929	960	961	977	1.7	2.1
Derby	474	464	513	538	543	0.9	3.5
Donc	261	259	284	302	330	9.3	6.0
Dorset	609	627	664	681	687	0.9	3.1
Dudley	315	310	305	314	346	10.2	2.4
Exeter	842	888	945	968	1,017	5.1	4.8
Glouc	415	410	428	443	470	6.1	3.2
Hull	782	813	801	857	858	0.1	2.3
Ipswi	339	355	367	403	411	2.0	4.9
Kent	918	958	1,013	1,039	1,070	3.0	3.9
L Barts	1,947	2,090	2,208	2,278	2,372	4.1	5.1
L Guys	1,738	1,828	1,913	2,012	2,098	4.3	4.8
L Kings	917	963	1,023	1,084	1,108	2.2	4.8
L Rfree	1,841	1,921	2,006	2,093	2,177	4.0	4.3
L St.G	705	755	793	846	863	2.0	5.2
L West	3,078	3,121	3,231	3,315	3,417	3.1	2.6
Leeds	1,413	1,464	1,500	1,523	1,552	1.9	2.4
Leic	1,974	2,067	2,145	2,184	2,310	5.8	4.0
Liv Ain	194	190	217	221	227	2.7	4.0
Liv Roy	1,228	1,263	1,268	1,237	1,225	−1.0	−0.1
M RI	1,710	1,854	1,795	1,890	1,994	5.5	3.9
Middlbr	788	827	854	902	891	−1.2	3.1
Newc	946	962	977	1,009	1,053	4.4	2.7
Norwch	622	690	687	740	774	4.6	5.6
Nottm	1,012	1,073	1,061	1,113	1,152	3.5	3.3
Oxford	1,532	1,563	1,655	1,691	1,767	4.5	3.6
Plymth	458	502	502	503	513	2.0	2.9
Ports	1,439	1,544	1,591	1,669	1,693	1.4	4.1
Prestn	1,079	1,089	1,171	1,215	1,206	−0.7	2.8
Redng	672	731	760	775	794	2.5	4.3
Salford	880	881	971	974	1,022	4.9	3.8
Sheff	1,299	1,328	1,361	1,384	1,427	3.1	2.4
Shrew	354	338	349	368	375	1.9	1.5
Stevng	664	755	778	817	904	10.6	8.0
Sthend	213	220	238	246	237	−3.7	2.7
Stoke	699	724	775	788	827	4.9	4.3
Sund	422	421	450	459	507	10.5	4.7
Truro	375	371	379	415	428	3.1	3.4
Wirral	226	248	277	280	337	20.4	10.5
Wolve	524	567	574	582	569	−2.2	2.1
York	396	409	461	490	535	9.2	7.8

Table 2.3. Continued

Centre	Date					% change 2015–2016	% annual change 2012–2016
	31/12/2012	31/12/2013	31/12/2014	31/12/2015	31/12/2016		
N Ireland							
Antrim	223	224	229	239	241	0.8	2.0
Belfast	702	726	747	772	829	7.4	4.2
Newry	188	199	208	226	237	4.9	6.0
Ulster	145	155	149	171	166	−2.9	3.4
West NI	254	238	274	293	307	4.8	4.9
Scotland							
Abrdn	507	517	502	532	557	4.7	2.4
Airdrie	389	389	395	425	440	3.5	3.1
D & Gall	128	119	130	130	131	0.8	0.6
Dundee	395	398	401	420	420	0.0	1.5
Edinb	720	737	747	770	780	1.3	2.0
Glasgw	1,536	1,586	1,607	1,710	1,754	2.6	3.4
Inverns	220	216	225	253	260	2.8	4.3
Klmarnk	301	296	299	310	318	2.6	1.4
Krkcldy	278	283	277	295	295	0.0	1.5
Wales							
Bangor	105	99	102	182	177	−2.7	13.9
Cardff	1,544	1,583	1,591	1,612	1,630	1.1	1.4
Clwyd	173	152	166	185	178	−3.8	0.7
Swanse	663	692	707	766	768	0.3	3.7
Wrexm	248	251	282	293	310	5.8	5.7
England	**45,890**	**47,808**	**49,639**	**51,605**	**53,361**	**3.4**	**3.8**
N Ireland	**1,512**	**1,542**	**1,607**	**1,701**	**1,780**	**4.6**	**4.2**
Scotland	**4,474**	**4,541**	**4,583**	**4,845**	**4,955**	**2.3**	**2.6**
Wales	**2,733**	**2,777**	**2,848**	**3,038**	**3,066**	**0.9**	**2.9**
UK	**54,609**	**56,668**	**58,677**	**61,189**	**63,162**	**3.2**	**3.7**

SPR and percentage of the population that were non-White ($r = 0.9$, $p < 0.001$). In 2016, for each 10% increase in ethnic minority population, the SPR increased by 0.17 (equates to ~17%). These trends are identical to those identified previously. The relationship between the ethnic composition of a CCG/HB and its SPR is demonstrated in figure 2.3.

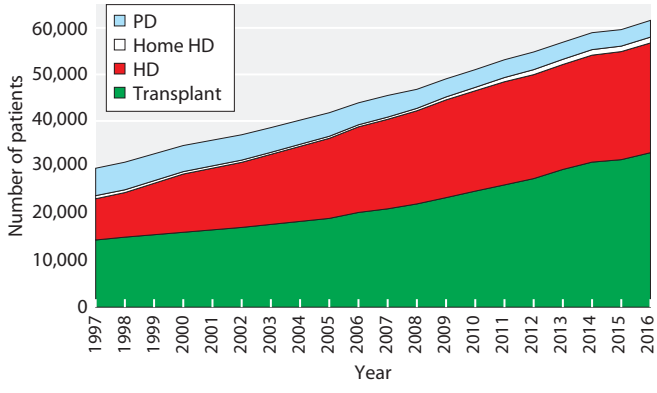

Fig. 2.2. Growth in prevalent patients by treatment modality at the end of each year 1997–2016

Excluding the eight CCGs where ⩾15% of their population was covered by Cambridge, only three of the 139 CCGs/HBs with ethnic minority populations of less than 10% had high SPRs: Belfast in Northern Ireland, Cwm Taf and Abertawe Bro Morgannwg University in Wales. Of the 86 CCGs/HBs with ethnic minority populations greater than or equal to 10%, 42 (48.8%) had high SPRs, whereas eleven (12.8%) (NHS Chiltern, NHS Leeds North, NHS Leeds West, NHS Richmond, NHS Havering, NHS Solihull, NHS Calderdale, NHS Newcastle and Gateshead, NHS East and North Hertfordshire, NHS Medway, NHS Trafford) had low SPRs. Some of the CCGs/HBs with a high (>15%) ethnic minority population had a normal expected RRT prevalence (e.g. NHS Central London (Westminster), NHS Wolverhampton, NHS Sheffield, NHS Crawley). Therefore, although differences in proportions of ethnic minority populations

Table 2.4. Change in RRT prevalence ratio pmp 2012–2016 by modality*

	Prevalence					% growth in prevalence pmp				
Year	HD pmp	PD pmp	Dialysis pmp	Transplant pmp	RRT pmp	HD	PD	Dialysis	Transplant	RRT
2012	370	60	430	436	866					
2013	369	57	427	462	888	−0.1	−4.6	−0.8	5.8	2.5
2014	374	56	430	482	913	1.3	−1.5	0.9	4.5	2.8
2015	384	55	440	501	941	2.7	−1.6	2.2	3.9	3.1
2016	385	55	440	522	962	0.1	−0.6	0.0	4.2	2.3
Average annual growth 2012–2016						1.0	−2.1	0.6	4.6	2.7

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

are clearly important in explaining differences in SPR they are not the only explanation.

The age and sex SPRs (which do not take into account variation in ethnicity) in each region of England and in Wales, Northern Ireland and Scotland are presented in table 2.6. Wales and Northern Ireland previously had higher than expected RRT prevalence but in more recent years were similar to expected. Scotland had lower than expected RRT prevalence as did the North and South of England. RRT prevalence in London remained higher than expected.

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 31 December 2016. Median time on RRT for all prevalent patients has remained fairly static at 6.2 years (6.2 years in 2015, 6.1 years in 2014). Patients with functioning transplants had survived a median of 10.3 years on RRT whilst the median time on RRT of HD and PD patients was significantly less (3.2 and 1.5 years respectively). The median time on HD was more than double that on PD and this could reflect early transplantation in the latter as well as higher technique failure rates for PD.

Age

The median age of prevalent UK patients on RRT at 31 December 2016 (59.1 years, table 2.8) has remained stable over recent years although it is significantly higher than in 2005 when it was 55.0 years. As observed previously, there were marked differences between modalities; the median age of HD patients (67.2 years) was greater than that of those on PD (63.7 years) and substantially higher than that of transplanted patients (54.3 years). Of the UK prevalent RRT population, 49.9% were in the 40–64 years age group (table 2.9). The proportion of patients aged 75 years and older varied greatly between countries and was highest in Wales (17.8%) and Northern Ireland (18.4%) and lowest in Scotland (12.5%) (table 2.9). Within countries there were large differences in the proportion of patients aged over 75 (within England these ranged between 8.8% in Liverpool Royal Infirmary and 41.4% in Colchester). In most centres the prevalent PD population was younger than the HD population (table 2.8).

Inter-centre differences in the median age of prevalent patients by treatment modality can reflect differing demographics of the catchment populations as well as differing approaches to treatment modalities. For example, Colchester had the highest median age (72.0 years), whilst London Guy's the lowest (55.3 years) (table 2.8). This could reflect either variation in the catchment populations or follow-up of younger transplant patients (Colchester had no transplant patients whereas 65% of prevalent patients at London Guy's were transplant patients). The median age of the non-White dialysis population was lower than the overall dialysis population (62.0 vs 66.8 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 was 24 years later than for prevalent transplant patients.

In the UK on 31 December 2016, 66.3% of patients on RRT aged less than 65 years had a functioning transplant (table 2.15), compared with only 32.6% of those aged 65 years and over. There was a similar pattern in all four UK countries, although the proportion of patients aged less than 65 years with a functioning transplant in Northern Ireland (77.4%) was much higher than elsewhere.

Sex

The age distributions of males and females were very similar (data not shown). Standardising the age of the

Table 2.5. Prevalence of RRT and SPRs in CCG/HB area

O/E – ratio of observed:expected rate of RRT given the age and sex breakdown of the area
LCL – lower 95% confidence limit
UCL – upper 95% confidence limit
Areas with significantly low SPRs in 2016 are italicised in lighter greyed areas, those with significantly high SPRs in 2016 are bold in darker greyed areas
Population numbers are the 2016 mid-year estimates by age group and sex (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
Office of National Statistics specifies that the populations should be rounded to the nearest 100 when presented

UK area	Name	Total population	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016 O/E	2016 95% LCL	2016 95% UCL	2016 Crude rate pmp	% non-White
Cheshire, Warrington and Wirral	*NHS Eastern Cheshire*	*196,900*	*0.76*	*0.81*	*0.78*	*0.78*	*0.77*	*0.72*	*0.62*	*0.84*	*792*	*3.7*
	NHS South Cheshire	179,800	0.90	0.88	0.90	0.94	0.95	0.93	0.80	1.08	968	2.9
	NHS Vale Royal	*103,700*	*0.78*	*0.73*	*0.79*	*0.74*	*0.74*	*0.69*	*0.55*	*0.86*	*704*	*2.1*
	NHS Warrington	*208,800*	*0.80*	*0.82*	*0.84*	*0.91*	*0.87*	*0.83*	*0.71*	*0.96*	*819*	*4.1*
	NHS West Cheshire	*232,000*	*0.99*	*0.96*	*0.97*	*0.95*	*0.83*	*0.86*	*0.75*	*0.98*	*892*	*2.8*
	NHS Wirral	*321,200*	*0.84*	*0.82*	*0.83*	*0.75*	*0.73*	*0.76*	*0.67*	*0.86*	*784*	*3.0*
Durham, Darlington and Tees	NHS Darlington	105,600	0.80	0.85	0.85	0.84	0.87	0.85	0.69	1.04	852	3.8
	NHS Durham Dales, Easington and Sedgefield	274,600	0.99	0.95	0.98	0.98	0.98	0.95	0.85	1.07	998	1.2
	NHS Hartlepool and Stockton-on-Tees	*288,500*	*0.89*	*0.91*	*0.89*	*0.92*	*0.88*	*0.84*	*0.74*	*0.96*	*818*	*4.4*
	NHS North Durham	*247,500*	*0.76*	*0.84*	*0.80*	*0.79*	*0.78*	*0.77*	*0.67*	*0.89*	*776*	*2.5*
	NHS South Tees	275,800	1.12	1.11	1.11	1.07	1.13	1.08	0.97	1.22	1,051	6.7
Greater Manchester	NHS Bolton	283,100	1.11	1.10	1.06	1.02	1.03	1.06	0.94	1.19	982	18.1
	NHS Bury	188,700	0.92	0.92	0.91	0.95	0.98	0.97	0.84	1.12	933	10.8
	NHS Heywood, Middleton & Rochdale	216,200	1.00	1.00	1.04	1.05	1.05	1.10	0.97	1.26	1,013	18.3
	NHS Manchester	**541,300**	**1.11**	**1.16**	**1.19**	**1.22**	**1.24**	**1.26**	**1.15**	**1.37**	**896**	**33.5**
	NHS Oldham	232,700	0.94	0.93	0.96	0.95	0.99	1.02	0.90	1.17	915	22.5
	NHS Salford	248,700	0.85	0.88	0.90	0.87	0.83	0.89	0.77	1.02	772	9.9
	NHS Stockport	*290,600*	*0.88*	*0.87*	*0.80*	*0.81*	*0.82*	*0.83*	*0.73*	*0.94*	*833*	*7.9*
	NHS Tameside and Glossop	256,400	0.94	0.94	0.93	0.91	0.89	0.94	0.83	1.07	913	8.2
	NHS Trafford	*234,700*	*0.84*	*0.85*	*0.87*	*0.88*	*0.84*	*0.83*	*0.72*	*0.96*	*793*	*14.5*
	NHS Wigan Borough	323,100	0.90	0.94	0.96	0.97	0.92	0.93	0.83	1.04	932	2.7
Lancashire	**NHS Blackburn with Darwen**	**147,000**	**1.30**	**1.27**	**1.26**	**1.22**	**1.24**	**1.20**	**1.03**	**1.41**	**1,047**	**30.8**
	NHS Blackpool	139,200	0.78	0.88	0.96	1.04	1.01	0.98	0.83	1.15	999	3.3
	NHS Chorley and South Ribble	174,300	0.81	0.87	0.94	0.92	0.89	0.87	0.74	1.02	878	2.9
	NHS East Lancashire	375,800	1.03	0.99	1.01	1.01	0.98	0.97	0.88	1.08	955	11.9
	NHS Fylde & Wyre	*169,000*	*0.83*	*0.85*	*0.85*	*0.84*	*0.86*	*0.83*	*0.71*	*0.97*	*953*	*2.1*
	NHS Greater Preston	203,500	0.83	0.90	0.87	0.88	0.88	0.88	0.75	1.02	821	14.7
	NHS Morecombe Bay	*348,500*	*0.73*	*0.75*	*0.74*	*0.72*	*0.73*	*0.70*	*0.62*	*0.79*	*743*	*4.0*
	NHS West Lancashire	*113,400*	*0.86*	*0.82*	*0.77*	*0.75*	*0.80*	*0.75*	*0.61*	*0.93*	*776*	*1.9*
Merseyside	NHS Halton	126,900	1.06	1.02	1.01	1.01	1.02	1.01	0.85	1.21	985	2.2
	NHS Knowsley	147,900	0.97	1.02	0.97	0.99	0.98	0.94	0.80	1.12	899	2.8
	NHS Liverpool	484,600	1.07	1.05	1.03	1.04	1.01	0.98	0.89	1.08	861	11.1
	NHS South Sefton	158,900	0.94	0.95	0.95	0.98	0.97	0.99	0.84	1.15	1,013	2.2
	NHS Southport and Formby	*115,400*	*0.83*	*0.76*	*0.80*	*0.81*	*0.76*	*0.75*	*0.62*	*0.92*	*841*	*3.1*
	NHS St Helens	*178,500*	*0.90*	*0.92*	*0.86*	*0.86*	*0.85*	*0.85*	*0.72*	*0.99*	*863*	*2.0*
Cumbria, Northumberland, Tyne and Wear	*NHS Cumbria North*	*318,200*	*0.73*	*0.70*	*0.73*	*0.76*	*0.81*	*0.80*	*0.71*	*0.90*	*870*	*1.5*
	NHS Newcastle Gateshead	*498,100*	*0.89*	*0.88*	*0.84*	*0.84*	*0.84*	*0.85*	*0.77*	*0.94*	*769*	*10.1*
	NHS North Tyneside	203,300	0.93	0.94	0.97	0.90	0.88	0.91	0.79	1.05	930	3.4
	NHS Northumberland	*316,000*	*0.74*	*0.74*	*0.72*	*0.77*	*0.76*	*0.73*	*0.65*	*0.83*	*816*	*1.6*
	NHS South Tyneside	149,400	1.04	0.98	0.94	0.86	0.84	0.95	0.81	1.12	970	4.1
	NHS Sunderland	278,000	0.98	1.00	0.95	0.96	0.94	1.01	0.90	1.14	1,011	4.1

Table 2.5. Continued

UK area	Name	Total population	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016 O/E	2016 95% LCL	2016 95% UCL	2016 Crude rate pmp	% non-White
North Yorkshire and Humber	*NHS East Riding of Yorkshire*	*315,900*	*0.85*	*0.83*	*0.81*	*0.80*	*0.80*	*0.79*	*0.71*	*0.89*	*896*	*1.9*
	NHS Hambleton, Richmondshire and Whitby	*153,200*	*0.65*	*0.67*	*0.73*	*0.75*	*0.74*	*0.70*	*0.58*	*0.83*	*770*	*2.7*
	NHS Harrogate and Rural District	156,300	0.82	0.86	0.84	0.88	0.93	0.91	0.78	1.06	985	3.7
	NHS Hull	260,200	1.00	0.95	0.97	1.02	1.08	1.10	0.97	1.24	972	5.9
	NHS North East Lincolnshire	159,100	1.08	1.04	1.00	0.96	0.97	0.93	0.79	1.09	930	2.6
	NHS North Lincolnshire	170,800	0.84	0.88	0.94	0.89	0.89	0.88	0.75	1.03	908	4.0
	NHS Scarborough and Ryedale	111,400	0.90	0.94	0.91	0.89	0.87	0.88	0.73	1.06	979	2.5
	NHS Vale of York	357,900	0.88	0.93	0.92	0.90	0.88	0.90	0.81	1.01	900	4.0
South Yorkshire and Bassetlaw	NHS Barnsley	241,200	1.11	1.05	1.02	1.03	0.99	1.02	0.90	1.16	1,028	2.1
	NHS Bassetlaw	114,800	0.83	0.89	0.83	0.83	0.84	0.83	0.68	1.00	879	2.6
	NHS Doncaster	306,400	0.98	0.96	0.93	0.96	0.95	0.97	0.87	1.09	960	4.7
	NHS Rotherham	261,900	1.07	1.06	1.04	1.04	1.05	1.05	0.94	1.19	1,054	6.4
	NHS Sheffield	575,400	1.11	1.13	1.12	1.10	1.08	1.05	0.97	1.15	928	16.3
West Yorkshire	NHS Airedale, Wharfedale and Craven	160,000	0.80	0.80	0.81	0.86	0.89	0.86	0.73	1.01	894	11.1
	NHS Bradford City	**84,900**	**1.80**	**1.88**	**1.94**	**2.15**	**2.14**	**2.31**	**1.93**	**2.75**	**1,449**	**72.2**
	NHS Bradford Districts	**339,700**	**1.17**	**1.24**	**1.22**	**1.19**	**1.22**	**1.28**	**1.16**	**1.41**	**1,110**	**28.7**
	NHS Calderdale	*209,800*	*1.02*	*0.95*	*0.90*	*0.85*	*0.86*	*0.85*	*0.73*	*0.98*	*834*	*10.3*
	NHS Greater Huddersfield	245,000	0.92	0.98	0.95	0.97	0.96	0.94	0.82	1.07	898	17.4
	NHS Leeds North	*201,200*	*1.00*	*0.95*	*0.90*	*0.87*	*0.88*	*0.86*	*0.74*	*1.00*	*840*	*17.4*
	NHS Leeds South and East	253,700	0.96	0.95	0.95	0.98	0.97	0.97	0.85	1.11	812	18.3
	NHS Leeds West	*326,900*	*0.82*	*0.80*	*0.86*	*0.89*	*0.90*	*0.88*	*0.78*	*1.00*	*731*	*10.8*
	NHS North Kirklees	**192,000**	**1.17**	**1.14**	**1.24**	**1.23**	**1.17**	**1.20**	**1.04**	**1.37**	**1,083**	**25.3**
	NHS Wakefield	*336,800*	*0.86*	*0.88*	*0.87*	*0.86*	*0.82*	*0.83*	*0.74*	*0.93*	*828*	*4.6*
Arden, Herefordshire and Worcestershire	**NHS Coventry and Rugby**	**456,700**	**1.24**	**1.29**	**1.27**	**1.22**	**1.15**	**1.16**	**1.06**	**1.27**	**994**	**22.2**
	NHS Herefordshire	*189,300*	*0.79*	*0.79*	*0.77*	*0.77*	*0.85*	*0.85*	*0.73*	*0.98*	*930*	*1.8*
	NHS Redditch and Bromsgrove	181,700	0.91	0.94	0.89	0.89	0.89	0.89	0.77	1.04	908	6.0
	NHS South Warwickshire	262,700	0.95	0.92	0.91	0.92	0.94	0.91	0.80	1.03	944	7.0
	NHS South Worcestershire	*301,400*	*0.81*	*0.83*	*0.80*	*0.80*	*0.79*	*0.79*	*0.70*	*0.89*	*839*	*3.7*
	NHS Warwickshire North	190,200	1.15	1.06	1.07	1.10	1.07	1.04	0.90	1.19	1,057	6.5
	NHS Wyre Forest	99,900	0.92	0.90	0.89	0.99	0.90	0.91	0.75	1.11	991	2.8
Birmingham and the Black Country	**NHS Birmingham CrossCity**	**748,300**	**1.45**	**1.45**	**1.43**	**1.42**	**1.43**	**1.47**	**1.38**	**1.57**	**1,205**	**35.2**
	NHS Birmingham South and Central	**204,000**	**1.69**	**1.74**	**1.73**	**1.71**	**1.66**	**1.69**	**1.50**	**1.90**	**1,324**	**40.4**
	NHS Dudley	317,600	0.90	0.96	0.97	0.95	0.94	0.95	0.85	1.06	948	10.0
	NHS Sandwell and West Birmingham	**495,100**	**1.76**	**1.72**	**1.70**	**1.67**	**1.69**	**1.77**	**1.65**	**1.91**	**1,450**	**45.3**
	NHS Solihull	*211,800*	*0.92*	*0.89*	*0.86*	*0.83*	*0.85*	*0.84*	*0.72*	*0.97*	*850*	*10.9*
	NHS Walsall	**278,700**	**1.34**	**1.31**	**1.32**	**1.33**	**1.30**	**1.25**	**1.12**	**1.39**	**1,162**	**21.1**
	NHS Wolverhampton	256,600	1.13	1.14	1.15	1.16	1.13	1.12	1.00	1.27	1,025	32.0
Derbyshire and Nottinghamshire	NHS Erewash	96,700	1.01	0.99	0.92	0.89	0.97	0.95	0.78	1.17	951	3.2
	NHS Hardwick	*111,400*	*0.77*	*0.74*	*0.72*	*0.73*	*0.74*	*0.74*	*0.60*	*0.91*	*772*	*1.8*
	NHS Mansfield & Ashfield	197,900	0.96	0.92	0.93	0.94	0.93	0.92	0.80	1.07	925	2.5
	NHS Newark & Sherwood	119,700	1.12	1.07	1.02	0.98	0.90	0.84	0.70	1.02	894	2.4
	NHS North Derbyshire	*273,200*	*0.83*	*0.81*	*0.80*	*0.78*	*0.77*	*0.78*	*0.68*	*0.88*	*849*	*2.5*
	NHS Nottingham City	**325,300**	**1.16**	**1.13**	**1.14**	**1.13**	**1.19**	**1.21**	**1.08**	**1.36**	**919**	**28.5**
	NHS Nottingham North & East	*150,300*	*0.90*	*0.91*	*0.88*	*0.85*	*0.82*	*0.84*	*0.70*	*1.00*	*851*	*6.2*
	NHS Nottingham West	112,700	0.99	1.04	1.07	1.07	1.06	1.04	0.87	1.24	1,065	7.3
	NHS Rushcliffe	*115,200*	*0.87*	*0.77*	*0.83*	*0.78*	*0.74*	*0.73*	*0.59*	*0.90*	*755*	*6.9*
	NHS Southern Derbyshire	527,400	1.02	0.98	0.98	0.99	0.99	0.99	0.91	1.08	961	11.0

Table 2.5. Continued

UK area	Name	Total population	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016 O/E	2016 95% LCL	2016 95% UCL	2016 Crude rate pmp	% non-White
East Anglia	NHS Cambridgeshire and Peterborough[a]	884,600	0.94	0.91	0.94	0.92						9.5
	NHS Great Yarmouth & Waveney[b]	215,700	1.00	0.98	0.98	0.96	0.92[b]	0.98[b]	0.86[b]	1.11[b]	1,062[b]	2.7
	NHS Ipswich and East Suffolk[b]	*401,000*	*0.85*	*0.84*	*0.87*	*0.86*	*0.83*[b]	*0.81*[b]	*0.73*[b]	*0.90*[b]	*858*[b]	*5.6*
	NHS North Norfolk	171,900	0.92	0.89	0.98	0.95	0.90	0.87	0.76	1.01	1,041	1.5
	NHS Norwich	216,800	0.84	0.84	0.92	0.92	0.91	0.90	0.77	1.04	826	7.3
	NHS South Norfolk[a]	229,900	0.81	0.82	0.86	0.81						2.6
	NHS West Norfolk [a]	175,100	0.79	0.76	0.74	0.73						2.6
	NHS West Suffolk [a]	227,800	0.83	0.81	0.81	0.78						4.6
Essex	NHS Basildon and Brentwood	259,800	0.98	0.96	1.04	1.01	0.95	0.95	0.84	1.08	912	7.1
	NHS Castle Point, Rayleigh and Rochford	*175,400*	*0.80*	*0.78*	*0.82*	*0.87*	*0.81*	*0.79*	*0.67*	*0.92*	*855*	*3.0*
	NHS Mid Essex [a]	388,400	0.85	0.81	0.85	0.86						4.4
	NHS North East Essex[a]	329,200	0.93	0.90	0.88	0.91						5.5
	NHS Southend	179,800	0.93	0.94	0.99	0.96	0.94	0.94	0.80	1.09	918	8.4
	NHS Thurrock	167,000	0.98	0.97	0.97	0.96	0.95	0.92	0.78	1.09	802	14.1
	NHS West Essex[a]	302,500	0.74	0.83	0.88	0.92						8.2
Hertfordshire and the South Midlands	NHS Bedfordshire[a]	447,700	0.86	0.88	0.90	0.91						11.2
	NHS Corby	68,200	0.84	0.89	0.82	0.84	0.88	0.93	0.72	1.21	836	4.5
	NHS East and North Hertfordshire[b]	*565,700*	*0.90*	*0.89*	*0.91*	*0.93*	*0.82*[b]	*0.82*[b]	*0.74*[b]	*0.90*[b]	*769*[b]	*10.4*
	NHS Herts Valleys	591,800	0.94	0.92	0.92	0.94	0.93	0.96	0.88	1.05	899	14.6
	NHS Luton[b]	**216,800**	**1.29**	**1.32**	**1.39**	**1.41**	**1.30**[b]	**1.41**[b]	**1.25**[b]	**1.60**[b]	**1,130**[b]	**45.3**
	NHS Milton Keynes	270,500	0.90	0.89	0.91	1.01	0.99	1.06	0.93	1.20	924	19.6
	NHS Nene	*648,600*	*0.91*	*0.90*	*0.90*	*0.90*	*0.86*	*0.89*	*0.82*	*0.96*	*860*	*9.1*
Leicestershire and Lincolnshire	*NHS East Leicestershire and Rutland*	*328,600*	*0.81*	*0.81*	*0.80*	*0.80*	*0.79*	*0.78*	*0.69*	*0.88*	*819*	*9.8*
	NHS Leicester City	**348,300**	**1.68**	**1.69**	**1.71**	**1.71**	**1.70**	**1.76**	**1.61**	**1.93**	**1,372**	**49.5**
	NHS Lincolnshire East	*233,400*	*0.85*	*0.88*	*0.90*	*0.86*	*0.84*	*0.84*	*0.74*	*0.96*	*960*	*2.0*
	NHS Lincolnshire West	*236,900*	*0.87*	*0.82*	*0.86*	*0.87*	*0.85*	*0.80*	*0.70*	*0.93*	*798*	*3.0*
	NHS South Lincolnshire[b]	*147,800*	*0.73*	*0.75*	*0.70*	*0.72*	*0.62*[b]	*0.63*[b]	*0.52*[b]	*0.77*[b]	*676*[b]	*2.3*
	NHS South West Lincolnshire[b]	*125,200*	*0.75*	*0.72*	*0.69*	*0.67*	*0.64*[b]	*0.60*[b]	*0.48*[b]	*0.74*[b]	*639*[b]	*2.3*
	NHS West Leicestershire	*393,000*	*0.90*	*0.89*	*0.89*	*0.89*	*0.87*	*0.87*	*0.78*	*0.97*	*865*	*6.9*
Shropshire and Staffordshire	NHS Cannock Chase	135,100	0.93	0.84	0.93	0.91	0.91	0.92	0.77	1.09	933	2.4
	NHS East Staffordshire	*126,400*	*0.76*	*0.78*	*0.78*	*0.79*	*0.77*	*0.75*	*0.61*	*0.92*	*752*	*9.0*
	NHS North Staffordshire	218,300	0.96	0.93	0.95	0.91	0.90	0.90	0.78	1.03	944	3.5
	NHS Shropshire	*313,400*	*0.86*	*0.85*	*0.79*	*0.80*	*0.81*	*0.78*	*0.69*	*0.88*	*858*	*2.0*
	NHS South East Staffs and Seisdon and Peninsular	*225,200*	*0.96*	*0.87*	*0.86*	*0.84*	*0.84*	*0.83*	*0.72*	*0.95*	*875*	*3.6*
	NHS Stafford and Surrounds	154,000	0.92	0.92	0.88	0.93	0.96	0.98	0.84	1.15	1,059	4.7
	NHS Stoke on Trent	261,400	1.14	1.09	1.08	1.14	1.03	1.07	0.94	1.20	998	11.0
	NHS Telford & Wrekin	173,000	1.02	1.01	1.02	1.00	1.06	1.02	0.88	1.19	965	7.3
London	**NHS Barking & Dagenham**	**206,500**	**1.36**	**1.41**	**1.44**	**1.49**	**1.49**	**1.49**	**1.31**	**1.70**	**1,085**	**41.7**
	NHS Barnet	**386,100**	**1.40**	**1.43**	**1.43**	**1.43**	**1.44**	**1.41**	**1.29**	**1.55**	**1,217**	**35.9**
	NHS Camden	246,200	1.14	1.14	1.14	1.14	1.15	1.13	1.00	1.29	922	33.7
	NHS City and Hackney	**282,900**	**1.28**	**1.33**	**1.34**	**1.35**	**1.31**	**1.40**	**1.24**	**1.57**	**1,014**	**44.6**
	NHS Enfield	**331,400**	**1.42**	**1.45**	**1.45**	**1.47**	**1.46**	**1.52**	**1.38**	**1.67**	**1,270**	**39.0**
	NHS Haringey	**278,500**	**1.42**	**1.51**	**1.55**	**1.60**	**1.60**	**1.64**	**1.48**	**1.82**	**1,296**	**39.5**
	NHS Havering	*252,800*	*0.87*	*0.90*	*0.86*	*0.84*	*0.86*	*0.86*	*0.75*	*0.98*	*811*	*12.3*
	NHS Islington	**232,900**	**1.21**	**1.32**	**1.36**	**1.36**	**1.37**	**1.31**	**1.15**	**1.49**	**983**	**31.8**
	NHS Newham	**341,000**	**1.58**	**1.61**	**1.70**	**1.79**	**1.86**	**1.88**	**1.72**	**2.06**	**1,320**	**71.0**
	NHS Redbridge	**299,200**	**1.32**	**1.36**	**1.41**	**1.43**	**1.44**	**1.47**	**1.32**	**1.63**	**1,203**	**57.5**

Table 2.5. Continued

UK area	Name	Total population	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016 O/E	2016 95% LCL	2016 95% UCL	2016 Crude rate pmp	% non-White
London (*cont.*)	**NHS Tower Hamlets**	**304,900**	**1.19**	**1.28**	**1.35**	**1.41**	**1.48**	**1.49**	**1.33**	**1.67**	**991**	**54.8**
	NHS Waltham Forest	**275,800**	**1.46**	**1.41**	**1.46**	**1.58**	**1.59**	**1.64**	**1.48**	**1.82**	**1,305**	**47.8**
	NHS Brent	**328,300**	**2.02**	**2.06**	**2.05**	**2.09**	**2.12**	**2.14**	**1.98**	**2.32**	**1,773**	**63.7**
	NHS Central London (Westminster)	178,400	1.01	1.01	1.06	1.08	1.07	1.09	0.94	1.26	959	36.2
	NHS Ealing	**343,200**	**1.80**	**1.86**	**1.83**	**1.84**	**1.90**	**1.88**	**1.72**	**2.04**	**1,588**	**51.0**
	NHS Hammersmith and Fulham	**179,700**	**1.30**	**1.31**	**1.26**	**1.30**	**1.29**	**1.37**	**1.20**	**1.58**	**1,113**	**31.9**
	NHS Harrow	**248,800**	**1.83**	**1.82**	**1.72**	**1.71**	**1.69**	**1.73**	**1.57**	**1.91**	**1,560**	**57.8**
	NHS Hillingdon	**302,500**	**1.44**	**1.47**	**1.48**	**1.47**	**1.42**	**1.41**	**1.27**	**1.56**	**1,187**	**39.4**
	NHS Hounslow	**271,100**	**1.42**	**1.45**	**1.52**	**1.53**	**1.55**	**1.57**	**1.42**	**1.75**	**1,306**	**48.6**
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	**226,000**	**1.19**	**1.14**	**1.14**	**1.19**	**1.15**	**1.15**	**1.01**	**1.30**	**1,022**	**33.4**
	NHS Bexley	**244,800**	**1.28**	**1.28**	**1.27**	**1.30**	**1.32**	**1.39**	**1.24**	**1.55**	**1,271**	**18.1**
	NHS Bromley	326,900	0.99	0.96	0.97	0.97	1.05	1.04	0.93	1.16	988	15.7
	NHS Croydon	**382,300**	**1.33**	**1.39**	**1.44**	**1.45**	**1.45**	**1.48**	**1.35**	**1.61**	**1,279**	**44.9**
	NHS Greenwich	**279,800**	**1.22**	**1.21**	**1.37**	**1.39**	**1.40**	**1.45**	**1.30**	**1.62**	**1,147**	**37.5**
	NHS Kingston	176,100	1.11	1.09	1.02	1.03	0.99	1.05	0.90	1.23	903	25.5
	NHS Lambeth	**327,900**	**1.56**	**1.61**	**1.64**	**1.71**	**1.75**	**1.71**	**1.56**	**1.88**	**1,293**	**42.9**
	NHS Lewisham	**301,900**	**1.46**	**1.49**	**1.52**	**1.50**	**1.50**	**1.49**	**1.35**	**1.66**	**1,176**	**46.5**
	NHS Merton	**205,000**	**1.25**	**1.31**	**1.28**	**1.36**	**1.40**	**1.45**	**1.28**	**1.64**	**1,229**	**35.1**
	NHS Richmond	*195,800*	*0.74*	*0.75*	*0.77*	*0.75*	*0.73*	*0.72*	*0.60*	*0.85*	*664*	*14.0*
	NHS Southwark	**313,200**	**1.69**	**1.75**	**1.78**	**1.83**	**1.86**	**1.85**	**1.69**	**2.03**	**1,411**	**45.8**
	NHS Sutton	**202,200**	**1.18**	**1.20**	**1.15**	**1.15**	**1.18**	**1.21**	**1.06**	**1.38**	**1,103**	**21.4**
	NHS Wandsworth	**316,100**	**1.23**	**1.18**	**1.15**	**1.23**	**1.28**	**1.29**	**1.15**	**1.44**	**990**	**28.6**
Bath, Gloucestershire, Swindon and Wiltshire	*NHS Bath and North East Somerset*	*187,800*	*0.81*	*0.82*	*0.83*	*0.82*	*0.85*	*0.82*	*0.70*	*0.97*	*772*	*5.4*
	NHS Gloucestershire	*623,100*	*0.88*	*0.89*	*0.88*	*0.87*	*0.86*	*0.88*	*0.81*	*0.95*	*907*	*4.6*
	NHS Swindon	223,600	0.91	0.94	0.95	0.98	1.00	0.99	0.86	1.13	930	10.0
	NHS Wiltshire	*488,400*	*0.75*	*0.72*	*0.73*	*0.72*	*0.73*	*0.74*	*0.67*	*0.82*	*766*	*3.4*
Bristol, North Somerset, Somerset and South Gloucestershire	**NHS Bristol**	**454,200**	**1.22**	**1.25**	**1.29**	**1.28**	**1.24**	**1.20**	**1.10**	**1.32**	**975**	**16.0**
	NHS North Somerset	211,700	0.91	0.95	0.94	0.95	0.92	0.87	0.76	1.00	931	2.7
	NHS Somerset	*549,400*	*0.87*	*0.85*	*0.82*	*0.83*	*0.80*	*0.82*	*0.75*	*0.90*	*888*	*2.0*
	NHS South Gloucestershire	*277,600*	*0.93*	*0.91*	*0.96*	*0.95*	*0.90*	*0.87*	*0.76*	*0.99*	*850*	*5.0*
Devon, Cornwall and Isles of Scilly	NHS Kernow	556,000	0.99	0.98	0.98	0.97	0.96	0.94	0.86	1.02	1,023	1.8
	NHS North, East, West Devon	*898,000*	*0.93*	*0.94*	*0.93*	*0.92*	*0.91*	*0.90*	*0.84*	*0.96*	*933*	*3.0*
	NHS South Devon and Torbay	279,900	1.07	1.05	1.09	1.07	1.05	1.05	0.95	1.17	1,193	2.1
Kent and Medway	NHS Ashford	126,200	1.01	1.02	0.97	0.98	0.94	0.97	0.81	1.16	951	6.3
	NHS Canterbury and Coastal	210,500	0.98	0.97	1.00	1.07	1.05	0.99	0.87	1.14	969	5.9
	NHS Dartford, Gravesham and Swanley	260,600	1.06	1.08	1.11	1.13	1.09	1.09	0.97	1.23	1,032	13.0
	NHS Medway	*278,500*	*0.84*	*0.87*	*0.91*	*0.91*	*0.91*	*0.87*	*0.76*	*0.99*	*793*	*10.4*
	NHS South Kent Coast	*207,600*	*0.83*	*0.83*	*0.78*	*0.82*	*0.81*	*0.83*	*0.72*	*0.96*	*896*	*4.5*
	NHS Swale	114,800	1.09	1.17	1.18	1.13	1.10	1.10	0.92	1.32	1,063	3.8
	NHS Thanet	140,700	1.00	1.05	1.11	1.06	1.00	0.99	0.84	1.16	1,024	4.5
	NHS West Kent	*481,600*	*0.79*	*0.81*	*0.79*	*0.82*	*0.79*	*0.81*	*0.73*	*0.89*	*797*	*4.9*

Table 2.5. Continued

UK area	Name	Total population	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016 O/E	2016 95% LCL	2016 95% UCL	2016 Crude rate pmp	% non-White
Surrey and Sussex	NHS Brighton & Hove	289,200	0.83	0.88	0.84	0.87	0.87	0.93	0.82	1.06	802	10.9
	NHS Coastal West Sussex	*498,900*	*0.81*	*0.82*	*0.82*	*0.83*	*0.85*	*0.86*	*0.78*	*0.94*	*948*	*3.8*
	NHS Crawley	111,400	1.07	1.01	0.93	0.94	0.89	1.00	0.82	1.22	862	20.1
	NHS East Surrey	183,700	0.82	0.89	0.94	0.87	0.87	0.86	0.74	1.01	838	8.3
	NHS Eastbourne, Hailsham and Seaford	*189,500*	*0.76*	*0.82*	*0.84*	*0.83*	*0.81*	*0.77*	*0.66*	*0.90*	*850*	*4.4*
	NHS Guildford and Waverley	*207,800*	*0.63*	*0.69*	*0.65*	*0.67*	*0.68*	*0.70*	*0.60*	*0.83*	*669*	*7.2*
	NHS Hastings & Rother	*185,800*	*0.78*	*0.77*	*0.83*	*0.82*	*0.82*	*0.80*	*0.68*	*0.93*	*877*	*4.6*
	NHS High Weald Lewes Havens	*172,600*	*0.64*	*0.70*	*0.68*	*0.72*	*0.75*	*0.76*	*0.65*	*0.90*	*829*	*3.1*
	NHS Horsham and Mid Sussex	*233,500*	*0.74*	*0.69*	*0.69*	*0.68*	*0.67*	*0.66*	*0.56*	*0.77*	*664*	*4.9*
	NHS North West Surrey	344,600	0.97	0.97	0.97	0.99	0.98	1.01	0.90	1.12	978	12.5
	NHS Surrey Downs	*288,200*	*0.91*	*0.89*	*0.90*	*0.86*	*0.82*	*0.80*	*0.70*	*0.91*	*815*	*9.1*
	NHS Surrey Heath	*96,700*	*0.97*	*0.98*	*0.87*	*0.83*	*0.81*	*0.75*	*0.60*	*0.95*	*755*	*9.3*
Thames Valley	NHS Aylesbury Vale	211,400	0.95	0.95	0.94	0.93	0.89	0.97	0.84	1.11	936	9.7
	NHS Bracknell and Ascot	137,700	0.82	0.80	0.91	0.93	0.91	0.92	0.77	1.10	850	9.5
	NHS Chiltern	*325,900*	*0.84*	*0.84*	*0.89*	*0.87*	*0.84*	*0.84*	*0.74*	*0.94*	*828*	*15.8*
	NHS Newbury and District	107,100	1.00	0.95	0.98	0.98	0.97	1.02	0.85	1.23	1,008	4.4
	NHS North & West Reading	100,300	0.82	0.82	0.82	0.79	0.79	0.83	0.67	1.03	817	10.4
	NHS Oxfordshire	*668,700*	*0.90*	*0.91*	*0.91*	*0.91*	*0.87*	*0.86*	*0.79*	*0.93*	*809*	*9.3*
	NHS Slough	**147,200**	**1.88**	**1.88**	**1.89**	**1.90**	**1.93**	**1.81**	**1.58**	**2.07**	**1,393**	**54.3**
	NHS South Reading	**112,000**	**1.34**	**1.25**	**1.38**	**1.44**	**1.38**	**1.43**	**1.19**	**1.71**	**1,071**	**30.5**
	NHS Windsor, Ascot and Maidenhead	142,900	0.96	0.98	1.00	1.06	1.06	1.08	0.92	1.27	1,022	14.7
	NHS Wokingham	161,900	0.95	0.92	0.93	0.89	0.87	0.85	0.72	1.01	828	11.6
Wessex	*NHS Dorset*	*771,900*	*0.80*	*0.81*	*0.80*	*0.81*	*0.79*	*0.77*	*0.71*	*0.83*	*828*	*4.0*
	NHS Fareham and Gosport	200,800	0.87	0.86	0.92	0.93	0.96	0.92	0.80	1.06	961	3.4
	NHS Isle of Wight	*139,800*	*0.61*	*0.64*	*0.75*	*0.76*	*0.72*	*0.65*	*0.54*	*0.79*	*751*	*2.7*
	NHS North East Hampshire and Farnham	210,500	0.83	0.85	0.89	0.90	0.93	0.88	0.76	1.02	845	9.7
	NHS North Hampshire	*221,900*	*0.67*	*0.67*	*0.69*	*0.73*	*0.73*	*0.71*	*0.61*	*0.83*	*699*	*6.4*
	NHS Portsmouth	214,800	0.91	0.93	0.96	0.90	0.93	0.92	0.79	1.07	773	11.6
	NHS South Eastern Hampshire	212,300	0.96	0.90	0.93	0.95	0.93	0.90	0.79	1.03	961	3.1
	NHS Southampton	254,300	0.98	1.02	0.98	0.97	1.01	1.03	0.90	1.18	826	14.1
	NHS West Hampshire	*558,300*	*0.77*	*0.76*	*0.77*	*0.76*	*0.74*	*0.70*	*0.64*	*0.77*	*747*	*3.9*
Wales	*Betsi Cadwaladr University*	*695,800*	*0.89*	*0.91*	*0.83*	*0.86*	*0.91*	*0.90*	*0.83*	*0.97*	*943*	*2.5*
	Powys Teaching	*132,200*	*0.89*	*0.88*	*0.85*	*0.80*	*0.81*	*0.78*	*0.65*	*0.93*	*893*	*1.6*
	Hywel Dda	383,700	0.98	0.92	0.95	0.95	0.96	0.91	0.83	1.01	985	2.2
	Abertawe Bro Morgannwg University	**529,300**	**1.27**	**1.25**	**1.19**	**1.13**	**1.14**	**1.11**	**1.02**	**1.20**	**1,102**	**3.9**
	Cwm Taf	**298,100**	**1.36**	**1.28**	**1.27**	**1.23**	**1.18**	**1.16**	**1.04**	**1.29**	**1,127**	**2.6**
	Aneurin Bevan	584,100	1.11	1.11	1.09	1.10	1.07	1.06	0.98	1.15	1,067	3.9
	Cardiff and Vale University	489,900	1.05	1.03	1.04	0.99	0.99	1.01	0.92	1.11	888	12.2
Scotland	Ayrshire and Arran	370,600	1.08	1.06	1.02	0.99	0.98	0.99	0.89	1.09	1,052	1.2
	Borders	*114,500*	*0.97*	*0.92*	*0.89*	*0.84*	*0.83*	*0.81*	*0.67*	*0.98*	*908*	*1.3*
	Dumfries and Galloway	*149,500*	*0.92*	*0.90*	*0.84*	*0.83*	*0.83*	*0.80*	*0.67*	*0.94*	*903*	*1.2*
	Fife	*370,300*	*1.02*	*1.00*	*1.00*	*0.93*	*0.94*	*0.88*	*0.79*	*0.98*	*902*	*2.4*
	Forth Valley	*304,500*	*0.91*	*0.88*	*0.87*	*0.87*	*0.87*	*0.84*	*0.74*	*0.95*	*844*	*2.2*
	Grampian	588,100	0.94	0.98	0.96	0.90	0.92	0.93	0.86	1.01	911	4.0
	Greater Glasgow and Clyde	1,161,400	1.06	1.08	1.06	1.04	1.06	1.06	1.00	1.12	1,001	7.3
	Highland	*321,900*	*0.92*	*0.88*	*0.84*	*0.82*	*0.87*	*0.86*	*0.77*	*0.96*	*938*	*1.3*
	Lanarkshire	656,500	0.95	0.99	0.97	0.96	0.97	0.96	0.88	1.03	952	2.0
	Lothian	*880,000*	*0.81*	*0.81*	*0.80*	*0.79*	*0.79*	*0.79*	*0.73*	*0.86*	*741*	*5.6*
	Orkney	*21,900*	*0.79*	*0.76*	*0.83*	*0.62*	*0.68*	*0.57*	*0.34*	*0.97*	*641*	*0.7*

Table 2.5. Continued

UK area	Name	Total population	2011 O/E	2012 O/E	2013 O/E	2014 O/E	2015 O/E	2016 O/E	2016 95% LCL	2016 95% UCL	2016 Crude rate pmp	% non-White
Scotland (*cont.*)	Shetland	23,200	0.50	0.49	0.51	0.50	0.65	0.67	0.41	1.09	690	1.5
	Tayside	415,500	1.04	0.99	0.95	0.93	0.95	0.92	0.84	1.02	948	3.2
	Western Isles	26,900	0.67	0.57	0.55	0.70	0.81	0.82	0.55	1.21	929	0.9
Northern Ireland	**Belfast**	**354,700**	**1.15**	**1.17**	**1.16**	**1.15**	**1.13**	**1.16**	**1.05**	**1.29**	**1,023**	**3.2**
	Northern	473,100	1.04	1.03	1.02	1.02	1.00	0.97	0.89	1.07	920	1.2
	Southern	377,200	1.01	0.96	0.97	0.98	1.01	1.04	0.94	1.16	912	1.2
	South Eastern	356,700	0.90	0.88	0.86	0.83	0.89	0.92	0.82	1.03	889	1.3
	Western	300,400	1.08	0.99	0.97	1.04	1.08	1.11	1.00	1.25	1,012	1.0

Note that there was a merger between South Manchester CCG, North Manchester CCG and Central Manchester CCG into a single Manchester CCG. Due to boundary changes, a new Morecambe Bay CCG was created covering Lancashire North CCG and North Cumbria CCG was reconfigured; here the new CCGs are used

[a]Excluded from the rate analysis for the 2015–2016 period because 15–100% of their population was covered by Cambridge (based on estimates using 2014 prevalent data)

[b]Five further CCGs are flagged because between 5–15% of their population was estimated to be covered by Cambridge and therefore prevalence ratios for 2015 and 2016 are likely underestimated

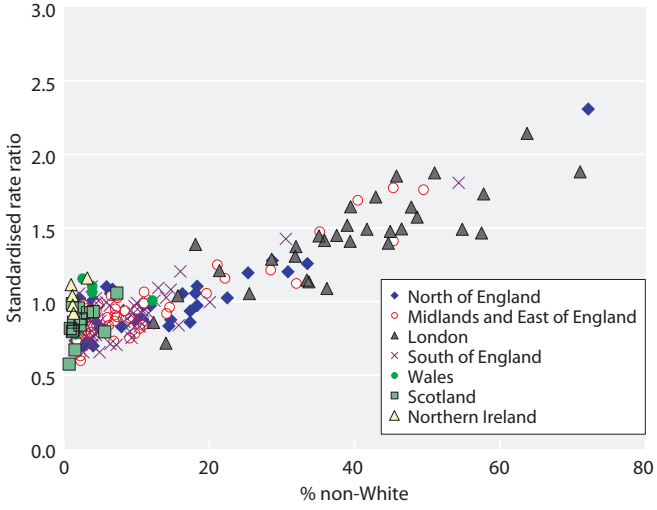

Fig. 2.3. SPRs for CCG/HB areas by percentage non-White on 31/12/2016 (excluding areas with <5% ethnic minorities)

Table 2.7. Median time on RRT of prevalent patients on 31/12/2016

Modality	*N*	Median time treated (years)
Haemodialysis	24,443	3.2
Peritoneal dialysis	3,563	1.5
Transplant	31,836	10.3
All RRT	**59,842**	**6.2**

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. SPRs of RRT for each region in England and for Wales, Scotland and Northern Ireland in 2016

UK area	Total population	O/E	95% LCL	95% UCL	Crude rate pmp
North England	15,430,294	0.93	0.91	0.94	899.2
Midlands and East of England*	13,792,915	0.99	0.98	1.01	960.9
London	**8,787,892**	**1.45**	**1.42**	**1.48**	**1,191.2**
South England	14,271,741	0.88	0.87	0.90	882.6
Wales	3,113,150	1.00	0.96	1.03	1,005.1
Scotland	5,404,700	0.92	0.89	0.94	915.1
Northern Ireland	1,862,137	1.03	0.99	1.08	946.8

O/E – observed/expected SPR given the age/sex breakdown of each region

Bold – higher than expected SPR

*Eight CCGs covered by Cambridge (NHS Cambridgeshire and Peterborough, NHS South Norfolk, NHS West Norkfolk, NHS West Suffolk, NHS Mid Essex, NHS North East Essex, NHS West Essex, NHS Bedfordshire) were excluded from the rate analysis for the 2015–2016 period because 15–100% of their population was covered by Cambridge, based on estimates using 2014 prevalent data

Table 2.8. Median age of prevalent RRT patients by treatment modality in renal centres on 31/12/2016

	Median age			
Centre	HD	PD	Transplant	RRT
England				
B Heart	69.5	66.5	54.6	65.1
B QEH	64.4	60.0	52.7	57.6
Basldn	67.7	63.3	54.3	63.4
Bradfd	64.0	58.0	51.7	56.0
Brightn	68.6	71.6	54.8	60.8
Bristol	70.4	63.3	54.9	59.0
Carlis	67.8	65.6	54.9	60.4
Carsh	69.7	66.6	55.6	62.3
Chelms	68.0	74.0	58.4	63.6
Colchr	72.0			72.0
Covnt	67.9	63.2	52.9	58.2
Derby	67.8	63.0	54.5	60.6
Donc	69.2	66.6	56.6	64.3
Dorset	72.5	69.3	57.8	64.6
Dudley	67.2	64.3	57.2	65.7
Exeter	72.6	67.7	55.8	63.8
Glouc	71.5	67.3	54.6	64.3
Hull	68.4	64.3	53.6	58.8
Ipswi	71.5	75.0	56.4	62.2
Kent	69.2	66.1	55.3	60.8
L Barts	62.1	60.2	52.3	56.4
L Guys	61.4	59.7	52.1	55.3
L Kings	63.0	58.1	55.8	59.3
L Rfree	68.5	62.1	53.4	58.3
L St.G	66.9	70.7	55.3	61.1
L West	66.6	65.1	55.8	60.0
Leeds	62.6	55.7	54.0	56.4
Leic	68.1	64.9	54.4	59.6
Liv Ain	69.7	59.1	42.5	68.3
Liv Roy	60.8	62.1	54.1	56.0
M RI	63.6	58.6	53.3	55.8
Middlbr	68.0	61.9	55.2	59.3
Newc	63.9	61.1	55.0	58.0
Norwch	71.7	62.4	55.3	61.9
Nottm	69.4	61.9	53.6	58.2
Oxford	68.4	63.9	53.8	56.9
Plymth	71.5	68.0	57.2	60.6
Ports	67.4	62.8	54.9	59.0
Prestn	66.7	66.9	54.8	60.7
Redng	69.6	62.7	57.1	62.4
Salford	62.6	62.4	53.8	57.6
Sheff	67.2	65.0	54.1	59.6
Shrew	70.4	61.6	56.5	64.2
Stevng	66.9	61.8	53.4	60.1
Sthend	65.9	68.6	55.3	62.1
Stoke	69.4	69.2	53.1	61.0
Sund	64.9	59.2	56.0	60.0
Truro	70.3	67.1	55.9	61.8
Wirral	68.2	63.3	56.1	62.1
Wolve	65.7	64.3	52.8	60.6
York	68.7	66.4	54.5	60.2
N Ireland				
Antrim	72.9	59.0	54.2	64.0
Belfast	69.8	67.2	53.5	56.0
Newry	67.3	76.0	53.6	61.1
Ulster	74.8	75.3	52.8	67.6
West NI	70.8	70.2	51.1	59.1
Scotland				
Abrdn	66.8	50.9	50.7	57.5
Airdrie	64.4	60.5	53.1	56.7
D & Gall	68.4	64.1	53.8	59.6
Dundee	68.8	63.6	54.4	61.2
Edinb	60.4	61.8	54.4	56.9
Glasgw	65.6	58.7	54.0	57.7
Inverns	69.0	65.6	51.6	57.6
Klmarnk	64.0	56.2	54.3	58.7
Krkcldy	68.1	73.3	55.3	61.4
Wales				
Bangor	70.1	69.4	55.6	64.0
Cardff	67.0	64.8	54.2	58.0
Clwyd	65.2	67.1	55.3	62.8
Swanse	70.6	62.1	57.3	64.0
Wrexm	70.5	62.2	51.8	60.9
England	**67.1**	**63.8**	**54.4**	**59.2**
N Ireland	**71.0**	**72.3**	**53.1**	**58.4**
Scotland	**65.7**	**60.7**	**53.7**	**58.0**
Wales	**68.9**	**64.8**	**54.7**	**60.2**
UK	**67.2**	**63.7**	**54.3**	**59.1**

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

UK RRT prevalent patients by using the age and sex distribution of the UK population by CCG/HB (from mid-2016 population estimates), allowed estimation of crude prevalence by age and sex (figure 2.5). This shows a progressive increase in prevalence with age, peaking at 2,276 pmp (similar to the 2,270 pmp estimate in 2015) in the age group 75–79 years then a rapid decline thereafter. Crude RRT prevalence in males exceeded that of females for all age groups. The difference was smallest in younger patients and was greatest from the age of 70 years onwards. RRT prevalence in males was highest in the 80–84 years group (3,072 pmp) and for females it was in the 70–74 years group (1,657 pmp). Survival on RRT by sex is described in chapter 5.

Ethnicity

Key to understanding differences in RRT prevalence between regions is understanding the ethnic diversity of

Table 2.9. Percentage of prevalent RRT patients in each age group by centre on 31/12/2016

Centre	*N*	Percentage of patients			
		18–39 years	40–64 years	65–74 years	75+ years
England					
B Heart	654	9.3	40.5	21.9	28.3
B QEH	2,394	15.7	51.6	19.0	13.7
Basldn	276	12.0	40.9	24.6	22.5
Bradfd	635	21.4	48.5	16.1	14.0
Brightn	996	11.9	45.5	22.6	20.0
Bristol	1,470	14.6	48.4	20.7	16.3
Carlis	279	13.3	48.4	19.4	19.0
Carsh	1,641	8.3	46.6	22.9	22.2
Chelms	278	11.2	41.4	25.9	21.6
Colchr	124	6.5	25.0	27.4	41.1
Covnt	977	13.5	51.0	18.1	17.4
Derby	543	10.1	49.7	22.7	17.5
Donc	330	11.8	40.3	24.8	23.0
Dorset	687	9.9	42.1	25.6	22.4
Dudley	346	8.4	40.8	26.9	24.0
Exeter	1,017	10.2	42.3	24.8	22.7
Glouc	470	8.5	42.6	23.4	25.5
Hull	858	14.2	49.2	21.3	15.3
Ipswi	411	8.8	47.0	23.1	21.2
Kent	1,070	11.9	46.7	24.3	17.1
L Barts	2,372	15.1	56.7	17.6	10.6
L Guys	2,098	18.7	54.8	16.9	9.6
L Kings	1,108	8.6	55.3	18.9	17.2
L Rfree	2,177	15.6	49.5	18.4	16.4
L St.G	863	11.7	47.9	24.0	16.5
L West	3,417	11.5	51.5	22.5	14.5
Leeds	1,552	16.6	53.2	18.1	12.0
Leic	2,310	12.7	48.8	22.4	16.1
Liv Ain	227	7.5	34.8	25.6	32.2
Liv Roy	1,225	14.5	59.4	17.2	8.8
M RI	1,994	18.2	53.4	17.8	10.7
Middlbr	891	13.1	49.5	22.4	14.9
Newc	1,053	15.2	52.4	20.7	11.7
Norwch	774	11.2	45.0	24.5	19.3
Nottm	1,152	15.9	49.7	17.9	16.6
Oxford	1,767	14.2	53.3	19.7	12.8
Plymth	513	12.1	48.5	23.6	15.8
Ports	1,693	12.8	50.5	21.0	15.7
Prestn	1,206	10.8	49.8	25.1	14.3
Redng	794	8.6	48.9	23.2	19.4
Salford	1,022	13.1	53.4	20.5	13.0
Sheff	1,427	14.4	48.6	20.5	16.5
Shrew	375	9.6	41.9	24.8	23.7
Stevng	904	11.8	48.8	18.9	20.5
Sthend	237	10.5	45.6	20.7	23.2
Stoke	827	12.9	45.2	22.0	19.8
Sund	507	10.8	50.7	25.2	13.2
Truro	428	10.7	46.3	23.4	19.6
Wirral	337	11.3	43.6	23.7	21.4
Wolve	569	11.6	48.3	20.4	19.7
York	535	13.6	46.7	21.3	18.3

Table 2.9. Continued

Centre	*N*	Percentage of patients			
		18–39 years	40–64 years	65–74 years	75+ years
N Ireland					
Antrim	241	9.1	45.2	22.0	23.7
Belfast	829	16.5	53.9	16.9	12.7
Newry	237	13.1	47.7	19.4	19.8
Ulster	166	8.4	35.5	21.7	34.3
West NI	307	12.7	44.6	22.8	19.9
Scotland					
Abrdn	557	17.8	50.1	21.4	10.8
Airdrie	440	16.4	51.1	18.2	14.3
D & Gall	131	9.2	47.3	26.7	16.8
Dundee	420	7.6	51.2	22.6	18.6
Edinb	780	14.2	57.7	18.8	9.2
Glasgw	1,754	14.1	55.1	19.3	11.5
Inverns	260	10.8	54.6	21.5	13.1
Klmarnk	318	10.4	57.5	19.5	12.6
Krkcldy	295	11.2	48.1	24.1	16.6
Wales					
Bangor	180	11.1	41.1	27.8	20.0
Cardff	1,630	13.5	52.0	21.2	13.3
Clwyd	178	12.4	43.8	24.7	19.1
Swanse	768	10.4	41.7	23.2	24.7
Wrexm	310	13.2	44.8	19.4	22.6
England	**51,810**	**13.2**	**49.8**	**20.9**	**16.1**
N Ireland	**1,780**	**13.7**	**48.6**	**19.4**	**18.4**
Scotland	**4,955**	**13.5**	**53.8**	**20.2**	**12.5**
Wales	**3,066**	**12.5**	**47.6**	**22.1**	**17.8**
UK	**61,611**	**13.2**	**49.9**	**20.9**	**16.0**
Range (Min : Max)		**(6.5, 21.4)**	**(25, 59.4)**	**(16.1, 27.8)**	**(8.8, 41.1)**

the patient groups. As such, the completeness of ethnicity data provided by renal centres is important. As in 2015, 61 of the 70 centres (87.1%) providing patient-level data provided ethnicity data that were at least 90% complete (table 2.10), an improvement on only 36 centres in 2006. Overall ethnicity completeness for prevalent RRT patients has reached a stable 93.6% for the UK in 2016 compared to 93.3% in 2015. Data completeness was very high in England, Wales and Northern Ireland (98.7%, 99.5% and 98.3%, respectively), but much lower in Scotland (35.1%). Completeness in Scotland is

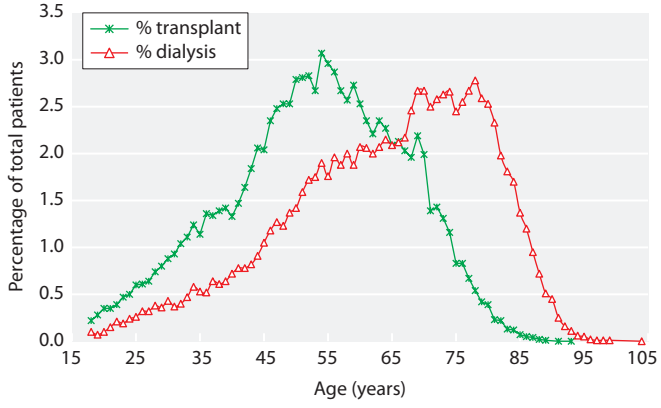

Fig. 2.4. Age profile of prevalent RRT patients by modality on 31/12/2016

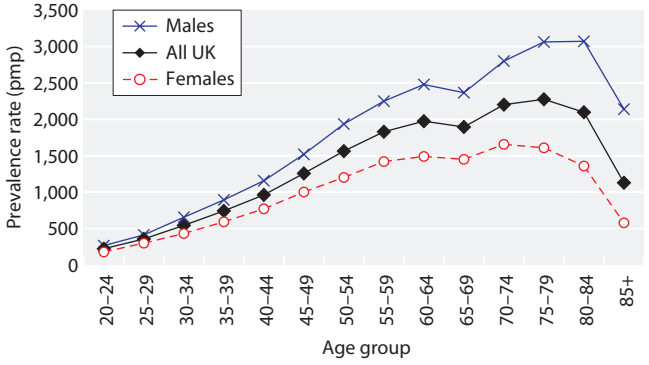

Fig. 2.5. Prevalence of RRT patients pmp by age and sex on 31/12/2016

Table 2.10. Ethnicity of prevalent RRT patients by centre on 31/12/2016

Centre	Percentage data not available	*N* with data	Percentage in each ethnic group[a]				
			White	Black	S Asian	Chinese	Other
England							
B Heart	0.0	654	60.9	9.8	27.8	0.8	0.8
B QEH	0.6	2,379	59.9	9.9	26.9	0.7	2.7
Basldn	0.0	276	86.6	5.1	4.3	*	*
Bradfd	0.5	632	53.8	2.2	42.9	*	*
Brightn	2.9	967	91.4	1.9	4.7	*	*
Bristol	2.2	1,437	89.0	5.2	4.0	0.3	1.5
Carlis	0.4	278	98.6	0.0	*	*	0.0
Carsh	1.9	1,610	69.2	10.1	14.0	1.7	5.0
Chelms	1.1	275	90.9	3.6	2.2	*	*
Colchr	0.0	124	97.6	0.0	*	0.0	*
Covnt	0.3	974	79.1	4.4	15.8	0.7	0.0
Derby	0.6	540	82.4	2.8	12.4	*	*
Donc	0.0	330	93.9	1.8	2.1	*	*
Dorset	0.1	686	96.2	*	1.3	*	1.3
Dudley	0.0	346	84.1	3.2	11.3	*	*
Exeter	0.4	1,013	98.1	1.0	0.5	*	*
Glouc	0.2	469	93.4	2.6	2.6	*	*
Hull	1.6	844	96.8	*	2.0	*	0.6
Ipswi	2.2	402	83.1	2.7	*	*	12.4
Kent	0.5	1,065	94.0	*	3.4	*	1.5
L Barts	0.0	2,371	35.3	23.0	31.4	1.2	9.0
L Guys	1.4	2,068	61.7	24.9	7.4	1.1	5.0
L Kings	0.0	1,108	47.2	35.6	12.5	1.7	2.9
L Rfree	1.7	2,140	47.3	22.9	21.3	1.4	7.1
L St.G	4.3	826	45.8	23.7	21.9	2.1	6.5
L West	0.0	3,416	40.0	18.4	31.2	0.9	9.5
Leeds	0.2	1,549	78.9	4.9	14.5	0.6	1.2
Leic	3.5	2,230	74.3	4.2	18.9	0.6	1.9
Liv Ain	0.4	226	96.5	*	*	*	*
Liv Roy	1.2	1,210	92.2	2.4	1.8	1.2	2.3
M RI	1.1	1,972	74.2	9.9	12.9	0.9	2.1
Middlbr	0.2	889	94.0	*	4.9	0.6	*
Newc	0.1	1,052	92.7	1.1	4.2	1.0	1.0
Norwch	0.3	772	96.9	*	1.0	1.0	*
Nottm	0.3	1,148	83.8	5.6	7.2	*	*
Oxford	5.8	1,664	82.2	4.0	9.8	0.6	3.4
Plymth	0.2	512	97.1	*	*	*	1.8
Ports	4.2	1,622	93.3	1.2	3.5	0.0	2.0
Prestn	0.1	1,205	85.0	0.9	13.6	0.0	0.5
Redng	5.0	754	70.2	5.7	21.9	*	*
Salford	0.0	1,022	80.7	2.5	15.0	0.5	1.3
Sheff	0.9	1,414	89.5	2.4	5.1	0.8	2.1
Shrew	0.5	373	93.0	*	3.8	*	1.9
Stevng	4.0	868	70.7	8.8	17.5	*	*
Sthend	0.0	237	84.0	4.2	6.3	*	*
Stoke	1.6	814	92.8	*	4.3	*	1.4
Sund	0.0	507	96.3	*	3.2	*	0.0
Truro	0.0	428	98.4	*	*	*	*
Wirral	0.6	335	95.8	*	2.4	*	*
Wolve	0.5	566	67.7	10.1	21.0	*	*
York	2.6	521	97.1	*	1.5	*	*

Table 2.10. Continued

Centre	Percentage data not available	*N* with data	Percentage in each ethnic group[a]				
			White	Black	S Asian	Chinese	Other
N Ireland							
Antrim	0.0	241	99.6	*	0.0	*	0.0
Belfast	3.7	798	97.5	0.8	1.3	*	*
Newry	0.0	237	98.3	*	*	*	0.0
Ulster	0.0	166	96.4	*	*	*	0.0
West NI	0.0	307	98.7	*	*	*	0.0
Scotland							
Abrdn	60.7	219					
Airdrie	28.4	315	95.2	*	3.5	*	*
D & Gall	75.6	32					
Dundee	60.5	166					
Edinb	71.0	226					
Glasgw	76.7	408					
Inverns	38.5	160	95.6	*	*	0.0	*
Klmarnk	56.6	138					
Krkcldy	74.6	75					
Wales							
Bangor	1.7	177	98.3	*	0.0	0.0	*
Cardff	0.3	1,625	92.6	0.4	5.0	0.4	1.6
Clwyd	1.7	175	97.7	0.0	*	0.0	*
Swanse	0.0	768	97.7	*	1.7	0.0	*
Wrexm	1.0	307	97.7	*	*	*	*
England	**1.3**	**51,120**	**74.4**	**8.5**	**13.3**	**0.7**	**3.1**
N Ireland	**1.7**	**1,749**	**98.0**	**0.7**	**0.9**	*	*
Scotland	**64.9**	**1,739**	**82.0**	**6.8**	**8.4**	**2.0**	**0.7**
Wales	**0.5**	**3,052**	**95.0**	**0.4**	**3.2**	**0.3**	**1.2**
UK	**6.4**	**57,660**	**76.4**	**7.8**	**12.2**	**0.7**	**2.9**

[a]See appendix H for ethnicity coding
*Values suppressed due to small numbers (primary or secondary suppression)
Blank cells – percentage breakdown not shown for centres with less than 50% data completeness, but these centres are included in national averages

improving however and only three years ago was 23%. In 2016, completeness of ethnicity data was highest in prevalent transplant patients (42.6%) which likely reflects improved data recording during the intensive work-up for transplantation.

In 2016, 23.6% of the prevalent UK RRT population (with ethnicity assigned) were from ethnic minorities (25.6% in England). The proportion of the prevalent UK RRT population (with ethnicity assigned) from ethnic minorities in Wales, Scotland and Northern Ireland was very small, although it should be noted that there was a high level of missing ethnicity data in Scotland as described above. The Office of National Statistics estimates that approximately 13% of the UK general population is designated as belonging to an ethnic minority [1]. 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 to 23.6% in 2016, which may reflect 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 0.4% in Antrim to 64.7% in London St Bartholomew's.

Primary renal diagnosis

Primary renal diagnosis (PRD) is associated with patient outcomes and as it could be used for case-mix adjustment, high levels of data completeness are important. Data for PRD were not complete for 3.2% of patients (table 2.11), but there existed a marked inter-centre

Table 2.11. PRD in prevalent RRT patients by age and sex on 31/12/2016

Primary diagnosis*	N	% all patients	Intercentre range %	Age <65		Age ⩾65		M : F ratio
				N	%	N	%	
Aetiology uncertain	9,274	15.1	4.3–32.9	5,311	13.7	3,963	17.5	1.6
Glomerulonephritis	11,716	19.1	9.9–26.3	8,367	21.5	3,349	14.8	2.1
Pyelonephritis	6,344	10.3	4.9–13.6	4,569	11.7	1,775	7.9	1.1
Diabetes	10,375	16.9	8.7–27.5	6,099	15.7	4,276	18.9	1.7
Polycystic kidney	6,146	10.0	3.1–16.1	3,935	10.1	2,211	9.8	1.1
Hypertension	3,774	6.1	1.7–18.1	2,076	5.3	1,698	7.5	2.5
Renal vascular disease	1,809	2.9	0.5–10.3	396	1.0	1,413	6.3	2.0
Other	10,114	16.5	11.0–29.4	7,036	18.1	3,078	13.6	1.3
Not sent	1,935	3.2	0.0–29.5	1,099	2.8	836	3.7	1.6

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

difference in completeness of data returns. One centre had ⩾40% PRD data coded as uncertain and has been excluded from the inter-centre analysis and other analyses where PRD is included in the case-mix adjustment (Colchester, 46% uncertain PRD); the UK and national totals have been appropriately adjusted. The percentage of patients with uncertain aetiology for the remaining 69 centres providing individual-level data ranged between 4.3% and 32.9%, which is comparable to recent years. No centre had >30% missing data in 2016.

As observed in previous years, glomerulonephritis (GN) is the most common PRD in the 2016 prevalent cohort at 19.1% (table 2.11). Diabetic nephropathy is the next most common PRD and accounted for 16.9% of renal disease in prevalent patients on RRT, although it was more common in the ⩾65 year age group compared to the younger group (18.9% vs 15.7%). The distribution of individual PRDs varied with age; patients aged 65 years and younger were more likely to have GN (21.5%) or diabetes (15.7%) and less likely to have renal vascular disease (1.0%) as the cause of their renal failure. This contrasts with older patients (⩾65 years) among whom 6.3% had renal vascular disease as the cause of their renal failure. Uncertain aetiology was a more common cause in this age group than amongst younger patients (18.1% compared with 13.6% amongst patients <65 years).

As described in previous years, the male : female ratio was greater than 1 : 1 for all PRDs (table 2.11). The biggest differences between males and females were for GN (male : female ratio of 2.1), hypertension (2.5) and renal vascular disease (2.0).

Older and younger patients had markedly different trends in the transplant : dialysis ratio by PRD. In individuals aged less than 65 years, the renal transplantation to dialysis ratio was greater than 1 in all PRD groups except diabetic nephropathy and renal vascular disease. In those aged ⩾65 years, dialysis was more prevalent than renal transplantation in all PRD groups except GN and polycystic kidney disease (PKD) (table 2.12).

Diabetes

Throughout this section the term 'diabetic nephropathy' is used to denote patients in whom diabetes mellitus is considered to be the primary cause of the kidney disease rather than merely an associated comorbidity. It includes all prevalent patients with type 1 or type 2 diabetes as the PRD (ERA-EDTA coding). This analysis did not differentiate between type 1 and type 2 diabetes

Table 2.12. Transplant : dialysis ratios by age and PRD in the prevalent RRT population on 31/12/2016

Primary diagnosis*	Transplant : dialysis ratio	
	<65 years	⩾65 years
Aetiology uncertain	2.2	0.4
Glomerulonephritis	2.5	1.0
Pyelonephritis	3.0	0.6
Diabetes	0.9	0.2
Polycystic kidney	3.4	2.0
Hypertension	1.5	0.4
Renal vascular disease	0.9	0.1
Other	2.2	0.5
Not sent	0.8	0.1

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

Table 2.13. Age relationships in patients with diabetes and patients without diabetes and modality in prevalent RRT patients on 31/12/2016

	Patients with diabetes[a]	Patients without diabetes[b]
N	10,375	49,177
M : F ratio	1.66	1.54
Median age on 31/12/16	62	58
Median age at start of RRT[cd]	56	47
Median years on RRT[d]	3.6	7.5
% HD	58	36
% PD	8	5
% transplant	34	59

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

as this distinction was not made in the data submitted by most centres.

The number of prevalent patients with diabetic nephropathy has increased steadily over the last number of years and grew by 4.7% to 10,375 in 2016, from 9,913 in 2015, representing 17.4% of all prevalent patients (compared with 13.5% in 2006) (table 2.13). Men were 1.66 times more likely to have diabetic nephropathy than women. The median age at start of RRT for patients with diabetic nephropathy (56 years) was nine years higher than those with other PRDs (47 years), although the median age at the end of 2016 for prevalent patients with diabetic nephropathy was only four years higher than for individuals without diabetic nephropathy. This reflects reduced survival for patients with diabetes compared with patients without diabetes on RRT. This is also supported by the lower median time on RRT for patients with diabetic nephropathy (3.6 years vs 7.5 years for those without diabetic nephropathy) and this difference in survival has not changed over the last five years (3.4 years in 2016 vs 6.5 years in 2011). The age at starting RRT in those with diabetic nephropathy was four years younger in Scotland compared with the UK average (data not shown).

Patients with diabetic nephropathy had a different distribution of RRT modalities than those without diabetes. Fifty eight percent of patients with diabetic nephropathy were undergoing HD compared with just 36% of patients with any other PRD (table 2.13). The percentage of patients with a functioning transplant was much lower in prevalent patients with diabetic nephropathy than in prevalent patients without (34% vs 59%). The proportion of patients with diabetic nephropathy with a functioning transplant has increased however since 2006 when only 27% of patients with diabetic nephropathy had a functioning transplant. For older patients with diabetic nephropathy (age ⩾65 years), only 15.1% had a functioning transplant compared with 47.8% of their peers with a transplant aged under 65 years (table 2.14). Amongst those patients receiving dialysis, a higher proportion of prevalent patients without diabetic nephropathy (18.1%) were on home dialysis therapies (home HD and PD) compared with prevalent patients with diabetic nephropathy (14.1%). Both of these trends (those with diabetic nephropathy being more likely to be doing home dialysis than those with other PRDs and less likely to be transplanted) were consistent across all age groups (18–39 years, 40–64 years, 65–74 years, 75 + years), although as expected the greatest proportion transplanted in both groups are those aged 18–39 years (data not shown).

Table 2.14. Treatment modalities by age and diabetes status on 31/12/2016

	<65		⩾65	
	Diabetes[a]	All other causes[b]	Diabetes[a]	All other causes[b]
N	6,099	31,690	4,276	17,487
% HD	44.8	25.1	76.8	54.7
% PD	7.4	4.2	8.2	7.2
% transplant	47.8	70.7	15.1	38.1

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

Modalities of treatment

Transplantation was the most common treatment modality (53.9%) for prevalent RRT patients in 2016, followed by centre-based HD (38.3%) in either hospital centre (17.5%) or satellite unit (20.8%) (figure 2.6). Satellite HD was again more prevalent than in-centre HD, a trend first noted in 2012. Home therapies made up the remaining 7.9% of treatment therapies, largely PD in its different formats (5.9%) which has followed a similar pattern since 2012. The proportion on continuous ambulatory PD (CAPD) and automated PD (APD) was 2.4% and 3.5% respectively, although the proportion on APD

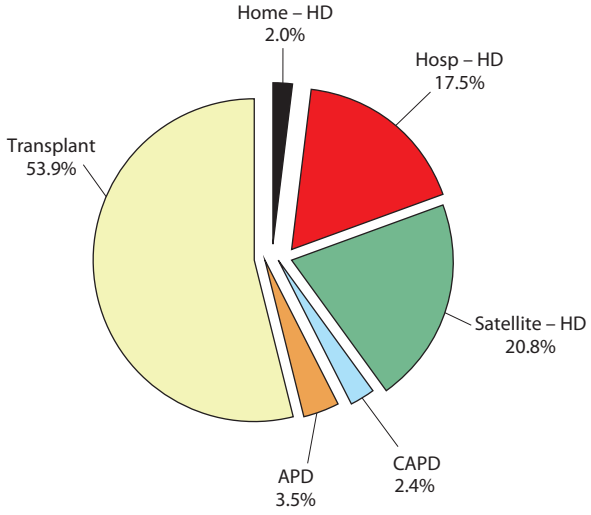

Fig. 2.6. Treatment modality in prevalent RRT patients on 31/12/2016

may be an underestimate due to centre level coding issues which mean the UKRR cannot always distinguish between these therapies.

As described earlier, treatment modality was related to patient age. Younger patients (age <65 years), were more likely to have a functioning transplant (66.3%) when compared with patients aged 65 years and over (32.6%) (table 2.15). HD was the principal modality in older patients (59.9%).

Figure 2.7 shows the distribution of RRT modalities by age group. From the age of 45 years onwards, transplant prevalence declined as HD prevalence increased. The proportion of each age group treated by PD remained relatively stable.

The proportion of prevalent dialysis patients receiving HD varied between centres, ranging from 72.9% in Carlisle to 100% in Colchester (table 2.16).

Of the dialysis population, 45.1% received their treatment at a satellite HD unit in 2016. This figure remained comparable to recent years, but represented an increase from 39.9% in 2010. In 2016, the number of centres that had more than 50% of their HD activity taking place in satellite units was 27 (figure 2.8). Although there were satellite units in Scotland, the data provided for 2016 did not distinguish between main centre and satellite unit HD. As such, it is difficult to accurately assess access to satellite HD across the UK as a whole so statistics pool only England, Wales and Northern Ireland.

Table 2.15. Percentage of prevalent RRT patients by age group and modality by UK country on 31/12/2016

	<65 years				≥65 years			
UK country	*N*	% HD	% PD	% transplant	*N*	% HD	% PD	% transplant
England	32,644	29.5	4.9	65.6	19,166	60.0	7.7	32.3
N Ireland	1,108	20.1	2.4	77.4	672	61.2	7.4	31.4
Scotland	3,333	27.5	4.2	68.4	1,622	61.0	5.5	33.4
Wales	1,842	26.2	5.6	68.1	1,224	55.5	8.3	36.2
UK	**38,927**	**28.9**	**4.8**	**66.3**	**22,684**	**59.9**	**7.5**	**32.6**

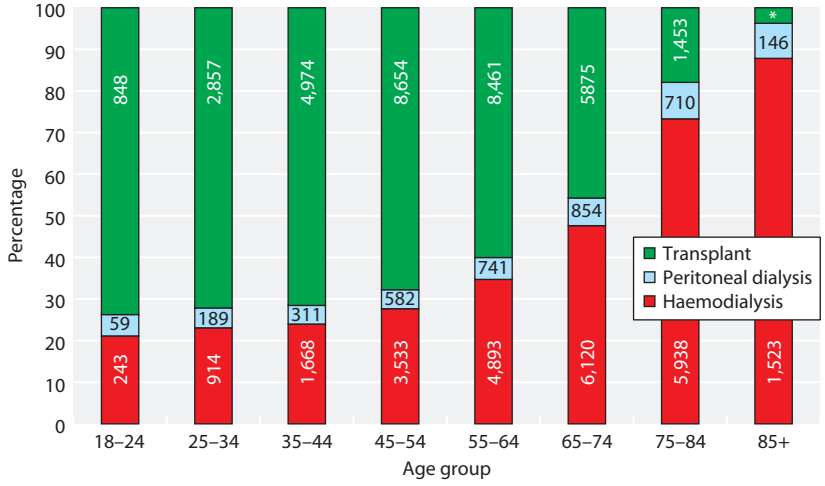

Fig. 2.7. Treatment modality distribution by age in prevalent RRT patients on 31/12/2016
*$N = 65$

Table 2.16 Percentage of prevalent dialysis patients by dialysis modality and centre on 31/12/2016

		% HD				% PD	
Centre	*N*	Total	Home	Hospital	Satellite	CAPD	APD
England							
B Heart	483	81.8	3.9	72.9	5.0	5.6	12.6
B QEH	1,152	87.6	4.9	10.8	72.0	3.9	8.5
Basldn	196	82.7	*	64.3	17.9	*	10.7
Bradfd	275	90.9	*	74.6	13.8	*	7.6
Brightn	524	87.6	7.1	37.8	42.8	7.6	4.8
Bristol	563	90.6	3.4	16.3	70.9	3.9	5.5
Carlis	129	72.9	*	51.9	20.9	*	24.0
Carsh	961	88.3	3.0	18.6	66.6	2.8	9.0
Chelms	166	80.1	*	78.9	*	8.4	10.8
Colchr	124	100.0	*	100.0	*	0.0	0.0
Covnt	443	85.1	2.7	82.4	0.0	14.7	0.0
Derby	318	75.8	13.2	62.6	0.0	16.7	7.6
Donc	221	87.8	4.1	44.8	38.9	2.7	9.5
Dorset	318	88.4	2.8	18.9	66.7	3.5	7.9
Dudley	253	80.2	5.5	30.0	44.7	13.8	5.5
Exeter	539	84.4	1.7	8.5	74.2	6.3	9.3
Glouc	286	85.3	3.2	59.1	23.1	3.5	11.2
Hull	401	82.0	*	42.6	38.4	11.7	*
Ipswi	182	80.2	0.0	68.7	11.5	8.2	11.5
Kent	486	88.5	4.5	33.3	50.6	8.4	3.1
L Barts	1,232	83.6	1.9	36.3	45.5	1.5	14.9
L Guys	732	94.7	6.6	18.3	69.8	1.9	3.4
L Kings	672	86.5	2.7	17.4	66.4	5.2	8.3
L Rfree	889	82.0	2.3	3.6	76.2	5.5	12.5
L St.G	399	88.7	*	17.0	70.7	*	7.3
L West	1,572	93.6	1.0	20.4	72.2	3.3	3.1
Leeds	573	91.6	3.0	18.0	70.7	2.6	5.8
Leic	1,054	91.6	6.9	18.3	66.3	2.5	6.0
Liv Ain	213	87.8	6.1	7.5	74.2	0.0	12.2
Liv Roy	438	83.6	8.9	37.4	37.2	8.9	7.5
M RI	588	89.5	10.2	26.7	52.6	2.4	8.2
Middlbr	359	92.5	3.1	25.6	63.8	7.5	0.0
Newc	373	85.8	*	70.8	8.6	*	13.7
Norwch	380	87.1	4.2	50.5	32.4	12.9	0.0
Nottm	475	82.7	6.1	35.4	41.3	7.2	10.1
Oxford	545	82.6	3.5	31.2	47.9	6.2	11.0
Plymth	184	78.3	4.4	65.2	8.7	7.6	14.1
Ports	711	89.5	10.6	17.2	61.7	10.6	0.0
Prestn	604	93.4	6.8	19.9	66.7	1.3	5.3
Redng	359	84.4	2.2	39.0	43.2	10.0	5.6
Salford	509	79.0	5.5	20.2	53.2	8.8	12.2
Sheff	671	91.8	7.9	37.6	46.4	8.2	0.0
Shrew	244	84.0	7.8	42.6	33.6	3.3	12.7
Stevng	554	96.0	4.7	42.1	49.3	*	*
Sthend	144	79.2	*	77.1	*	20.8	0.0
Stoke	425	81.4	8.0	47.3	26.1	2.1	9.2
Sund	268	93.7	2.2	61.6	29.9	3.7	2.6
Truro	188	90.4	4.8	49.5	36.2	5.3	4.3
Wirral	221	90.0	4.5	41.2	44.3	2.3	7.7
Wolve	384	81.8	7.8	50.3	23.7	3.9	12.0
York	231	85.7	6.1	29.0	50.7	10.0	4.3

Table 2.16 Continued

Centre	*N*	% HD				% PD	
		Total	Home	Hospital	Satellite	CAPD	APD
N Ireland							
Antrim	139	88.5	*	87.8	0.0	*	11.5
Belfast	218	89.0	4.1	84.9	0.0	0.0	11.0
Newry	108	80.6	*	77.8	0.0	*	18.5
Ulster	108	94.5	*	93.5	0.0	*	5.6
West NI	138	92.8	*	90.6	0.0	*	5.8
Scotland							
Abrdn	252	91.7	*	90.1	*	4.0	4.4
Airdrie	209	88.5	0.0	88.5	0.0	3.8	7.7
D & Gall	60	83.3	*	78.3	*	8.3	8.3
Dundee	200	89.5	*	88.5	0.0	9.0	*
Edinb	326	88.7	*	86.8	0.0	*	10.1
Glasgw	647	91.7	3.6	88.1	0.0	2.0	6.3
Inverns	104	89.4	6.7	82.7	*	7.7	*
Klmarnk	174	81.0	*	76.4	0.0	*	17.2
Krkcldy	162	88.9	*	88.9	0.0	*	10.5
Wales							
Bangor	91	82.4	11.0	50.6	20.9	5.5	12.1
Cardff	592	87.3	5.2	9.5	72.6	6.9	5.7
Clwyd	88	83.0	*	78.4	*	8.0	9.1
Swanse	440	84.8	9.1	45.7	30.0	6.1	9.1
Wrexm	157	79.0	*	60.5	13.4	*	20.4
England	**24,211**	**87.3**	**4.5**	**32.3**	**50.5**	**5.4**	**7.2**
N Ireland[a]	**711**	**89.2**	*	**86.8**	**0.0**	*	**10.4**
Scotland[b]	**2,134**	**89.3**	**2.5**	**86.8**	**0.0**	**3.3**	**7.5**
Wales	**1,368**	**85.0**	**6.8**	**34.1**	**44.0**	**5.9**	**9.1**
UK	**28,424**	**87.4**	**4.4**	**37.9**	**45.1**	**5.1**	**7.4**

* Values suppressed due to small numbers (primary or secondary suppression)
[a] There were no satellite units in Northern Ireland
[b] All HD patients in Scotland were shown as receiving treatment at home or in centre as no data was available regarding satellite dialysis

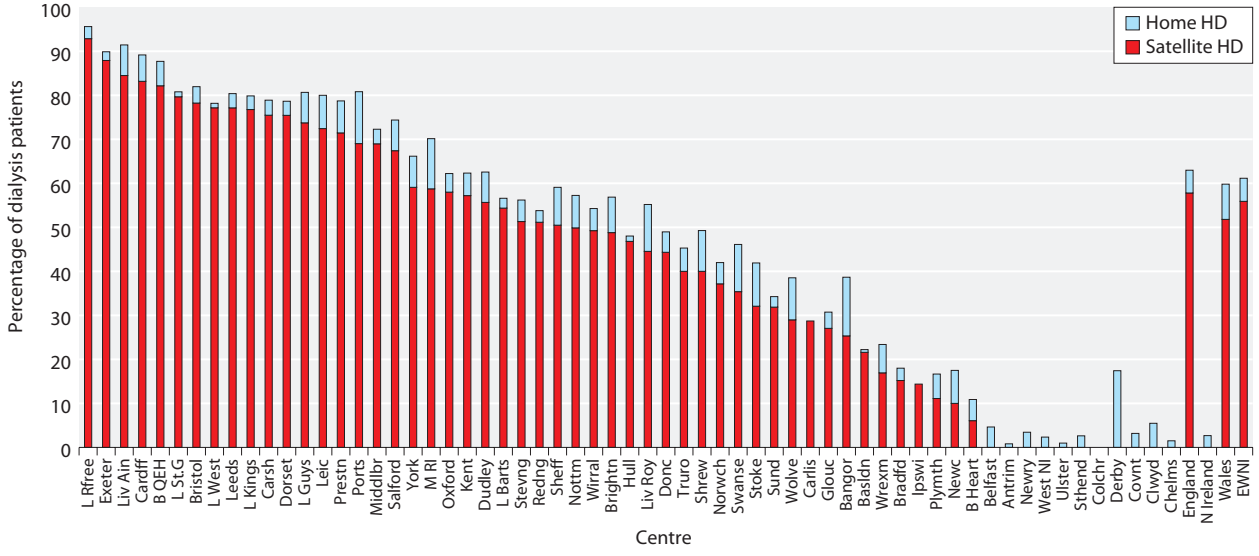

Fig. 2.8. Percentage of prevalent HD patients treated with satellite or home HD by centre on 31/12/2016
*Scottish centres excluded as information on satellite HD was not available. No centres in Northern Ireland had satellite dialysis units

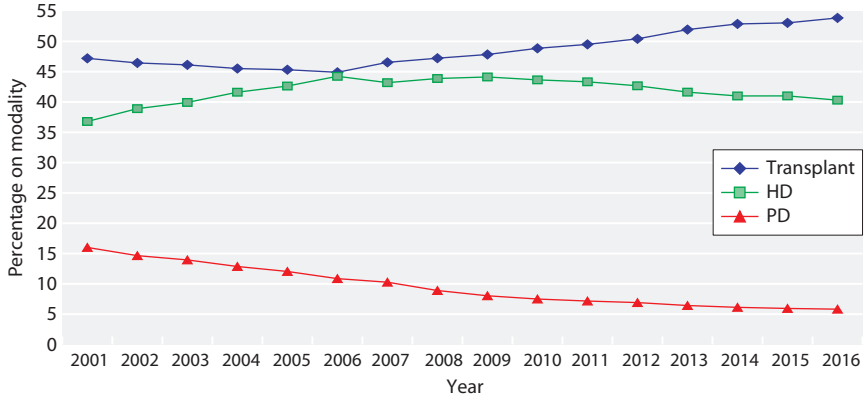

Fig. 2.9. Modality changes in prevalent RRT patients from 2001–2016

Some centres also showed differences in satellite HD provision in 2016 compared to 2015. For example, at London St George's, 70.7% of patients received dialysis at satellite units in 2016 compared to 49.7% in 2015. Stevenage had a decrease in the proportion of patients receiving HD at satellite units from 66.3% in 2015 to 49.3% in 2016.

There was also wide variation between centres in the proportion of dialysis patients being managed with APD, ranging from 0.0% to 24.0% (table 2.16). While in Northern Ireland nearly all PD patients were on APD, across the UK six of the 69 centres with a PD programme did not report having any patients on APD.

Home haemodialysis

In 2016, the percentage of dialysis patients receiving home HD varied from 0% in five centres, to 5% or greater in 24 centres (table 2.16). In the UK, the overall percentage of dialysis patients receiving home HD has increased from 3.4% in 2011 to 4.4% in 2016.

The proportion of dialysis patients receiving home HD was greatest in Wales at 6.8%, compared with 2.4% in Northern Ireland, 4.5% in England and 2.5% in Scotland (figure 2.8, table 2.16). By comparison, in 2007, the proportion of patients receiving home HD was 2% in each of the four UK countries. More recently, 30 renal centres across the UK had an increase in the proportion of individuals on home HD compared with 2015.

Change in modality

The relative proportion of RRT modalities in prevalent patients has changed dramatically over the past 16 years. The main features are depicted in figure 2.9, which describes a year on year decline in the proportion of patients treated using PD since 2001 and a drop of 5.0% over the last ten years. The absolute number of patients on PD decreased from 4,293 patients in 2006 to 3,589 patients in 2016. Time on PD has decreased over the last nine years, from a median of 2.0 years in 2007 to 1.5 years in 2016 probably reflecting increased transplantation rates in this largely younger patient group and reducing PD technique survival rates. The percentage of patients undergoing PD for more than seven years was only 8.7%.

The proportion of all RRT patients being treated with HD has fallen slightly since 2009 from 44.1% to 40.3% although this still represents an increase in absolute numbers on HD (from 21,671 to 24,832) as well as an increase in HD prevalence (from 354 to 385 pmp).

The proportion of patients with a functioning transplant has been increasing since 2007 (46.5%) to 53.9% in 2016. This probably reflects both an increasing number of incident transplants (2,218 adults and children in 2007 [2] to 3,174 in 2016) as well as increasing survival of prevalent transplant patients.

Figure 2.10 depicts in more detail the modality changes in the prevalent dialysis population during this time. The data show a clear reduction in patients treated by CAPD over time and an increase in satellite HD coupled with a reduction in hospital HD.

International comparisons

There were marked differences in RRT prevalence between countries (figure 2.11). RRT prevalence in Northern European countries (including the UK), Australia and New Zealand was lower than in Southern Europe which was lower than the USA, Canada and Japan. Identifying the source of these differences is complicated by differences in healthcare systems, patient registry coverage, approaches to conservative care and incidence rates in these countries.

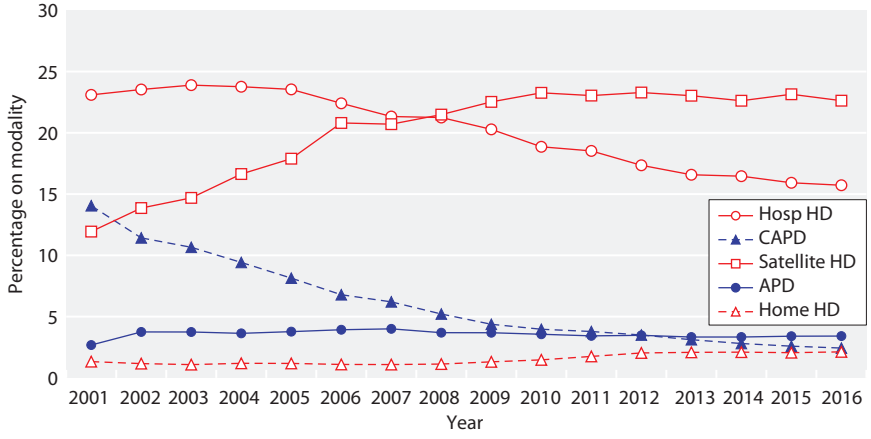

Fig. 2.10. Detailed dialysis modality changes in prevalent RRT patients from 2001–2016
*Scottish centres excluded as information on satellite HD was not available

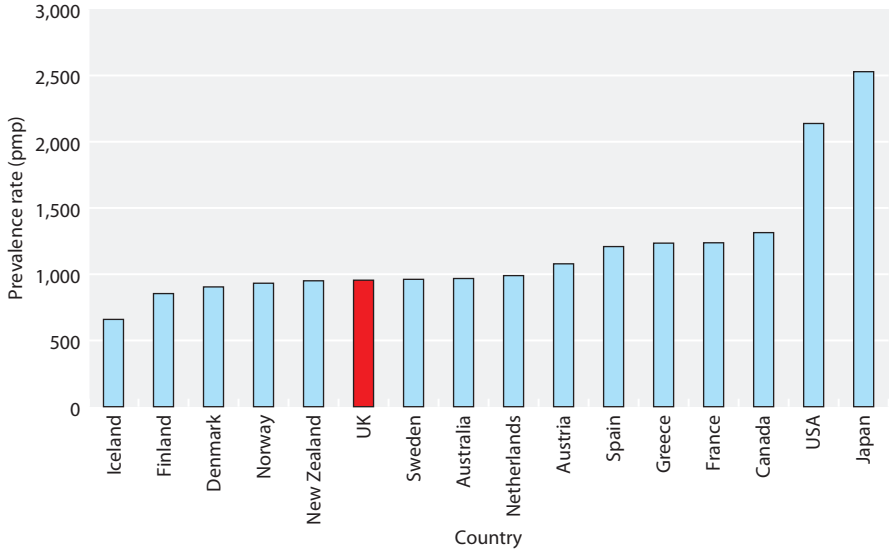

Fig. 2.11. RRT prevalence (pmp) by country in 2015
Non-UK data from the USRDS available at https://www.usrds.org/2017/ref/ESRD_Ref_N_International_2017.xlsx
The UK data include paediatric patients to correspond with the data from the other countries
All rates unadjusted
Data for France include 26 regions (excluding Martinique); data for Canada excludes Quebec

Discussion

Prevalence of RRT continued to increase in the UK, with an absolute increase in the number of adults receiving RRT of 3% between 2015 and 2016. The majority of this increase was in people with a functioning renal transplant (5% increase); with a 1% increase in the number of people receiving HD. There was significant variation between centres in the change in the number of prevalent RRT patients between 2015 and 2016; one centre experienced a 4% fall whereas another had a 20% increase. Whether this variation reflects local differences or recent changes in RRT choices, a one-off movement of patients, historical differences in dialysis planning, or differences in genuine need for RRT would require local interpretation.

The change in prevalence of RRT represents a balance between new patients to RRT (discussed in chapter 1 on incidence), movements between treatment types (discussed particularly in chapter 9 on access to transplantation) and mortality (discussed in chapter 5 on survival). Occasionally it can be artefactual due to a change in reporting practice by centres. The growth in the prevalence of adults with a functioning transplant for example, in part represents the success of recent increases in transplant numbers and a lower mortality rate (compared with those receiving dialysis).

There have been constraints such as historic in-centre HD capacity because of high capital costs, people requiring a renal transplant being limited by the availability of donor organs and people preferring home therapies being limited by access to equipment or training resources. Therefore, it is not possible to conclude from this report whether the prevalence of RRT (in its entirety or by modality) reflects the genuine need for RRT in a particular locality or whether there was (currently unmeasured) unmet need. The UKRR has started collecting

information about patients with CKD stage 4 and 5 from renal centres which it is hoped will enable a better description of the prevalence of people with CKD5 not on dialysis. This will include those having dialysis preparation, those waiting to start RRT and those having conservative kidney care which will help assess this further in future years.

PD as a treatment type continued to grow very slowly in absolute numbers and has decreased as a proportion of all those on RRT. The numbers of people treated by home HD continued to increase (an average annual increase of 15% pmp since 2012) but this was from a low base so represents an increase from 737 patients in 2012 to 1,188 in 2016. Increasing the number of people able to dialyse at home is one of the three priorities identified by the Kidney Quality Improvement Partnership (KQuIP) along with vascular access and transplant first. At regional KQuIP meetings, several local renal teams have identified access to home therapies and renal transplantation as topics that they will work to improve in the coming year. Evaluation of their efforts on these priorities will be collected and published through the UKRR annual report, allowing teams to focus their efforts on the improvement programmes themselves and is a good example of how a national registry can help facilitate local improvement.

The population of the UK continues to age which was also reflected in the population receiving RRT with a median age of 59 years compared with 55 years in the year 2005. Age appears to be one of a group of factors (including diabetes as PRD) which influences the proportions on each RRT modality. Patients with a functioning renal transplant are younger on average (54 years) than those on PD (64 years) and (predominantly in-centre) HD (67 years). Whilst age confounds the treatment modality for those with diabetes as the cause of their ERF, at any age the proportion of those with diabetes who have a functioning renal transplant was lower than those who had an alternate cause of ERF.

Chronic kidney disease (CKD) is associated with several conditions which increase in prevalence with age (diabetes, hypertension and cardiovascular disease for example). It is unsuprising therefore that the peak prevalence of RRT pmp was in the 80–84 age group for men and the 70–74 age group for women. The prevalence of CKD stages 3–5 was higher amongst women in the UK either in GP practice populations [3], or health surveys [4] and women in the UK general population have a longer life expectancy than men [5]. Whilst it is thought that women progress to ERF more slowly [6] and once on dialysis lose their general population survival advantage over men [7], the full explanation for why in contrast a greater proportion of people receiving RRT were men is not known. Information obtained from patients in renal centres with CKD 4–5 may help unravel this paradox better in the future.

Acknowledgement

The (non-UK) data reported in the section on International comparisons have been supplied by the United States Renal Data System (USRDS). The interpretation and reporting of these data are the responsibility of the author(s) and in no way should be seen as an official policy or interpretation of the U.S. government.

Conflicts of interest: the authors declare no conflicts of interest

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UK Renal Registry 20th Annual Report: Chapter 3 Demographic and Biochemistry Profile of Kidney Transplant Recipients in the UK in 2016: National and Centre-specific Analyses

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Keywords

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 5% increase in overall renal transplant numbers from 2015 to 2016, with an increase in kidney transplants from donors after brainstem death (9%), donors after cardiac death (13%) but a fall from living donors (−3%).
- In 2016, death-censored renal transplant failure rates in prevalent patients were similar to previous years at 2.4% per annum. Transplant patient death rates were similar at 2.5 per 100 patient years.
- The median age of incident and prevalent renal transplant patients in the UK was 51.4 and 54.3 years respectively.
- The median eGFR of prevalent renal transplant recipients was 52.2 ml/min/1.73 m^2.
- The median eGFR of patients one year after transplantation was 57.2 ml/min/1.73 m^2 post live transplant, 52.4 ml/min/1.73 m^2 post brainstem death transplant and 48.4 ml/min/1.73 m^2 post circulatory death transplant.
- In 2016, 13.1% 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 −0.7 ml/min/1.73 m^2/year.
- In 2016, malignancy (23%) replaced infection (22%) as the commonest cause of death in patients with a functioning renal transplant.
- Data completeness for attainment of blood pressure targets remained variable between centres.

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Introduction

This chapter includes independent analyses regarding renal transplant activity and survival data from the UK Transplant Registry, held by the Organ Donation and Transplantation Directorate (ODT) of NHS Blood and Transplant (NHSBT). The UK Renal Registry (UKRR) has performed additional analyses of renal transplant recipient follow-up data examining demographics, clinical and biochemical variables. NHSBT records all 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 allows for the comparison of key quality measures 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) estimated glomerular filtration rate (eGFR) slope analysis; and (6) cause of death in transplant recipients. Methodology, results and discussion of these analyses are provided in detail for all six sections separately.

The UKRR methodology has previously been described [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.

In previous years, this chapter has used the Modification of Diet in Renal Disease (MDRD) study equation to estimate GFR from serum creatinine. In line with NICE recommendations and for consistency across the UKRR report, the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) creatinine equation is used this year [2]. There is conflicting evidence as to whether either equation is superior in the transplant population although the EPI formula is felt to be more accurate at higher levels of eGFR [3–6]. In light of this change, the authors advise caution in comparing eGFR results with previous published editions of this chapter. The NICE guidelines further recommend that laboratories using the MDRD equation to calculate eGFR consider changing their practice to using CKD-EPI.

Unless otherwise specified, prevalent transplant patients were defined as patients with a functioning renal transplant on 31 December 2016.

A list of the Renal Association recommended audit measures which were relevant to the transplant population in 2016 are given in appendix 1 of this chapter [7]. 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. Updated guidelines were published in 2017 with some revised audit standards although the same reporting challenges will persist [8]. Over time it is hoped to work with the renal community to improve reporting across the range of recommended standards.

The data were analysed using SAS 9.3.

Transplant activity, waiting list activity and survival data

Introduction

NHSBT prospectively collects donor and recipient data at the time of transplantation. They also request that transplant centres provide an annual paper based data return on the status of the recipient including graft function. This enables ODT to generate comprehensive analyses of renal transplant activity and graft survival statistics, albeit on a financial year basis rather than a calendar year basis as is used in the UKRR report [9].

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 2016, there were 23 UK adult renal transplant centres, 19 in England, two in Scotland and one each in Northern Ireland and Wales.

Annual organ-specific updates and five-year reports with comprehensive data concerning the number of patients on the transplant waiting list, percentage of pre-emptive listing, the number of transplants performed, the number of deceased kidney donors (donor after brainstem death (DBD) and donor after circulatory death (DCD)), living kidney donors, patient survival and graft survival are available on the NHSBT website (https://www.organdonation.nhs.uk/statistics/).

Results

During 2016, 3,328 kidney or kidney plus transplants were performed (table 3.1). The absolute number of living kidney donors showed a small decline in 2016, but still represented 30.6 % of all transplants performed. Deceased kidney-only transplants from both DBD and DCD increased 9% and 13% respectively. The number of kidney plus other organ transplants remained at a similar level, apart from a fall in kidney and pancreas transplant (−16%).

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

Using data from the UKRR on prevalent renal transplant patients on 1 January 2016, the death rate during 2016 was 2.5 per 100 patient years (CI 2.3–2.7) when censored for return to dialysis, and 2.6 per 100 patient years (CI 2.5–2.8) without censoring for dialysis. These death rates were similar to those observed over the last five years and have not shown any impact from the increasing age or comorbidity of the transplanted cohort.

During 2016, 2.4% of prevalent transplant patients experienced graft failure and returned to dialysis (censored at death for patients who died with a functioning graft), which is slightly below the mean rate from 2010–2015 (2.5%) and a fall from the 2015 rate (2.7%).

Discussion

During 2016, there was a 5% increase in overall kidney transplant numbers due to increases in both types of deceased donor kidney transplants, partially offset by a further fall in the number of living kidney donors. Despite a small fall in 2015, there has been a steady increasing trend in total transplant numbers over the last decade. In the prevalent transplant population, the graft failure rate of 2.4% per annum and the patient death rate of 2.5 per 100 patient years has remained stable over recent years despite changes in the demographics of the transplanted cohort.

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 should be interpreted in the context of centre-specific variations in repatriation policies; some transplant centres continued to follow up and report on all patients they transplanted, whereas others referred patients back to non-transplanting centres at some point post-transplant. Some transplant centres only referred back patients when their graft was failing. The time post-transplantation that a patient was referred back to their local centre varied between transplant centres, but the UKRR can 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 B for allocation procedure). This process may result in some discrepancies in transplant numbers particularly in Oxford/Reading and Clwyd/Liverpool Royal.

Table 3.1. UK kidney and kidney plus other organ transplant numbers in the UK (including paediatric), 1/1/2014–31/12/2016

Organ	2014	2015	2016	% change 2015–2016
Donor after brainstem death (DBD)[a]	1,205	1,130	1,234	9
Donor after circulatory death (DCD)[b]	713	802	909	13
Living donor kidney	1,096	1,045	1,018	−3
Kidney and liver[c]	12	21	18	
Kidney and heart	1	0	1	
Kidney and pancreas[d]	171	175	147	−16
Kidney and lung	1	0	0	
Small bowel (inc kidney)	1	2	1	
Total kidney transplants	**3,200**	**3,175**	**3,328**	**5**

[a]Includes en bloc kidney transplants (3 in 2014, 4 in 2015, 6 in 2016) and double kidney transplants (22 in 2014, 15 in 2015, 15 in 2016)
[b]Includes en bloc kidney transplants (4 in 2014, 8 in 2015, 8 in 2016) and double kidney transplants (51 in 2014, 31 in 2015, 39 in 2016)
[c]Includes DCD transplants (47 in 2014, 50 in 2015, 44 in 2016)
[d]Includes DCD transplants (1 in 2016)

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

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

Cohorts for survival rate estimation: 1 year survival: 1/4/2011–31/03/2015; 5 year survival: 1/4/2007–31/3/2011; first grafts only – re-grafts excluded for patient survival estimation. Since the cohorts to estimate 1- and 5-year survival are different, some centres may appear to have 5 year survival better than 1 year survival

*Information courtesy of NHSBT: number of transplants, patients and 95% CI for each estimate; statistical methodology for computing risk-adjusted estimates can be obtained from the NHSBT website (see http://odt.nhs.uk/pdf/organ_specific_report_kidney_2016.pdf)

Methods

Cambridge renal centre (Addenbrooke's) has been unable to submit their 2015 and 2016 data. The centre was able to submit summary numbers of patients still on renal replacement therapy (RRT) at the end of 2016, by treatment modality, and incident numbers. Cambridge renal centre is therefore excluded from all centre level prevalent analyses. However their data have been included in the transplant rates calculation in England and UK, where only summary numbers are needed. For the calculation of transplant rates by Clinical Commissioning Groups (CCG) or Health Board/Social Care Areas (HB), where patient-level information are needed for age/sex standardisation, areas covered by Cambridge have been excluded. Based on prevalent transplant 2014 data, the percentage of patients resident in each CCG that was under the care of Cambridge renal centre at the end of 2014 was calculated. CCGs with >15% prevalent transplant patients seen in Cambridge were excluded from the analysis of the transplant prevalent rate by CCG in 2015 and 2016.

As Colchester did not have any transplant patients they were excluded from some of the analyses, although 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 incidence 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, sex, ethnicity, PRD) for patients in a given renal centre was obtained from the UKRR patient registration data fields. Individual patients were assigned to the centre that returned data for them during 2016. The prevalence of transplant patients in areas covered by individual CCG or HB was estimated based on the postcode of the registered address for patients on RRT. Data on ethnic origin, supplied as Patient Administration System (PAS) codes, were retrieved from fields within renal centre IT systems. For the purpose of this analysis, patients were grouped into White, South Asian, Black, Other and Unknown categories. The details of ethnicity regrouping into the above categories are provided in appendix H: Coding www.renalreg.org/publications-reports/.

Results and Discussion

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

Table 3.3. The prevalence per million population (pmp) of renal transplants in adults in the UK on 31/12/2016, by country

	England	N Ireland	Scotland	Wales	UK
Number of prevalent transplant patients	28,698	1,069	2,821	1,698	34,286
Total population, mid–2016 estimates* (millions)	55.3	1.9	5.4	3.1	65.6
Prevalence transplant rate (pmp)	519	574	522	545	522

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

The prevalence of renal transplant recipients in each CCG 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 are described in tables 3.4 and 3.5 respectively.

After standardisation for age and sex, unexplained variability was evident in the prevalence of renal

Table 3.4. The prevalence per million population (pmp) of patients with a renal transplant and standardised rate ratio in the UK, as on 31 December 2012–2016, by CCG/HB

CCG/HB – CCG in England, Health and Social Care Areas in Northern Ireland, Local Health Boards in Wales and Health Boards in Scotland
O/E – age and sex standardised transplant prevalence rate ratio
LCL – lower 95% confidence limit
UCL – upper 95% confidence limit
pmp – per million population
CCG/HBs with significantly high average rate ratios are bold in darker greyed areas
CCG/HBs with significantly low average rate ratios are italicised in lighter greyed areas
Mid-2016 population data at CCG/HB level was obtained 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

			O/E				2016				
UK area	**CCG/HB**	**Total population**	**2012**	**2013**	**2014**	**2015**	**O/E**	**95% LCL**	**95% UCL**	**Crude rate pmp**	**% non-White**
Cheshire, Warrington and Wirral	NHS Eastern Cheshire	196,900	0.88	0.87	0.87	0.86	0.90	0.74	1.10	513	3.7
	NHS South Cheshire	179,800	0.90	0.93	0.97	0.99	1.04	0.86	1.26	573	2.9
	NHS Vale Royal	103,700	0.74	0.77	0.75	0.79	0.79	0.59	1.05	434	2.1
	NHS Warrington	208,800	0.89	0.96	0.94	0.89	0.89	0.73	1.08	479	4.1
	NHS West Cheshire	232,000	0.96	0.96	0.95	0.87	0.89	0.74	1.07	487	2.8
	NHS Wirral	*321,200*	*0.80*	*0.77*	*0.73*	*0.73*	*0.78*	*0.66*	*0.93*	*423*	*3.0*
Durham, Darlington and Tees	NHS Darlington	105,600	0.97	1.01	1.03	1.00	0.97	0.75	1.27	521	3.8
	NHS Durham Dales, Easington and Sedgefield	274,600	1.03	1.06	1.09	1.03	1.02	0.87	1.19	564	1.2
	NHS Hartlepool and Stockton-on-Tees	288,500	1.00	0.98	1.00	1.00	0.99	0.85	1.16	520	4.4
	NHS North Durham	*247,500*	*0.94*	*0.90*	*0.86*	*0.85*	*0.79*	*0.65*	*0.95*	*420*	*2.5*
	NHS South Tees	**275,800**	**1.40**	**1.31**	**1.31**	**1.29**	**1.23**	**1.06**	**1.43**	**638**	**6.7**
Greater Manchester	**NHS Bolton**	**283,100**	**1.29**	**1.24**	**1.20**	**1.23**	**1.22**	**1.06**	**1.42**	**622**	**18.1**
	NHS Bury	188,700	1.01	0.95	0.99	1.04	1.05	0.86	1.27	546	10.8
	NHS Heywood, Middleton & Rochdale	216,200	1.10	1.10	0.97	1.02	1.14	0.95	1.35	574	18.3
	NHS Manchester	541,300	0.92	0.95	1.00	1.06	1.08	0.95	1.22	453	33.5
	NHS Oldham	232,700	1.01	1.07	1.01	1.06	1.08	0.90	1.28	529	22.5
	NHS Salford	248,700	1.02	0.97	0.99	1.02	1.03	0.86	1.22	499	9.9
	NHS Stockport	290,600	0.95	0.94	0.91	0.93	0.95	0.81	1.11	506	7.9
	NHS Tameside and Glossop	256,400	1.07	1.04	1.05	1.04	1.12	0.96	1.31	597	8.2
	NHS Trafford	234,700	0.89	0.90	0.94	0.96	0.96	0.80	1.15	499	14.5
	NHS Wigan Borough	323,100	1.08	1.10	1.07	1.06	1.08	0.93	1.24	585	2.7

Table 3.4. Continued

UK area	CCG/HB	Total population	O/E 2012	O/E 2013	O/E 2014	O/E 2015	2016 O/E	2016 95% LCL	2016 95% UCL	2016 Crude rate pmp	% non-White
Lancashire	NHS Blackburn with Darwen	147,000	1.01	1.03	1.08	1.07	1.02	0.81	1.28	496	30.8
	NHS Blackpool	139,200	0.91	1.00	1.01	0.99	0.99	0.79	1.25	539	3.3
	NHS Chorley and South Ribble	174,300	0.91	0.95	0.93	0.94	0.95	0.78	1.17	522	2.9
	NHS East Lancashire	375,800	1.06	1.07	1.05	1.07	1.07	0.93	1.22	564	11.9
	NHS Fylde & Wyre	169,000	0.81	0.82	0.77	0.84	0.83	0.66	1.03	473	2.1
	NHS Greater Preston	203,500	0.86	0.84	0.86	0.86	0.84	0.68	1.04	427	14.7
	NHS Morecombe Bay	*348,500*	*0.87*	*0.87*	*0.84*	*0.84*	*0.85*	*0.73*	*1.00*	*471*	*4.0*
	NHS West Lancashire	113,400	0.92	0.88	0.83	0.86	0.80	0.61	1.06	432	1.9
Merseyside	NHS Halton	126,900	1.03	1.00	1.03	1.03	0.98	0.77	1.25	520	2.2
	NHS Knowsley	147,900	0.96	0.97	0.94	0.88	0.89	0.70	1.13	460	2.8
	NHS Liverpool	484,600	0.97	1.00	1.00	0.96	0.92	0.81	1.05	448	11.1
	NHS South Sefton	158,900	0.94	0.90	0.87	0.85	0.88	0.70	1.10	478	2.2
	NHS Southport and Formby	*115,400*	*0.65*	*0.75*	*0.73*	*0.70*	*0.67*	*0.50*	*0.90*	*373*	*3.1*
	NHS St Helens	178,500	0.82	0.85	0.91	0.91	0.84	0.67	1.04	454	2.0
Cumbria, Northumberland, Tyne and Wear	*NHS Cumbria North*	*318,200*	*0.89*	*0.88*	*0.90*	*0.92*	*0.82*	*0.70*	*0.97*	*468*	*1.5*
	NHS Newcastle Gateshead	498,100	0.99	0.94	0.92	0.90	0.92	0.81	1.05	452	10.1
	NHS North Tyneside	203,300	1.32	1.24	1.11	1.09	1.07	0.89	1.28	585	3.4
	NHS Northumberland	316,000	0.93	0.93	0.92	0.86	0.86	0.73	1.00	497	1.6
	NHS South Tyneside	149,400	1.16	1.20	1.06	0.97	1.02	0.82	1.26	555	4.1
	NHS Sunderland	278,000	1.14	1.11	1.08	1.02	1.05	0.90	1.23	565	4.1
North Yorkshire and Humber	NHS East Riding of Yorkshire	315,900	0.96	1.02	0.98	0.96	0.92	0.79	1.07	535	1.9
	NHS Hambleton, Richmondshire and Whitby	153,200	0.75	0.79	0.92	0.94	0.86	0.68	1.07	490	2.7
	NHS Harrogate and Rural District	156,300	1.17	1.09	1.08	1.09	1.06	0.86	1.29	595	3.7
	NHS Hull	260,200	1.03	1.04	1.03	1.09	1.10	0.94	1.30	542	5.9
	NHS North East Lincolnshire	159,100	1.01	0.98	0.92	0.92	0.94	0.75	1.17	496	2.6
	NHS North Lincolnshire	*170,800*	*0.64*	*0.63*	*0.67*	*0.68*	*0.72*	*0.57*	*0.92*	*398*	*4.0*
	NHS Scarborough and Ryedale	111,400	1.16	1.04	1.03	1.05	1.01	0.79	1.29	575	2.5
	NHS Vale of York	357,900	1.07	1.06	1.06	1.05	1.03	0.89	1.18	545	4.0
South Yorkshire and Bassetlaw	NHS Barnsley	241,200	0.93	0.91	0.95	0.94	0.96	0.80	1.14	518	2.1
	NHS Bassetlaw	114,800	0.70	0.67	0.72	0.80	0.80	0.61	1.05	453	2.6
	NHS Doncaster	306,400	0.91	0.87	0.90	0.93	0.93	0.79	1.09	493	4.7
	NHS Rotherham	261,900	1.03	1.04	1.08	1.05	1.03	0.87	1.21	550	6.4
	NHS Sheffield	575,400	0.99	0.97	0.96	0.94	0.92	0.81	1.04	440	16.3
West Yorkshire	NHS Airedale, Wharfedale and Craven	160,000	1.05	1.04	1.01	1.06	1.02	0.83	1.26	556	11.1
	NHS Bradford City	**84,900**	**1.55**	**1.64**	**1.64**	**1.87**	**2.05**	**1.61**	**2.61**	**777**	**72.2**
	NHS Bradford Districts	**339,700**	**1.30**	**1.31**	**1.29**	**1.30**	**1.31**	**1.15**	**1.50**	**633**	**28.7**
	NHS Calderdale	209,800	1.21	1.12	1.03	1.01	1.01	0.84	1.22	543	10.3
	NHS Greater Huddersfield	245,000	1.06	1.03	1.06	1.07	1.09	0.92	1.28	567	17.4
	NHS Leeds North	201,200	1.04	0.99	1.02	1.04	1.00	0.83	1.21	522	17.4
	NHS Leeds South and East	253,700	1.00	1.05	0.99	1.01	0.98	0.82	1.18	457	18.3
	NHS Leeds West	326,900	0.99	1.04	1.07	1.05	1.04	0.89	1.21	480	10.8
	NHS North Kirklees	**192,000**	**1.18**	**1.29**	**1.36**	**1.37**	**1.28**	**1.08**	**1.53**	**641**	**25.3**
	NHS Wakefield	336,800	0.85	0.85	0.85	0.84	0.87	0.74	1.02	469	4.6

Table 3.4. Continued

UK area	CCG/HB	Total population	O/E 2012	O/E 2013	O/E 2014	O/E 2015	2016 O/E	2016 95% LCL	2016 95% UCL	2016 Crude rate pmp	% non-White
Arden, Herefordshire and Worcester-shire	NHS Coventry and Rugby	456,700	1.05	1.02	1.07	1.08	1.08	0.95	1.23	510	22.2
	NHS Herefordshire	*189,300*	*0.71*	*0.68*	*0.69*	*0.72*	*0.74*	*0.59*	*0.92*	*417*	*1.8*
	NHS Redditch and Bromsgrove	181,700	0.86	0.81	0.84	0.81	0.86	0.70	1.07	468	6.0
	NHS South Warwickshire	262,700	1.05	1.03	1.00	1.02	0.94	0.80	1.12	514	7.0
	NHS South Worcestershire	*301,400*	*0.78*	*0.77*	*0.76*	*0.73*	*0.74*	*0.62*	*0.88*	*408*	*3.7*
	NHS Warwickshire North	190,200	1.05	1.02	0.97	0.96	0.96	0.79	1.17	526	6.5
	NHS Wyre Forest	99,900	0.81	0.83	0.75	0.69	0.77	0.57	1.03	430	2.8
Birmingham and the Black Country	**NHS Birmingham CrossCity**	**748,300**	**1.04**	**1.05**	**1.07**	**1.08**	**1.13**	**1.02**	**1.24**	**509**	**35.2**
	NHS Birmingham South and Central	204,000	0.97	1.05	1.11	1.11	1.16	0.95	1.40	505	40.4
	NHS Dudley	*317,600*	*0.68*	*0.70*	*0.70*	*0.73*	*0.75*	*0.63*	*0.89*	*394*	*10.0*
	NHS Sandwell and West Birmingham	495,100	1.00	1.09	1.04	1.04	1.13	1.00	1.27	517	45.3
	NHS Solihull	*211,800*	*0.76*	*0.72*	*0.74*	*0.74*	*0.71*	*0.57*	*0.88*	*378*	*10.9*
	NHS Walsall	278,700	1.05	1.08	1.10	1.05	1.07	0.91	1.26	535	21.1
	NHS Wolverhampton	256,600	0.78	0.88	0.87	0.84	0.85	0.71	1.03	421	32.0
Derbyshire and Nottingham-shire	NHS Erewash	96,700	0.65	0.83	0.87	0.83	0.83	0.61	1.12	445	3.2
	NHS Hardwick	*111,400*	*0.54*	*0.47*	*0.55*	*0.59*	*0.60*	*0.43*	*0.82*	*332*	*1.8*
	NHS Mansfield & Ashfield	197,900	1.04	1.04	1.03	0.96	0.95	0.79	1.16	515	2.5
	NHS Newark & Sherwood	119,700	1.11	1.11	1.11	1.03	0.95	0.74	1.21	526	2.4
	NHS North Derbyshire	*273,200*	*0.89*	*0.82*	*0.78*	*0.78*	*0.80*	*0.67*	*0.95*	*458*	*2.5*
	NHS Nottingham City	325,300	0.93	0.96	0.95	0.97	0.98	0.83	1.15	421	28.5
	NHS Nottingham North & East	150,300	0.91	0.94	0.83	0.85	0.86	0.68	1.08	466	6.2
	NHS Nottingham West	112,700	1.04	1.02	1.04	1.08	1.06	0.83	1.35	577	7.3
	NHS Rushcliffe	*115,200*	*0.89*	*0.96*	*0.87*	*0.80*	*0.75*	*0.56*	*0.99*	*408*	*6.9*
	NHS Southern Derbyshire	527,400	0.95	0.96	0.95	0.95	0.99	0.88	1.11	518	11.0
East Anglia	NHS Cambridgeshire and Peterborough[a]	884,600	0.96	0.95	0.94						9.5
	NHS Great Yarmouth & Waveney[a]	215,700	0.83	0.95	1.00						2.7
	NHS Ipswich and East Suffolk[b]	*401,000*	*0.86*	*0.91*	*0.90*	*0.79**	*0.77**	*0.67**	*0.90**	*424**	*5.6*
	NHS North Norfolk	171,900	0.82	1.02	0.92	0.90	0.89	0.72	1.09	524	1.5
	NHS Norwich[b]	216,800	0.75	0.93	0.94	0.90*	0.88*	0.72*	1.08*	434*	7.3
	NHS South Norfolk[a]	229,900	0.84	0.95	0.90						2.6
	NHS West Norfolk[a]	175,100	0.87	0.81	0.84						2.6
	NHS West Suffolk[a]	227,800	0.99	0.94	0.89						4.6
Essex	NHS Basildon and Brentwood	259,800	0.90	1.03	0.91	0.83	0.86	0.71	1.03	443	7.1
	NHS Castle Point, Rayleigh and Rochford	175,400	0.83	0.87	0.96	0.85	0.80	0.65	1.00	450	3.0
	NHS Mid Essex[a]	388,400	0.94	0.99	0.96						4.4
	NHS North East Essex[a]	329,200	0.93	0.95	0.99						5.5
	NHS Southend	179,800	0.88	0.95	0.94	0.88	0.89	0.72	1.10	467	8.4
	NHS Thurrock	167,000	0.83	0.79	0.79	0.82	0.79	0.62	1.00	389	14.1
	NHS West Essex[a]	302,500	0.89	0.85	0.89						8.2
Hertfordshire and the South Midlands	NHS Bedfordshire[a]	447,700	1.06	1.03	1.04						11.2
	NHS Corby[b]	68,200	0.75	0.67	0.60	0.82*	0.84*	0.59*	1.21*	425*	4.5
	NHS East and North Hertfordshire[a]	565,700	0.99	1.00	1.00						10.4
	NHS Herts Valleys	591,800	0.96	0.97	0.99	1.02	1.04	0.93	1.16	531	14.6
	NHS Luton[a]	216,800	1.19	1.22	1.33						45.3
	NHS Milton Keynes	270,500	1.01	0.95	1.05	1.07	1.09	0.93	1.29	547	19.6
	NHS Nene	648,600	0.91	0.91	0.96	0.92	0.95	0.85	1.06	504	9.1

Table 3.4. Continued

UK area	CCG/HB	Total population	O/E 2012	O/E 2013	O/E 2014	O/E 2015	2016 O/E	2016 95% LCL	2016 95% UCL	2016 Crude rate pmp	% non-White
Leicestershire and Lincolnshire	NHS East Leicestershire and Rutland	328,600	0.93	0.89	0.92	0.90	0.93	0.80	1.08	511	9.8
	NHS Leicester City	**348,300**	**1.45**	**1.50**	**1.57**	**1.58**	**1.61**	**1.43**	**1.83**	**718**	**49.5**
	NHS Lincolnshire East	233,400	0.88	0.89	0.89	0.86	0.88	0.74	1.06	510	2.0
	NHS Lincolnshire West	*236,900*	*0.81*	*0.84*	*0.87*	*0.79*	*0.77*	*0.63*	*0.94*	*405*	*3.0*
	NHS South Lincolnshire[a]	147,800	0.66	0.61	0.70						2.3
	NHS South West Lincolnshire	*125,200*	*0.73*	*0.70*	*0.69*	*0.69*	*0.68*	*0.52*	*0.91*	*383*	*2.3*
	NHS West Leicestershire	393,000	1.03	1.03	1.01	0.99	1.01	0.88	1.16	542	6.9
Shropshire and Staffordshire	*NHS Cannock Chase*	*135,100*	*0.74*	*0.77*	*0.73*	*0.70*	*0.72*	*0.55*	*0.94*	*392*	*2.4*
	NHS East Staffordshire	*126,400*	*0.60*	*0.68*	*0.63*	*0.68*	*0.73*	*0.56*	*0.97*	*396*	*9.0*
	NHS North Staffordshire	218,300	0.91	0.94	0.87	0.89	0.90	0.74	1.08	495	3.5
	NHS Shropshire	*313,400*	*0.76*	*0.74*	*0.73*	*0.76*	*0.70*	*0.58*	*0.83*	*396*	*2.0*
	NHS South East Staffs and Seisdon and Peninsular	*225,200*	*0.79*	*0.82*	*0.82*	*0.82*	*0.82*	*0.67*	*0.99*	*457*	*3.6*
	NHS Stafford and Surrounds	154,000	0.90	0.90	0.92	0.95	0.91	0.73	1.14	513	4.7
	NHS Stoke on Trent	261,400	1.03	0.97	0.98	0.94	0.95	0.79	1.13	482	11.0
	NHS Telford & Wrekin	*173,000*	*0.69*	*0.72*	*0.69*	*0.76*	*0.67*	*0.52*	*0.86*	*347*	*7.3*
London	NHS Barking & Dagenham	206,500	1.01	1.11	1.14	1.12	1.19	0.99	1.44	509	41.7
	NHS Barnet	**386,100**	**1.40**	**1.38**	**1.34**	**1.35**	**1.30**	**1.15**	**1.47**	**627**	**35.9**
	NHS Camden	246,200	1.12	1.06	1.01	1.02	1.03	0.86	1.23	483	33.7
	NHS City and Hackney	282,900	0.78	0.82	0.91	0.97	1.07	0.90	1.26	474	44.6
	NHS Enfield	**331,400**	**1.37**	**1.33**	**1.38**	**1.44**	**1.50**	**1.32**	**1.70**	**709**	**39.0**
	NHS Haringey	**278,500**	**1.17**	**1.17**	**1.23**	**1.31**	**1.37**	**1.18**	**1.59**	**646**	**39.5**
	NHS Havering	*252,800*	*0.76*	*0.83*	*0.76*	*0.79*	*0.80*	*0.66*	*0.97*	*404*	*12.3*
	NHS Islington	**232,900**	**1.21**	**1.21**	**1.24**	**1.25**	**1.23**	**1.03**	**1.46**	**554**	**31.8**
	NHS Newham	**341,000**	**0.91**	**1.01**	**1.11**	**1.16**	**1.18**	**1.01**	**1.37**	**504**	**71.0**
	NHS Redbridge	**299,200**	**1.20**	**1.18**	**1.26**	**1.24**	**1.27**	**1.10**	**1.47**	**595**	**57.5**
	NHS Tower Hamlets	304,900	0.79	0.78	0.87	0.87	0.92	0.77	1.10	381	54.8
	NHS Waltham Forest	**275,800**	**1.13**	**1.15**	**1.26**	**1.34**	**1.39**	**1.20**	**1.61**	**649**	**47.8**
	NHS Brent	**328,300**	**1.56**	**1.60**	**1.58**	**1.61**	**1.65**	**1.46**	**1.86**	**786**	**63.7**
	NHS Central London (Westminster)	178,400	0.97	0.95	1.02	1.07	1.10	0.90	1.33	555	36.2
	NHS Ealing	**343,200**	**1.49**	**1.44**	**1.50**	**1.52**	**1.55**	**1.37**	**1.75**	**752**	**51.0**
	NHS Hammersmith and Fulham	179,700	1.04	1.06	1.09	1.08	1.06	0.86	1.30	507	31.9
	NHS Harrow	**248,800**	**1.69**	**1.60**	**1.64**	**1.63**	**1.72**	**1.51**	**1.97**	**856**	**57.8**
	NHS Hillingdon	**302,500**	**1.48**	**1.41**	**1.47**	**1.40**	**1.41**	**1.23**	**1.62**	**671**	**39.4**
	NHS Hounslow	**271,100**	**1.19**	**1.27**	**1.32**	**1.37**	**1.29**	**1.11**	**1.50**	**620**	**48.6**
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	226,000	1.07	1.04	1.06	1.01	0.95	0.79	1.15	487	33.4
	NHS Bexley	**244,800**	**1.27**	**1.29**	**1.26**	**1.34**	**1.29**	**1.10**	**1.50**	**641**	**18.1**
	NHS Bromley	326,900	1.13	1.11	1.09	1.10	1.12	0.98	1.30	581	15.7
	NHS Croydon	382,300	0.88	0.94	0.92	0.96	0.97	0.84	1.12	476	44.9
	NHS Greenwich	**279,800**	**1.04**	**1.09**	**1.23**	**1.26**	**1.30**	**1.12**	**1.51**	**604**	**37.5**
	NHS Kingston	176,100	1.02	0.97	0.99	1.00	1.05	0.85	1.29	511	25.5
	NHS Lambeth	327,900	0.98	1.03	1.07	1.12	1.16	1.00	1.34	534	42.9
	NHS Lewisham	301,900	0.86	0.99	1.03	1.11	1.09	0.93	1.28	513	46.5
	NHS Merton	**205,000**	**1.15**	**1.18**	**1.18**	**1.20**	**1.22**	**1.02**	**1.45**	**595**	**35.1**
	NHS Richmond	*195,800*	*0.86*	*0.87*	*0.86*	*0.82*	*0.73*	*0.59*	*0.92*	*383*	*14.0*
	NHS Southwark	**313,200**	**1.38**	**1.40**	**1.45**	**1.43**	**1.43**	**1.25**	**1.64**	**661**	**45.8**
	NHS Sutton	202,200	1.08	1.05	0.99	0.99	1.02	0.84	1.24	519	21.4
	NHS Wandsworth	316,100	0.95	0.96	1.01	1.02	1.03	0.88	1.21	475	28.6

Table 3.4. Continued

UK area	CCG/HB	Total population	O/E 2012	O/E 2013	O/E 2014	O/E 2015	2016 O/E	2016 95% LCL	2016 95% UCL	2016 Crude rate pmp	2016 % non-White
Bath, Gloucestershire, Swindon and Wiltshire	NHS Bath and North East Somerset	187,800	0.70	0.78	0.81	0.81	0.85	0.69	1.06	426	5.4
	NHS Gloucestershire	*623,100*	*0.86*	*0.90*	*0.85*	*0.86*	*0.86*	*0.76*	*0.96*	*467*	*4.6*
	NHS Swindon	223,600	0.98	0.99	1.03	1.11	1.16	0.98	1.38	608	10.0
	NHS Wiltshire	*488,400*	*0.90*	*0.85*	*0.85*	*0.86*	*0.85*	*0.74*	*0.97*	*463*	*3.4*
Bristol, North Somerset, Somerset and South Gloucestershire	**NHS Bristol**	**454,200**	**1.25**	**1.25**	**1.24**	**1.22**	**1.20**	**1.06**	**1.36**	**548**	**16.0**
	NHS North Somerset	211,700	1.11	1.09	1.03	1.02	0.95	0.79	1.15	524	2.7
	NHS Somerset	*549,400*	*0.93*	*0.91*	*0.88*	*0.86*	*0.82*	*0.72*	*0.92*	*455*	*2.0*
	NHS South Gloucestershire	277,600	1.05	1.05	1.01	0.99	0.96	0.81	1.13	504	5.0
Devon, Cornwall and Isles of Scilly	NHS Kernow	556,000	1.17	1.15	1.12	1.11	1.05	0.95	1.17	594	1.8
	NHS North, East, West Devon	898,000	1.05	1.05	1.02	1.01	0.99	0.91	1.08	532	3.0
	NHS South Devon and Torbay	279,900	1.15	1.18	1.16	1.09	1.08	0.93	1.25	618	2.1
Kent and Medway	NHS Ashford	126,200	1.16	1.09	1.13	1.07	1.16	0.93	1.45	610	6.3
	NHS Canterbury and Coastal	210,500	1.20	1.14	1.19	1.10	1.06	0.88	1.27	537	5.9
	NHS Dartford, Gravesham and Swanley	260,600	1.15	1.13	1.17	1.19	1.11	0.95	1.31	572	13.0
	NHS Medway	278,500	0.93	0.96	0.92	0.90	0.91	0.76	1.08	460	10.4
	NHS South Kent Coast	207,600	0.87	0.89	0.94	0.90	0.88	0.73	1.07	491	4.5
	NHS Swale	114,800	1.39	1.43	1.38	1.35	1.25	1.00	1.57	653	3.8
	NHS Thanet	140,700	1.21	1.20	1.17	1.18	1.16	0.94	1.43	619	4.5
	NHS West Kent	481,600	0.86	0.86	0.86	0.84	0.88	0.77	1.00	465	4.9
Surrey and Sussex	NHS Brighton & Hove	289,200	0.87	0.83	0.82	0.88	0.87	0.73	1.04	425	10.9
	NHS Coastal West Sussex	498,900	0.96	0.96	0.94	0.93	0.94	0.83	1.06	521	3.8
	NHS Crawley	*111,400*	*0.78*	*0.71*	*0.70*	*0.65*	*0.62*	*0.44*	*0.87*	*305*	*20.1*
	NHS East Surrey	183,700	0.88	0.87	0.80	0.80	0.82	0.65	1.02	430	8.3
	NHS Eastbourne, Hailsham and Seaford	*189,500*	*0.75*	*0.75*	*0.74*	*0.73*	*0.69*	*0.54*	*0.87*	*375*	*4.4*
	NHS Guildford and Waverley	*207,800*	*0.69*	*0.68*	*0.69*	*0.69*	*0.67*	*0.53*	*0.85*	*342*	*7.2*
	NHS Hastings & Rother	*185,800*	*0.80*	*0.79*	*0.81*	*0.78*	*0.80*	*0.64*	*0.99*	*447*	*4.6*
	NHS High Weald Lewes Havens	*172,600*	*0.83*	*0.78*	*0.78*	*0.73*	*0.74*	*0.59*	*0.93*	*417*	*3.1*
	NHS Horsham and Mid Sussex	*233,500*	*0.70*	*0.72*	*0.77*	*0.79*	*0.74*	*0.60*	*0.90*	*398*	*4.9*
	NHS North West Surrey	344,600	1.03	1.03	1.01	0.98	0.96	0.82	1.11	502	12.5
	NHS Surrey Downs	288,200	0.89	0.90	0.90	0.88	0.87	0.74	1.03	472	9.1
	NHS Surrey Heath	96,700	1.24	1.09	0.95	0.91	0.92	0.69	1.22	496	9.3
Thames Valley	**NHS Aylesbury Vale**	**211,400**	**1.26**	**1.21**	**1.19**	**1.13**	**1.21**	**1.03**	**1.44**	**643**	**9.7**
	NHS Bracknell and Ascot	137,700	1.05	1.03	0.99	0.95	0.98	0.77	1.24	509	9.5
	NHS Chiltern	325,900	1.11	1.10	1.04	1.04	1.05	0.91	1.21	552	15.8
	NHS Newbury and District	107,100	1.31	1.25	1.14	1.05	1.02	0.79	1.32	551	4.4
	NHS North & West Reading	100,300	1.00	0.97	0.90	0.88	0.86	0.64	1.15	458	10.4
	NHS Oxfordshire	668,700	1.08	1.05	1.09	1.09	1.08	0.97	1.19	550	9.3
	NHS Slough	**147,200**	**1.65**	**1.86**	**1.90**	**1.98**	**1.90**	**1.60**	**2.26**	**863**	**54.3**
	NHS South Reading	**112,000**	**1.21**	**1.28**	**1.31**	**1.39**	**1.54**	**1.23**	**1.92**	**678**	**30.5**
	NHS Windsor, Ascot and Maidenhead	**142,900**	**1.23**	**1.26**	**1.30**	**1.27**	**1.23**	**1.00**	**1.51**	**630**	**14.7**
	NHS Wokingham	161,900	1.01	0.97	0.98	0.97	0.95	0.77	1.18	507	11.6
Wessex	*NHS Dorset*	*771,900*	*0.90*	*0.87*	*0.86*	*0.85*	*0.85*	*0.76*	*0.94*	*464*	*4.0*
	NHS Fareham and Gosport	200,800	0.95	1.02	1.03	1.01	0.99	0.82	1.19	538	3.4
	NHS Isle of Wight	*139,800*	*0.76*	*0.66*	*0.65*	*0.68*	*0.68*	*0.52*	*0.89*	*393*	*2.7*
	NHS North East Hampshire and Farnham	210,500	0.86	0.88	0.89	0.92	0.97	0.80	1.17	508	9.7
	NHS North Hampshire	*221,900*	*0.82*	*0.81*	*0.78*	*0.81*	*0.80*	*0.65*	*0.98*	*428*	*6.4*
	NHS Portsmouth	214,800	0.94	0.92	0.85	0.84	0.85	0.69	1.05	400	11.6
	NHS South Eastern Hampshire	212,300	1.08	1.02	1.09	1.07	1.06	0.89	1.27	584	3.1
	NHS Southampton	254,300	1.06	1.08	1.11	1.09	1.09	0.91	1.29	492	14.1
	NHS West Hampshire	*558,300*	*0.93*	*0.91*	*0.88*	*0.85*	*0.87*	*0.77*	*0.98*	*478*	*3.9*

Table 3.4. Continued

UK area	CCG/HB	Total population	O/E 2012	O/E 2013	O/E 2014	O/E 2015	2016 O/E	2016 95% LCL	2016 95% UCL	2016 Crude rate pmp	% non-White
Wales	*Betsi Cadwaladr University*	*695,800*	*0.82*	*0.73*	*0.73*	*0.85*	*0.88*	*0.79*	*0.98*	*483*	*2.5*
	Powys Teaching	*132,200*	*0.80*	*0.77*	*0.75*	*0.73*	*0.66*	*0.51*	*0.87*	*386*	*1.6*
	Hywel Dda	383,700	0.99	1.05	1.00	0.96	0.90	0.78	1.03	495	2.2
	Abertawe Bro Morgannwg University	529,300	1.34	1.30	1.25	1.20	1.12	1.00	1.25	591	3.9
	Cwm Taf	**298,100**	**1.58**	**1.59**	**1.51**	**1.43**	**1.36**	**1.18**	**1.55**	**711**	**2.6**
	Aneurin Bevan	**584,100**	**1.34**	**1.28**	**1.23**	**1.19**	**1.16**	**1.05**	**1.29**	**623**	**3.9**
	Cardiff and Vale University	489,900	1.23	1.18	1.12	1.13	1.12	1.00	1.27	545	12.2
Scotland	Ayrshire and Arran	370,600	0.99	0.98	1.00	0.98	1.01	0.88	1.15	567	1.2
	Borders	114,500	1.09	1.03	0.99	0.93	0.98	0.77	1.25	576	1.3
	Dumfries and Galloway	149,500	0.92	0.85	0.88	0.88	0.86	0.69	1.08	502	1.2
	Fife	*370,300*	*0.88*	*0.88*	*0.86*	*0.85*	*0.81*	*0.70*	*0.95*	*446*	*2.4*
	Forth Valley	304,500	0.88	0.89	0.93	0.94	0.96	0.82	1.12	525	2.2
	Grampian	588,100	0.93	0.94	0.90	0.92	0.93	0.83	1.05	500	4.0
	Greater Glasgow and Clyde	**1,161,400**	**1.14**	**1.14**	**1.15**	**1.13**	**1.14**	**1.05**	**1.22**	**592**	**7.3**
	Highland	321,900	1.08	1.06	1.04	1.05	1.02	0.89	1.18	587	1.3
	Lanarkshire	656,500	1.07	1.05	1.08	1.05	1.04	0.94	1.15	567	2.0
	Lothian	*880,000*	*0.87*	*0.84*	*0.85*	*0.83*	*0.80*	*0.72*	*0.89*	*415*	*5.6*
	Orkney	21,900	0.79	0.74	0.52	0.49	0.47	0.21	1.05	275	0.7
	Shetland	23,200	0.58	0.54	0.51	0.49	0.62	0.31	1.24	345	1.5
	Tayside	415,500	0.98	0.95	0.93	0.92	0.89	0.78	1.03	484	3.2
	Western Isles	26,900	0.64	0.59	0.56	0.53	0.63	0.34	1.18	372	0.9
Northern Ireland	**Belfast**	**354,700**	**1.13**	**1.13**	**1.19**	**1.19**	**1.20**	**1.05**	**1.38**	**584**	**3.2**
	Northern	473,100	0.93	0.95	1.00	1.02	1.03	0.91	1.16	528	1.2
	Southern	**377,200**	**0.96**	**0.97**	**1.03**	**1.13**	**1.20**	**1.05**	**1.37**	**588**	**1.2**
	South Eastern	356,700	0.94	0.93	0.96	1.01	1.06	0.92	1.21	552	1.3
	Western	**300,400**	**0.89**	**1.01**	**1.14**	**1.19**	**1.23**	**1.06**	**1.42**	**619**	**1.0**
	South Eastern	354,700	0.96	0.92	0.92	0.96	1.00	0.87	1.16	505	1.3
	Western	**299,000**	**0.92**	**0.89**	**1.02**	**1.15**	**1.20**	**1.03**	**1.39**	**582**	**1.0**

[a]CCGs where >15% of the prevalent transplant population from 2014 were patients of the Cambridge renal centre. These have not been included in the analysis for 2015 or 2016 but are included for 2011–2014

[b]CCGs where between 5% and 15% of the prevalent transplant population from 2014 were patients of the Cambridge renal centre. In these CCGs the rates/ratios for 2015 and 2016 are likely to be underestimated

transplant recipients, with some areas having higher than the predicted number of prevalent transplant patients per million population and others lower. This interpretation requires caution due to unadjusted underlying population differences and missing data. Variability in the prevalent transplant population may reflect differences in both wait-listing and transplantation rates, as well as differences in the outcomes of transplant recipients. As in previous years, a separate chapter of this report identifies continued significant inter-centre variation in access to transplant wait-listing and access to transplantation [10]. Centre differences in outcomes of transplantation are explored later in this chapter. A large national study (access to Transplant and Transplant Outcome Measures (ATTOM)) is currently investigating differences in access to and outcomes of renal transplantation [11]. The work has already identified significant age, ethnicity, socio-economic and geographic disparities in the utilisation of living kidney donor transplants in the UK [12].

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

Age and sex

The sex ratio amongst incident and prevalent kidney transplant patients has remained stable for at least the last six years (table 3.6, figure 3.1). The median age of incident transplant recipients increased during the same time period, which reflects changes to the renal replacement therapy population. This was mirrored by an increase in the median age of the prevalent population,

Table 3.5. Distribution of prevalent patients on RRT by centre and modality on 31/12/2016

Centre	*N*	% HD	% PD	% transplant
Transplant centre				
B QEH	2,394	42	6	52
Belfast	829	23	3	74
Bristol	1,470	35	4	62
Camb*	1,551	28	1	71
Cardff	1,630	32	5	64
Covnt	977	39	7	55
Edinb	780	37	5	58
Glasgw	1,754	34	3	63
L Barts	2,372	43	9	48
L Guys	2,098	33	2	65
L Rfree	2,177	33	7	59
L St.G	863	41	5	54
L West	3,417	43	3	54
Leeds	1,552	34	3	63
Leic	2,310	42	4	54
Liv Roy	1,225	30	6	64
M RI	1,994	26	3	71
Newc	1,053	30	5	65
Nottm	1,152	34	7	59
Oxford	1,767	25	5	69
Plymth	513	28	8	64
Ports	1,693	38	4	58
Sheff	1,427	43	4	53
Dialysis centre				
Abrdn	557	41	4	55
Airdrie	440	42	5	53
Antrim	241	51	7	42
B Heart	654	60	13	26
Bangor	180	42	9	49
Basldn	276	59	12	29
Bradfd	635	39	4	57
Brightn	996	46	7	47
Carlis	279	34	13	54
Carsh	1,641	52	7	41
Chelms	278	48	12	40
Clwyd	178	41	8	51
Colchr	124	100		
D & Gall	131	38	8	54
Derby	543	44	14	41
Donc	330	59	8	33
Dorset	687	41	5	54
Dudley	346	59	14	27
Dundee	420	43	5	52
Exeter	1,017	45	8	47
Glouc	470	52	9	39
Hull	858	38	8	53
Inverns	260	36	4	60
Ipswi	411	36	9	56
Kent	1,070	40	5	55
Klmarnk	318	44	10	45
Krkcldy	295	49	6	45
L Kings	1,108	52	8	39
Liv Ain	227	82	11	6

Table 3.5. Continued

Centre	*N*	% HD	% PD	% transplant
Middlbr	891	37	3	60
Newry	237	37	9	54
Norwch	774	43	6	51
Prestn	1,206	47	3	50
Redng	794	38	7	55
Salford	1,022	39	10	50
Shrew	375	55	10	35
Stevng	904	59	2	39
Sthend	237	48	13	39
Stoke	827	42	10	49
Sund	507	50	3	47
Swanse	768	49	9	43
Truro	428	40	4	56
Ulster	166	61	4	35
West NI	307	42	3	55
Wirral	337	59	7	34
Wolve	569	55	12	33
Wrexm	310	40	11	49
York	535	37	6	57
England	**53,361**	**40**	**6**	**54**
N Ireland	**1,780**	**36**	**4**	**60**
Scotland	**4,955**	**38**	**5**	**57**
Wales	**3,066**	**38**	**7**	**55**
UK	**63,162**	**40**	**6**	**54**

*Cambridge was unable to submit any patient level data for 2016 but provided the total number of adult patients on treatment at the end of the year by treatment modality. Those numbers have been added in tables 3.3 and 3.5 only, therefore Cambridge is not included in any of the centre level analyses
Blank cells: no patients on that modality

which reflects the increase in age at which patients were transplanted, the increased access to transplantation for older recipients, as well as improved survival after kidney transplantation over the last ten years.

Primary renal diagnosis

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

Ethnicity

The ethnicity of those receiving a kidney transplant between 2011 and 2016 is shown in table 3.8. A comparison of the proportion of patients within each ethnic group receiving a transplant to those commencing dialysis from the same group was difficult because data on ethnicity were missing, or there was a high proportion with ethnicity classified as 'missing'. This is a particular issue in Scotland, where ethnicity reporting is not mandatory.

Table 3.6. Median age and sex ratio of incident and prevalent transplant patients 2011–2016

	Incident transplants			Prevalent transplants*		
Year	*N*	Median age	M : F ratio	*N*	Median age	M : F ratio
2011	2,626	49.1	1.7	26,165	51.7	1.6
2012	2,783	50.4	1.6	27,531	52.3	1.5
2013	3,129	50.3	1.6	29,436	52.8	1.6
2014	3,032	50.6	1.5	31,025	53.3	1.5
2015	2,898	50.9	1.5	31,643	53.8	1.5
2016	2,995	51.4	1.6	33,187	54.3	1.5

*As on 31 December for given year

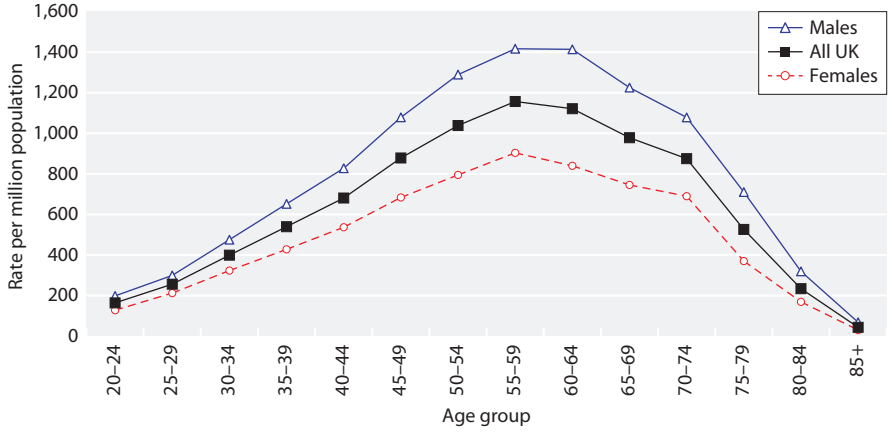

Fig. 3.1. Transplant prevalence rate per million population by age and sex on 31/12/2016

Table 3.7. Primary renal diagnosis in renal transplant recipients 2011–2016

	New transplants by year							Established transplants on 31/12/2016	
Primary renal diagnosis	2011 %	2012 %	2013 %	2014 %	2015 %	2016 %	2016 *N*	%	*N*
Aetiology uncertain	15.1	12.4	13.2	12.5	12.4	13.6	405	14.7	4,866
Diabetes	13.6	15.1	13.9	15.3	15.4	13.2	392	10.7	3,560
Glomerulonephritis	23.4	23.0	22.7	21.8	21.9	23.1	688	23.1	7,662
Polycystic kidney disease	12.6	13.6	13.9	14.0	13.8	13.1	391	13.6	4,508
Pyelonephritis	10.2	10.5	10.2	9.0	9.1	8.0	237	12.4	4,101
Reno-vascular disease	1.1	1.1	1.2	1.2	1.3	1.1	34	1.1	368
Other	17.0	17.1	15.2	17.1	16.0	16.0	477	17.6	5,825
Not available	0.9	1.2	2.6	2.7	3.5	5.2	156	1.7	556

Table 3.8. Ethnicity of patients who received a transplant in the years 2011–2016

Year	% White	% S Asian	% Black	% Other	% Unknown
2011	79.9	10.3	6.4	3.0	0.3
2012	77.6	11.1	7.6	3.2	0.4
2013	75.7	13.1	7.4	3.2	0.6
2014	73.9	13.3	7.0	4.6	1.2
2015	72.8	13.6	8.0	4.2	1.4
2016	70.6	15.6	7.9	3.8	2.1

There has been an increasing trend in the percentage of incident kidney recipients from non-White ethnic groups. This likely reflects the changing population of the UK and the different incidence of CKD in different ethnic groups. It may also reflect improved access to transplantation across these ethnic backgrounds through changes in the wait-listing of patients and changes in the national kidney allocation scheme.

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 and parathyroid hormone, which limits the ability to perform more meaningful comparisons between centres, or determine the causes of inter-centre differences in outcomes.

Table 3.9a. Percentage completeness of ethnicity, eGFR and blood pressure by centre for prevalent transplant patients on 31/12/2016

Centre	*N*	Ethnicity[a]	eGFR	Blood pressure[b]
England				
B Heart	170	100	94	0
B QEH	1,186	99	95	94
Basldn	76	100	95	80
Bradfd	346	100	95	79
Brightn	462	100	98	40
Bristol	883	100	100	81
Carlis	150	100	93	0
Carsh	662	100	91	4
Chelms	112	99	93	91
Covnt	522	100	95	86
Derby	215	100	98	95
Donc	106	100	100	99
Dorset	358	100	90	79
Dudley	84	100	99	44
Exeter	462	100	99	93
Glouc	179	100	97	81
Hull	437	99	95	2
Ipswi	223	98	99	98
Kent	568	100	99	95
L Barts	1,089	100	67	0
L Guys	1,310	99	98	0
L Kings	429	100	99	100
L RFree	1,253	99	96	84
L St.G	450	96	98	0
L West	1,792	100	97	0
Leeds	947	100	97	93
Leic	1,223	98	95	27
Liv Ain	14	100	100	0
Liv Roy	765	99	94	3
M RI	1,322	99	96	4
Middlbr	528	100	97	32
Newc	656	100	98	95
Norwch	389	100	97	4
Nottm	653	100	99	96
Oxford	1,161	95	99	9
Plymth	313	100	97	92
Ports	952	99	96	25
Prestn	592	100	98	0
Redng	417	97	99	98
Salford	505	100	99	0
Sheff	738	100	99	97
Shrew	129	100	95	1
Stevng	332	99	97	0
Sthend	91	100	99	77
Stoke	385	99	99	2
Sund	231	100	100	0
Truro	235	100	98	1
Wirral	101	100	92	0
Wolve	182	99	93	68
York	298	99	99	69
N Ireland				
Antrim	101	100	99	82
Belfast	581	99	99	54
Newry	127	100	97	86
Ulster	58	100	97	93
West NI	164	100	99	91
Scotland				
Abrdn	299	57	99	n/a
Airdrie	222	64	81	n/a
D & Gall	71	34	85	n/a
Dundee	218	59	98	n/a
Edinb	441	32	95	n/a
Glasgw	1,063	28	72	n/a
Inverns	155	79	37	n/a
Klmarnk	138	68	98	n/a
Krkcldy	130	35	95	n/a
Wales				
Bangor	86	100	99	88
Cardff	1,018	100	99	97
Clwyd	88	100	100	84
Swanse	318	100	100	98
Wrexm	146	100	99	92
England	**26,683**	**99**	**96**	**42**
N Ireland	**1,031**	**100**	**98**	**69**
Scotland	**2,737**	**43**	**82**	**n/a**
Wales	**1,656**	**100**	**99**	**96**
UK	**32,107**	**94**	**95**	**42**[c]

n/a – not available
[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

The 71 renal centres in the UK comprise 52 centres in England, five in Wales, five in Northern Ireland and nine in Scotland. Colchester was reported as having no transplanted patients and was therefore excluded. Cambridge was unable to submit patient level data for 2015 and 2016. After exclusion of these centres, prevalent patient data from 69 renal centres across the UK were analysed.

Table 3.9b. Percentage completeness of haemoglobin, serum cholesterol, serum calcium, serum phosphate and serum PTH by centre for prevalent transplant patients on 31/12/2016

Centre	*N*	Haemoglobin	Total serum cholesterol	Adjusted serum calcium[a]	Serum phosphate	Serum PTH
England						
B Heart	170	94	65	92	92	32
B QEH	1,186	95	95	95	94	0
Basldn	76	93	68	95	93	22
Bradfd	346	94	76	83	52	42
Brightn	462	98	69	96	96	47
Bristol	883	99	95	99	99	99
Carlis	150	93	72	93	83	36
Carsh	662	91	53	89	89	28
Chelms	112	92	86	93	65	38
Covnt	522	95	71	93	52	31
Derby	215	98	93	96	96	93
Donc	106	100	73	100	100	38
Dorset	358	89	68	87	68	32
Dudley	84	99	85	99	99	74
Exeter	462	99	93	99	98	46
Glouc	179	97	68	97	96	25
Hull	437	94	30	90	90	19
Ipswi	223	98	75	98	98	63
Kent	568	98	72	96	96	14
L Barts	1,089	98	100	98	98	98
L Guys	1,310	98	61	95	95	39
L Kings	429	99	79	99	99	68
L RFree	1,253	96	76	93	93	75
L St.G	450	98	90	98	98	87
L West	1,792	97	31	97	97	30
Leeds	947	96	98	94	91	31
Leic	1,223	95	94	94	94	63
Liv Ain	14	100	36	100	100	79
Liv Roy	765	94	41	92	92	54
M RI	1,322	96	66	96	96	55
Middlbr	528	96	40	95	94	11
Newc	656	98	76	98	98	74
Norwch	389	96	97	96	96	27
Nottm	653	99	81	97	97	89
Oxford	1,161	99	65	99	98	42
Plymth	313	96	67	96	96	63
Ports	952	96	55	95	90	32
Prestn	592	98	74	97	96	47
Redng	417	99	77	98	76	57
Salford	505	99	80	99	99	0
Sheff	738	99	57	98	98	0
Shrew	129	95	86	93	93	12
Stevng	332	98	42	93	93	62
Sthend	91	99	34	98	96	8
Stoke	385	99	99	99	99	83
Sund	231	100	83	99	100	94
Truro	235	98	98	98	98	97
Wirral	101	89	37	84	84	51
Wolve	182	91	74	91	77	38
York	298	98	75	96	95	19

Table 3.9b. Continued

Centre	*N*	Haemoglobin	Total serum cholesterol	Adjusted serum calcium[a]	Serum phosphate	Serum PTH
N Ireland						
Antrim	101	98	100	99	99	96
Belfast	581	99	99	98	98	27
Newry	127	97	99	97	97	98
Ulster	58	95	98	93	97	7
West NI	164	96	100	97	98	96
Scotland						
Abrdn	299	99	n/a	97	97	n/a
Airdrie	222	97	n/a	96	95	n/a
D & Gall	71	97	n/a	99	89	n/a
Dundee	218	99	n/a	97	96	n/a
Edinb	441	95	n/a	92	83	n/a
Glasgw	1,063	99	n/a	99	98	n/a
Inverns	155	31	n/a	28	26	n/a
Klmarnk	138	99	n/a	98	97	n/a
Krkcldy	130	93	n/a	93	92	n/a
Wales						
Bangor	86	99	99	99	99	28
Cardff	1,018	98	95	98	98	17
Clwyd	88	99	99	98	98	65
Swanse	318	100	90	99	99	78
Wrexm	146	99	99	99	99	99
England	26,683	97	72	96	93	47
N Ireland	1,031	98	100	98	98	52
Scotland[b]	94	n/a	93	90	n/a	
Wales	1,656	99	95	98	98	39
UK	32,107	97	68[c]	96	93	43[c]

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

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 were 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 2009–2015, with patients attributed to the transplant centre that performed the procedure.

Time since transplantation may have a significant effect on key biochemical and clinical variables and this was likely to be independent of a centre's clinical practices. Therefore, inter-centre comparison of data on prevalent transplant patients was 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 12 months post-transplant outcome, therefore comparison of outcomes between centres is more robust. However, even the 12 months post-transplant comparisons could be biased by differences in the repatriation of patients from the transplanting centre. In some centres repatriation of patients occurred at a fixed time post transplantation whilst in others it only occurred if the graft was failing or conversely if the graft function was stable.

Centres with <10 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 prevalent patients as on 31 December 2016. Patients were considered as having a functioning transplant if 'transplant' was listed as the last mode of RRT in the last quarter of 2016. 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 B). 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 three or quarter four of 2016 was used.

Estimated glomerular filtration rate (eGFR)

For the purpose of eGFR calculation, the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) creatinine equation formula was used, as advised by NICE recommendations [2]. Previous analyses have used the Modification of Diet in Renal Disease (MDRD) study equation therefore caution is needed in comparing with previous editions of this report. 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. 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 1 January 2009 and 31 December 2015 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 was from a timeline entry of data returned from a non-transplant centre; patients were re-assigned to the nearest transplant centre in this scenario.

As this analysis is stratified by donor type, the donor type used in this analysis was obtained from NHSBT because the donor type reporting to the UKRR was poor from some renal centres.

Patients who died or experienced graft failure within 12 months of transplantation were excluded from the analyses. Patients with more than one transplant between 2009 and 2015 were included as separate episodes, provided that each of the re-transplants functioned for at least a year.

The most recent laboratory or blood pressure result (for the relevant 4th/5th quarter) after renal transplantation was taken to represent one year post-transplant outcome. Patients with valid serum creatinine results but missing ethnicity data were assumed White for the purpose of the eGFR calculation.

Results and Discussion

Post-transplant eGFR in prevalent transplant patients

When interpreting eGFR post-transplantation, it is important to note that the estimated GFR formulae only have a modest predictive performance in the transplant population [13–14]. Median eGFR in each centre and percentage of patients with eGFR <30 ml/min/1.73 m^2 are shown in figures 3.2 and 3.3.

The median eGFR was 52.2 ml/min/1.73 m^2, with 13.1% of prevalent transplant recipients having an eGFR <30 ml/min/1.73 m^2, as summarised by centre in table 3.10. Some of the centre variability can be explained by differences in local repatriation policies for patients from transplanting centres back to referring centres; it is notable that both transplanting and non-transplanting centres feature at both ends of the scale in figure 3.3.

Figure 3.4 shows the percentage of prevalent patients by centre with eGFR <30 ml/min/1.73 m^2 as a funnel

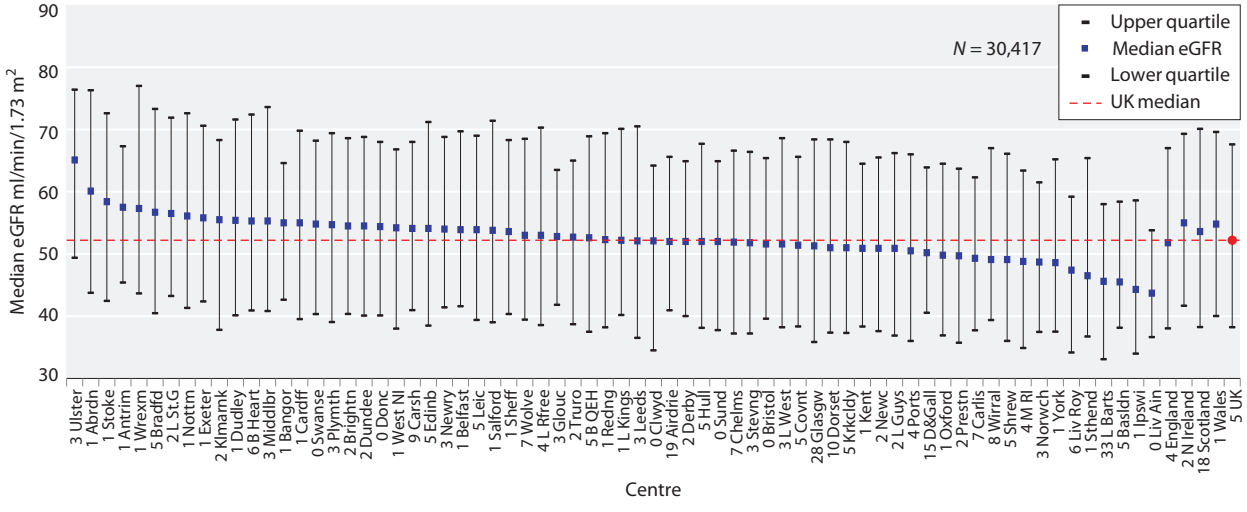

Fig. 3.2. Median eGFR in prevalent transplant patients by centre on 31/12/2016

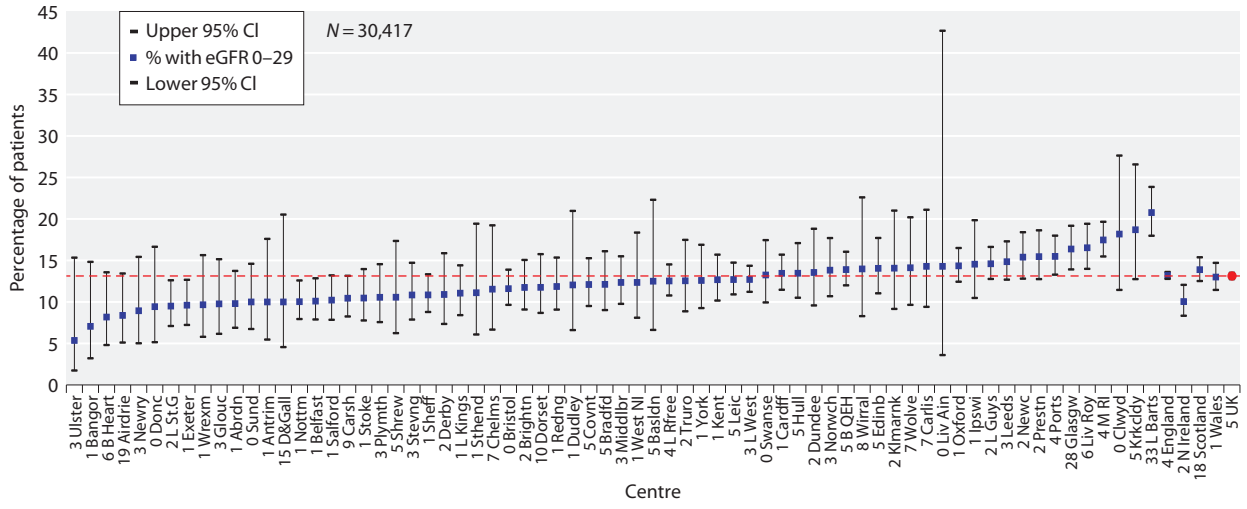

Fig. 3.3. Percentage of prevalent transplant patients by centre on 31/12/2016 with eGFR <30 ml/min/1.73 m^2

plot, enabling a more reliable comparison of outcomes between centres across the UK. The solid red lines show the two standard deviation limits (95%) and the dotted red lines represent the limits for three standard deviations (99.9%). With 69 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 marked variation between centres with 15 centres falling above and below the 95% CI. St Bartholomew's hospital and Manchester Royal infirmary both 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 [15]. Figures 3.5a, 3.5b, and 3.5c show the median one-year post-transplant eGFR for patients transplanted between 2009–2015, by transplant centre and donor type. Patients who received kidney transplants from living kidney donors had the highest median eGFR at one year (57.2 ml/min/1.73 m^2), followed by donor after brain-stem death (52.4 ml/min/1.73 m^2) and donor after circulatory death (48.4 ml/min/1.73 m^2).

Figures 3.6a, 3.6b and 3.6c show one-year post-transplant eGFR by donor type and year of transplantation. There was no significant trend in eGFR over the time period for patients who had either DBD, DCD or live kidney donor transplantation.

Haemoglobin in prevalent transplant patients

The Renal Association Anaemia guidelines recommend ***'achieving a population distribution centred on a mean of 11g/dl with a range of 10–12g/dl'*** [16] (equivalent to 110 g/L, range 100–120 g/L). However, many transplant patients with good graft function have haemoglobin concentrations >120 g/L without using erythropoiesis stimulating agents, therefore 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, that affect centre-specific protocols for management of anaemia will affect haemoglobin concentrations in transplant patients. Most of these data are not collected by the UKRR and therefore haemoglobin attainment analyses have to be interpreted with caution.

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 ⩾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 69 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.

Table 3.10. Percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 on 31/12/2016

Centre	Patients with eGFR data *N*	eGFR <30%	Centre	Patients with eGFR data *N*	eGFR <30%
Liv Ain	14	14.3	Bradfd	330	12.1
Ulster	56	5.4	Norwch	376	13.8
Inverns	57	12.3	Stoke	382	10.5
D & Gall	60	10.0	Redng	413	11.9
Basldn	72	12.5	Hull	416	13.5
Dudley	83	12.0	Edinb	420	14.0
Bangor	85	7.1	L Kings	425	11.1
Clwyd	88	18.2	L St.G	442	9.5
Sthend	90	11.1	Brightn	451	11.8
Wirral	93	14.0	Exeter	458	9.6
Antrim	100	10.0	Covnt	496	12.1
Chelms	104	11.5	Salford	499	10.2
Donc	106	9.4	Middlbr	510	12.4
Newry	123	8.9	Kent	560	12.7
Shrew	123	10.6	Belfast	574	10.1
Krkcldy	123	18.7	Prestn	582	15.5
Klmarnk	135	14.1	Carsh	603	10.4
Carlis	140	14.3	Newc	643	15.4
Wrexm	145	9.7	Nottm	648	10.0
B Heart	159	8.2	Liv Roy	720	16.5
West NI	162	12.3	Sheff	728	10.9
Wolve	170	14.1	L Barts	732	20.8
Glouc	174	9.8	Glasgw	763	16.4
Airdrie	179	8.4	Bristol	879	11.6
Derby	211	10.9	Ports	910	15.5
Dundee	214	13.6	Leeds	916	14.8
Ipswi	220	14.5	Cardff	1,004	13.4
Sund	230	10.0	B QEH	1,122	13.9
Truro	231	12.6	Oxford	1,150	14.3
York	294	12.6	Leic	1,165	12.7
Abrdn	296	9.8	L Rfree	1,205	12.5
Plymth	303	10.6	M RI	1,265	17.5
Swanse	317	13.2	L Guys	1,288	14.6
Stevng	323	10.8	L West	1,739	12.7
Dorset	323	11.8			

One centre (London St Bartholomew's) fell outside the upper 99.9% CI and two further centres (London Royal Free, London St Mary's Hammersmith) 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

The UK Renal Association (RA) guideline for the care of kidney transplant recipients recommends that '***Blood pressure should be <130/80 mmHg (or <125/75 mmHg if proteinuria)***' [7]. This blood pressure (BP) target is

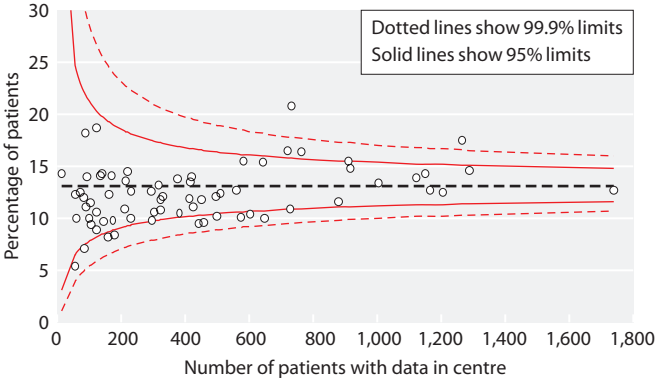

Fig. 3.4. Funnel plot of percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 by centre size on 31/12/2016

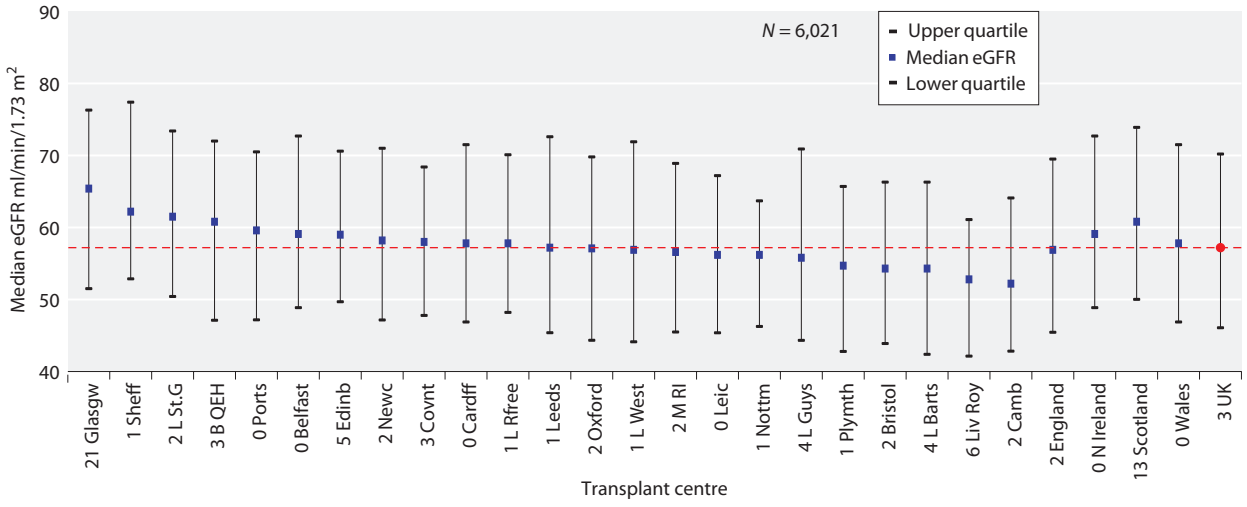

Fig. 3.5a. Median eGFR one year post-live donor transplant by transplant centre 2009–2015

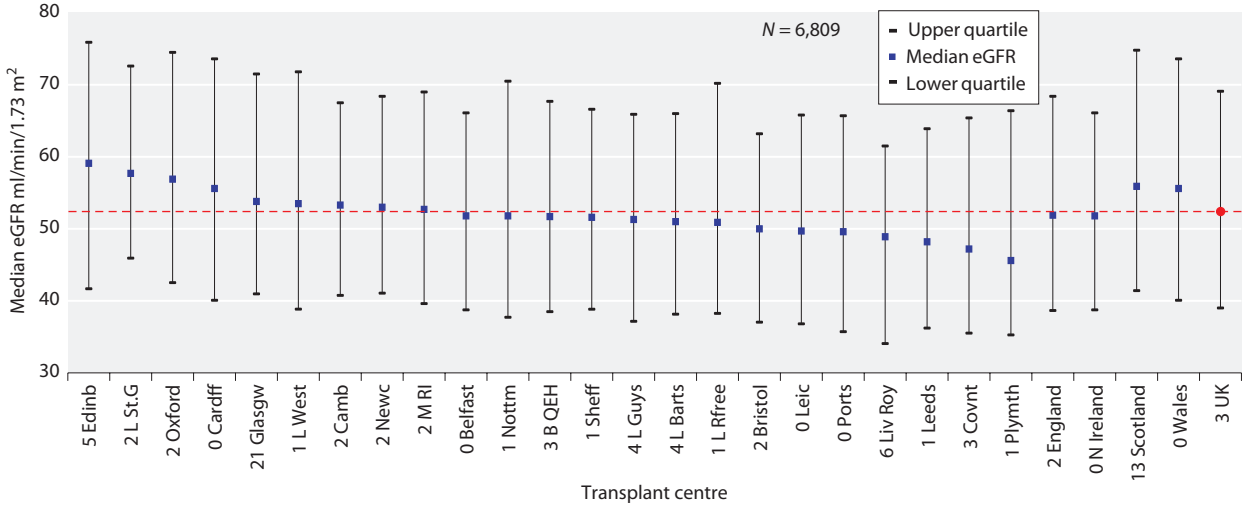

Fig. 3.5b. Median eGFR one year post-brainstem death donor transplant by transplant centre 2009–2015

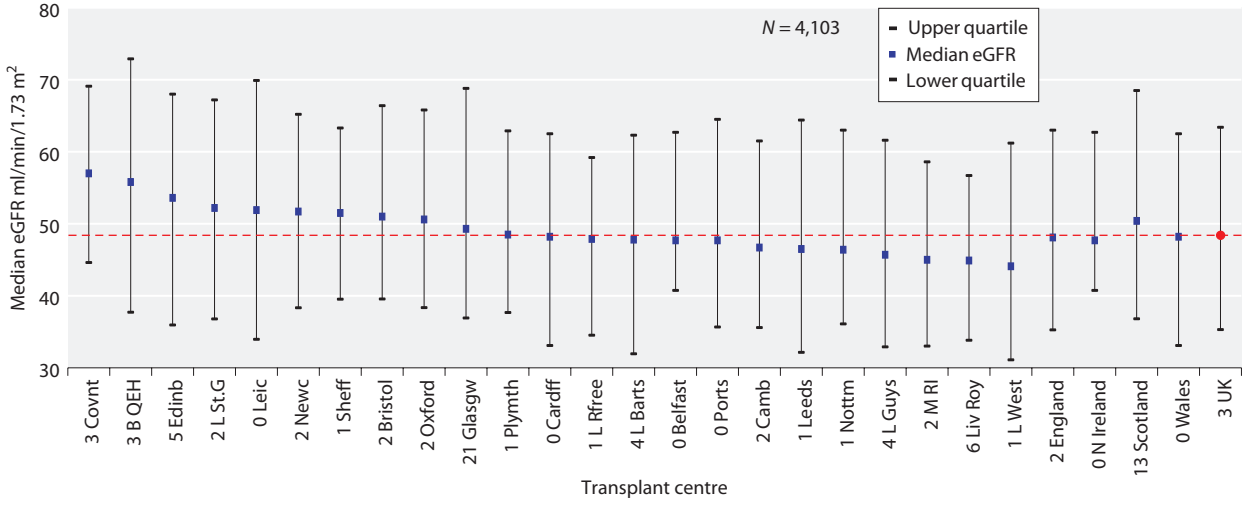

Fig. 3.5c. Median eGFR one year post-circulatory death donor transplant by transplant centre 2009–2015

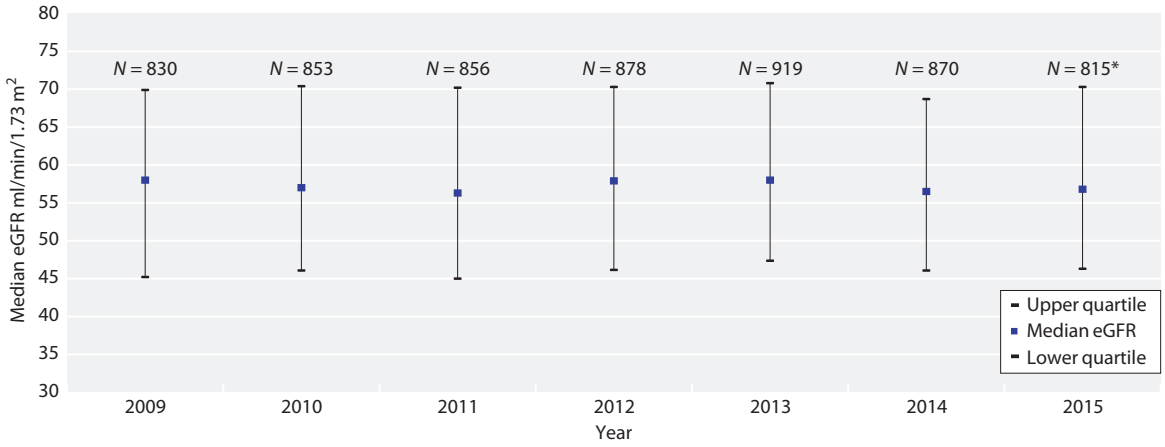

Fig. 3.6a. Median eGFR one year post-live donor transplant by year of transplantation 2009–2015
*This number does not include live-donor transplants performed in 2014 that were followed-up in Cambridge in 2015 and 2016, as Cambridge was unable to submit data for both 2015 and 2016

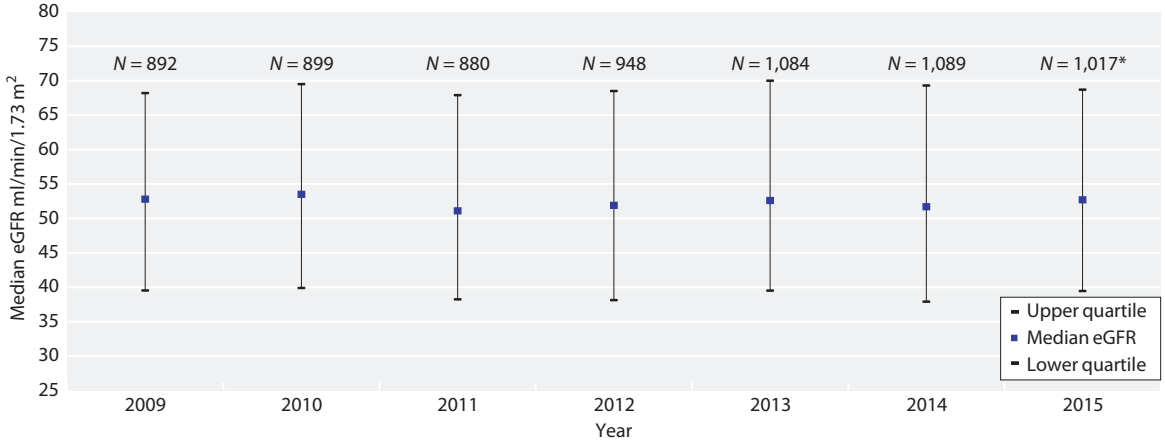

Fig. 3.6b. Median eGFR one year post-brainstem death donor transplant by year of transplantation 2009–2015
*This number does not include post-brainstem death donor transplants performed in 2016 that were followed-up in Cambridge in 2015 and 2016, as Cambridge was unable to submit data for both 2015 and 2016

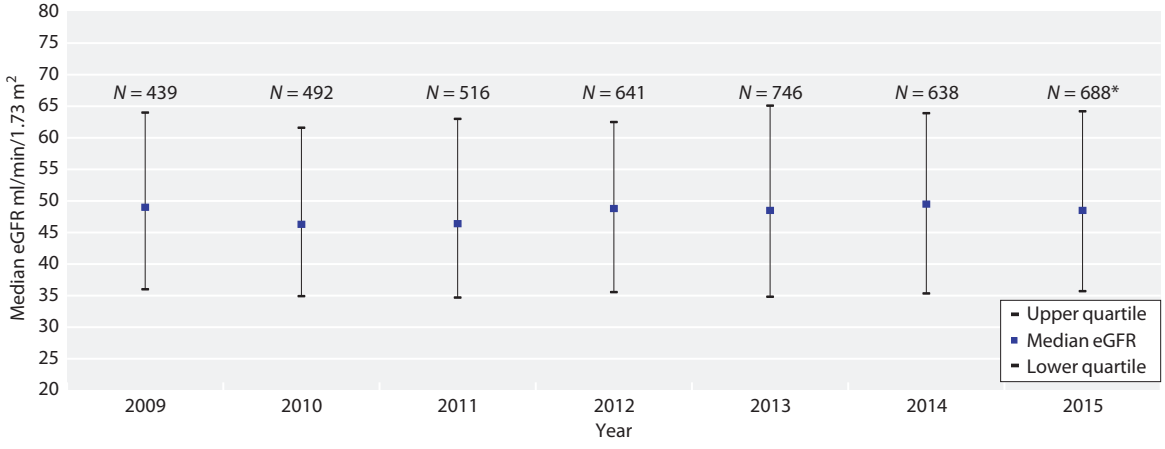

Fig. 3.6c. Median eGFR one year post-circulatory death donor transplant by year of transplantation 2009–2015
*This number does not include post-circulatory death donor transplants performed in 2014 that were followed-up in Cambridge in both 2015 and 2016, as Cambridge was unable to submit data for 2015 and 2016

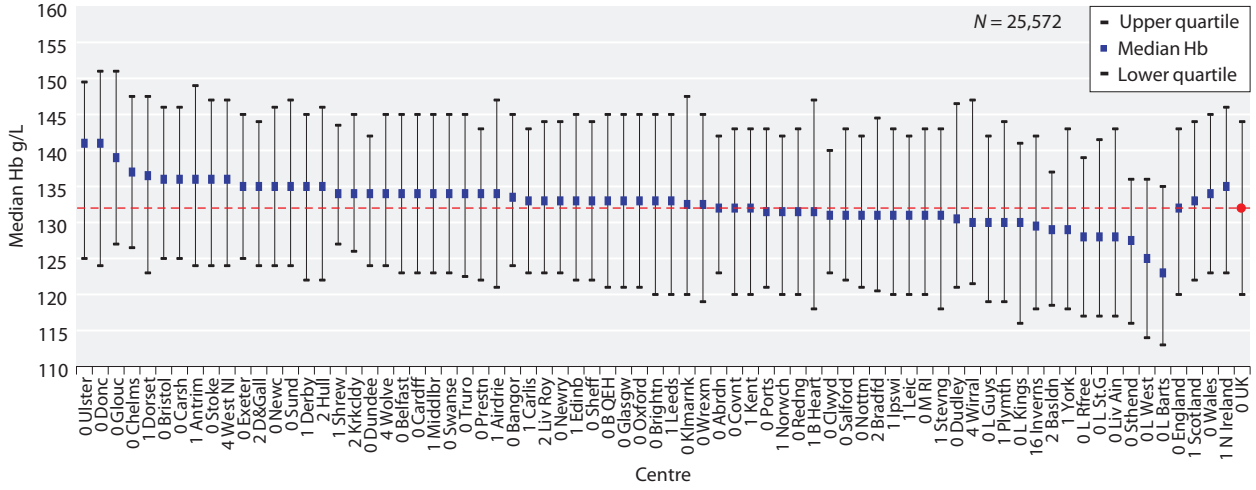

Fig. 3.7a. Median haemoglobin for prevalent transplant patients with eGFR ⩾30 ml/min/1.73 m^2 by centre on 31/12/2016

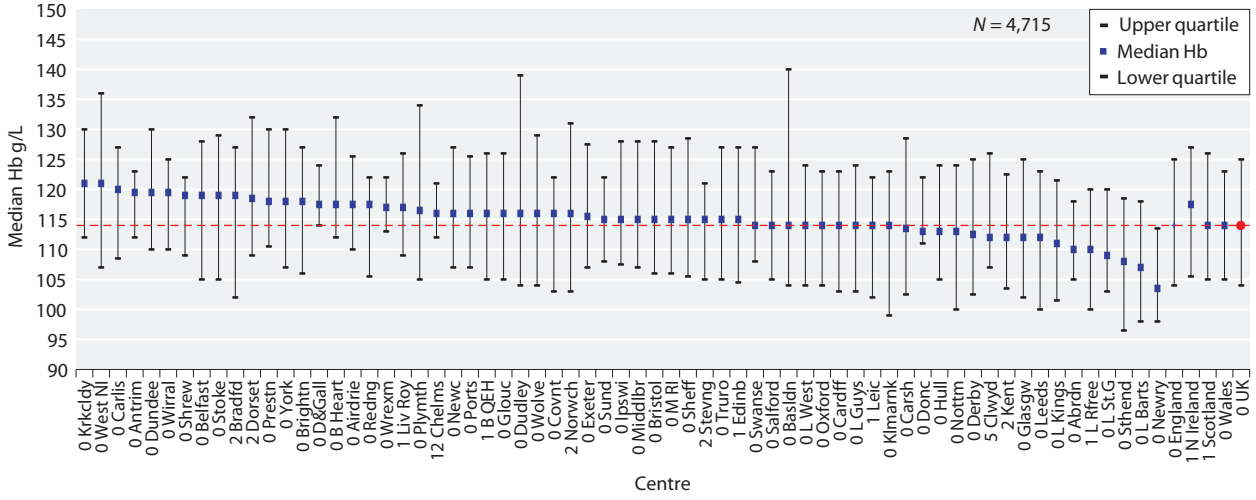

Fig. 3.7b. Median haemoglobin for prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 by centre on 31/12/2016

the same as that used in previous annual reports. The new guideline published by the RA in 2017 advocates higher target blood pressure of <140/90 (or <130/80 mm/Hg if proteinuria) reflecting a lack of strong evidence and will be incorporated into the analysis of 2017 data in the next report. Completeness of blood pressure data continued to be variable with some centres unable to report. Thirty-one centres returned data with >50% completeness and were included in the analysis. Despite restricting the analysis to only include centres with >50% completeness of data, there are other potential biases, especially for those with lower completeness (e.g. centres may be more likely to record blood pressure electronically for patients with poor BP control/other reasons for data to be missing systematically), therefore results should be interpreted with caution.

Figures 3.10a and 3.10b show the percentage of patients with a blood pressure of <130/80 mm Hg, by eGFR. The percentage of patients with BP <130/80 (systolic BP <130 and diastolic BP <80 mmHg) was higher (25.6% vs 19.8%) 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 2016, a similar percentage to that seen over the last few years. Amongst patients with native chronic kidney disease, late presentation is associated with

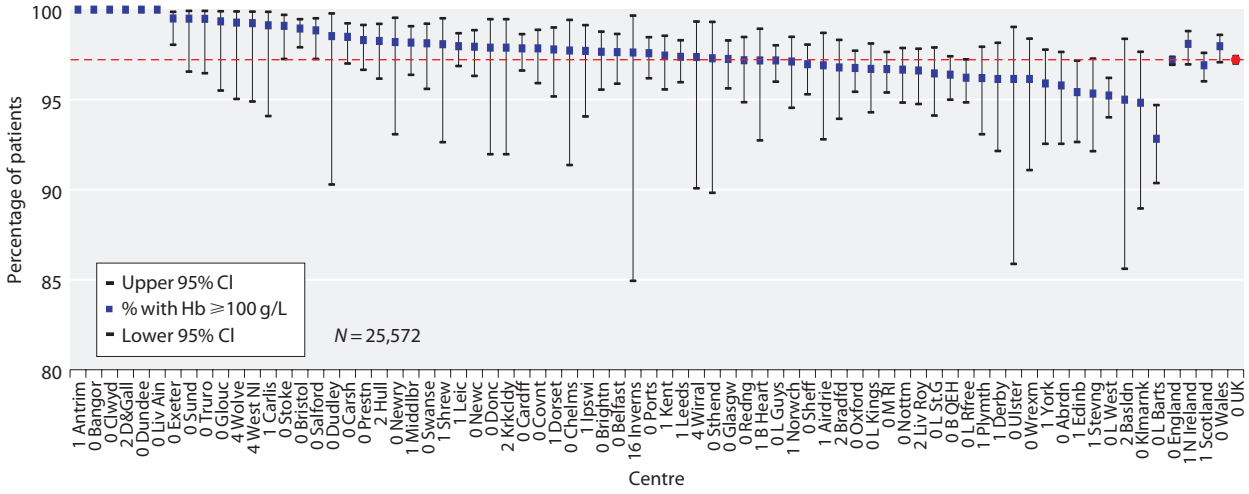

Fig. 3.8a. Percentage of prevalent transplant patients with eGFR ⩾30 ml/min/1.73 m^2 achieving haemoglobin ⩾100 g/L by centre on 31/12/2016

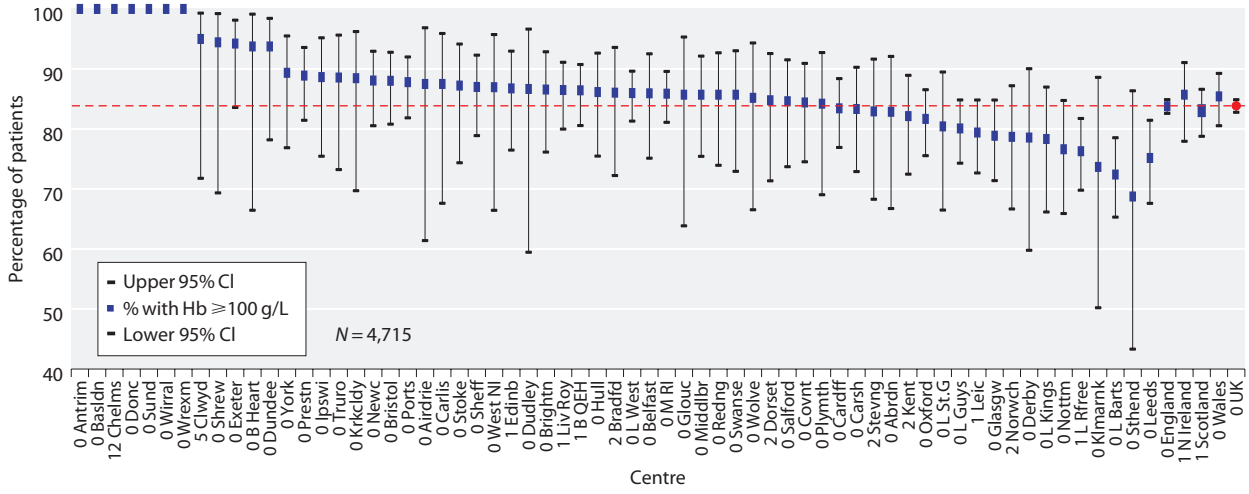

Fig. 3.8b. Percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 achieving haemoglobin ⩾100 g/L by centre on 31/12/2016

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 31 December 2016 and patients were classified according to the KDIGO staging criteria with the suffix of 'T' to represent

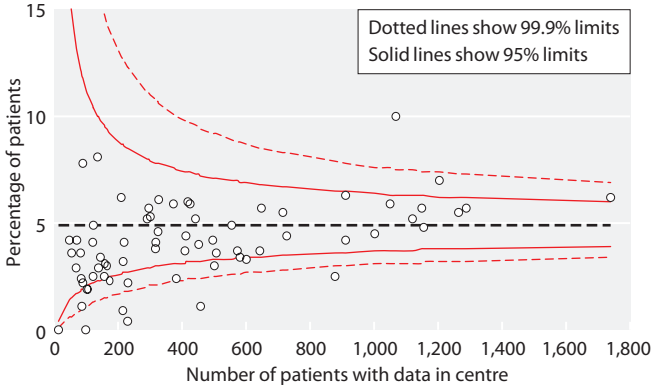

Fig. 3.9. Funnel plot of percentage of prevalent transplant patients with haemoglobin <100 g/L by centre size on 31/12/2016

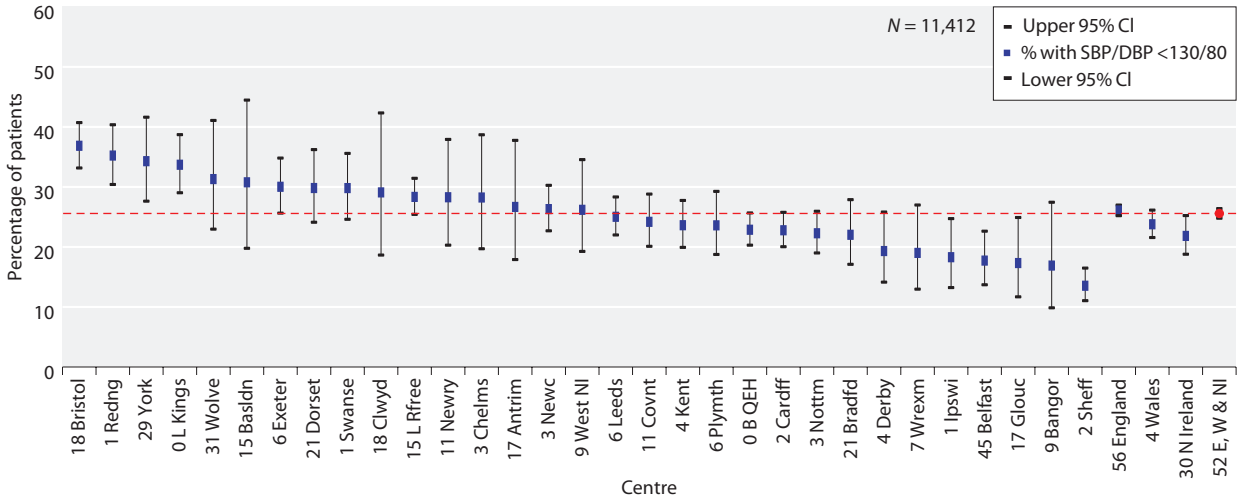

Fig. 3.10a. Percentage of prevalent transplant patients with eGFR ⩾30 ml/min/1.73 m^2 achieving blood pressure of <130/80 mmHg by centre on 31/12/2016

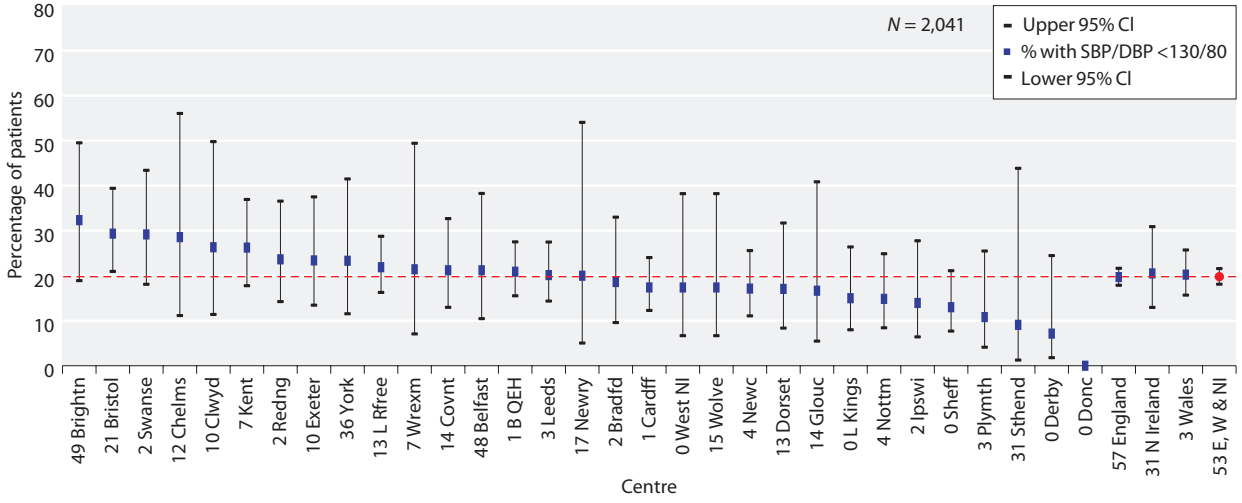

Fig. 3.10b. Percentage of prevalent transplant patients with eGFR <30 ml/min/1.73 m^2 achieving blood pressure of <130/80 mmHg by centre on 31/12/2016

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 2016, comprised the comparison dialysis cohort ($N = 21,716$) including 2,090 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 2016 laboratory data. Scottish centres were excluded from blood pressure, cholesterol and PTH analyses as corresponding data were not provided.

Results and Discussion

Table 3.11 shows that 15.6% of the prevalent transplant population (4,733 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 had poorer blood pressure control and achieved UK Renal Association standards for some key biochemical and clinical outcome variables less often than dialysis patients. This substantial group of patients continues to represent a challenge. Improved pre-dialysis

Table 3.11. Analysis by CKD stage for prevalent transplant patients compared with prevalent dialysis patients on 31/12/2016

CKD stage (eGFR)	Transplant				Prevalent dialysis
	Stage 1–2T (⩾60)	Stage 3T (30–59)	Stage 4T (15–29)	Stage 5T (<15)	Stage 5D
Number of patients	10,309	15,387	4,070	663	21,716
% of patients	33.9	50.6	13.4	2.2	
eGFR ml/min/1.73 m^2[a]					
Mean ± SD	76.9 ± 13.4	45.3 ± 8.4	23.9 ± 4.1	11.9 ± 2.3	
Median	73.7	45.4	24.5	12.4	
Systolic BP mmHg					
Mean ± SD	133.8 ± 16.0	137.0 ± 17.4	140.5 ± 18.7	144.4 ± 19.2	133.4 ± 24.9
% ⩾130	59.7	66.4	72.4	79.3	53.2
Diastolic BP mmHg					
Mean ± SD	79.2 ± 10.3	78.9 ± 10.9	78.7 ± 11.4	81.1 ± 12.6	68.7 ± 14.8
% ⩾80	49.7	49.1	47.2	56.1	21.9
Cholesterol mmol/L					
Mean ± SD	4.5 ± 1.0	4.6 ± 1.1	4.7 ± 1.2	4.7 ± 1.3	3.9 ± 1.1
% ⩾4	70.0	71.3	71.0	71.4	43.8
Haemoglobin g/L					
Mean ± SD	136.8 ± 16.0	128.7 ± 16.7	116.2 ± 16.1	106.6 ± 15.4	110.4 ± 13.7
% <100.0	1.5	3.6	13.7	31.3	19.4
Phosphate mmol/L[b]					
Mean ± SD	0.9 ± 0.2	1.0 ± 0.2	1.1 ± 0.3	1.5 ± 0.3	1.6 ± 0.4
% >1.7	0.1	0.3	1.7	20.4	36.8
Corrected calcium mmol/L					
Mean ± SD	2.4 ± 0.1	2.4 ± 0.1	2.4 ± 0.1	2.4 ± 0.2	2.3 ± 0.2
% >2.5	25.9	26.0	20.1	15.2	15.6
% <2.2	3.1	3.7	7.5	17.7	17.3
PTH pmol/L					
Median	8.4	10.0	16.0	29.5	33.3
% >72	0.2	0.6	3.2	14.6	18.8

[a]Prevalent transplant patients with no ethnicity data were classed as White
[b]Only PD patients included in stage 5D, $N = 2{,}090$

management should allow for timely re-listing for transplantation if appropriate and a smooth transition to another renal replacement modality.

eGFR slope analysis

Introduction

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

Methods

All UK patients aged ⩾18 years receiving their first renal transplant between 1 January 2005 and 31 December 2014 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

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

Patients characteristics		*N*	Median slope	Lower quartile	Upper quartile	p-value
Age at transplant	<40	4,696	–1.28	–4.51	0.84	<0.0001
	40–55	6,084	–0.52	–2.78	1.40	
	>55	6,573	–0.53	–2.97	1.30	
Ethnicity	Asian	1,896	–1.16	–4.30	0.95	<0.0001
	Black	1,146	–1.26	–4.16	1.00	
	Other	559	–0.86	–3.58	1.53	
	White	12,910	–0.60	–2.97	1.25	
Sex	Male	10,649	–0.47	–2.81	1.40	<0.0001
	Female	6,704	–1.23	–3.94	0.89	
Diabetes	No-diabetes	14,550	–0.59	–3.03	1.27	<0.0001
	Diabetes	2,612	–1.44	–4.31	0.84	
Donor	Deceased	11,088	–0.73	–3.29	1.25	0.76
	Live	6,265	–0.68	–3.15	1.18	
Year of transplant	2006	1,447	–0.69	–2.50	0.49	0.49
	2007	1,585	–0.76	–2.46	0.62	
	2008	1,812	–0.57	–2.46	0.71	
	2009	1,902	–0.80	–2.77	0.77	
	2010	1,991	–0.66	–2.82	0.94	
	2011	1,962	–0.52	–3.07	1.41	
	2012	2,171	–0.80	–3.57	1.63	
	2013	2,327	–0.91	–4.49	2.13	
	2014	2,156	–0.68	–5.96	4.22	
Status of transplant at end of follow-up	Died	1,231	–0.87	–4.09	1.64	<0.0001
	Failed	1,333	–6.37	–12.48	–3.13	
	Re-transplanted	66	–3.40	–7.33	–1.62	
	Functioning	14,789	–0.45	–2.59	1.37	
All		**17,353**	**–0.70**	**–3.24**	**1.22**	

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, sex, 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.

Results and Discussion

The study cohort consisted of 17,353 patients. The median GFR slope was −0.7 ml/min/1.73 m^2/year (table 3.12). The gradient was steeper for Black recipients (−1.26 ml/min/1.73 m^2/year), in keeping with previously published data suggesting poorer outcomes for this group [17].

There was no statistically significant difference in eGFR slope in recipients of deceased donor kidneys (−0.73 ml/min/1.73 m^2/year) compared to patients who received organs from live donors (−0.68 ml/min/1.73 m^2/year). Female patients had a steeper slope (−1.23 ml/min/1.73 m^2/year) than males (−0.47 ml/min/1.73 m^2/year), as did patients with diabetes (−1.44 ml/min/1.73 m^2/year) compared to patients without (−0.59 ml/min/1.73 m^2/year). The slope was steeper in younger recipients, possibly reflecting differences in causes of graft failure including a higher risk of non-adherence as a contributory factor. An analysis of the causes of graft failure using UKRR data is currently awaiting publication and reflects the challenges of accurately coding the causes of graft failure. As might be expected, the steepest slope was in patients where the transplant subsequently failed. This analysis has assumed linearity of progression of fall in GFR and further work is ongoing to characterise the patterns of graft failure as well as the outcomes of patients with graft failure who transition on to dialysis.

Table 3.13. Cause of death by modality in prevalent RRT patients on 1/1/2016, who died in 2016

	All modalities		Dialysis		Transplant	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	807	24	698	24	109	19
Cerebrovascular disease	159	5	129	5	30	5
Infection	696	20	570	20	126	22
Malignancy	351	10	218	8	133	23
Treatment withdrawal	565	17	544	19	21	4
Other	659	19	548	19	111	20
Uncertain	181	5	145	5	36	6
Total	**3,418**		**2,852**		**566**	
No cause of death data	1,775	34	1,464	34	311	35

Cause of death in transplant recipients

Introduction

Differences in cause 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 had high data returns to the UKRR regarding cause of death, whilst others returned no information. Provision of this information is not mandatory. Analysis of prevalent patients included all those aged over 18 years and receiving RRT on 1 January 2016.

Results and Discussion

Table 3.13 and figure 3.11 show the differences in the cause of death between prevalent dialysis and transplant patients. Table 3.14 shows the cause of death for prevalent transplant patients by age.

Death due to cardiovascular disease was less common in transplanted patients than in dialysis patients, perhaps reflecting the lower age of the transplanted patients. Cardiovascular screening undertaken during transplant work-up means transplant recipients are a pre-selected lower risk group of patients and over time, with good renal function, transplant recipients develop less vascular calcification. The leading cause of death amongst transplant patients was malignancy (23%) overtaking infection (22%) compared to last year. There has been a reduction over time in the proportion of deaths in transplant patients attributed to cardiovascular or cerebrovascular

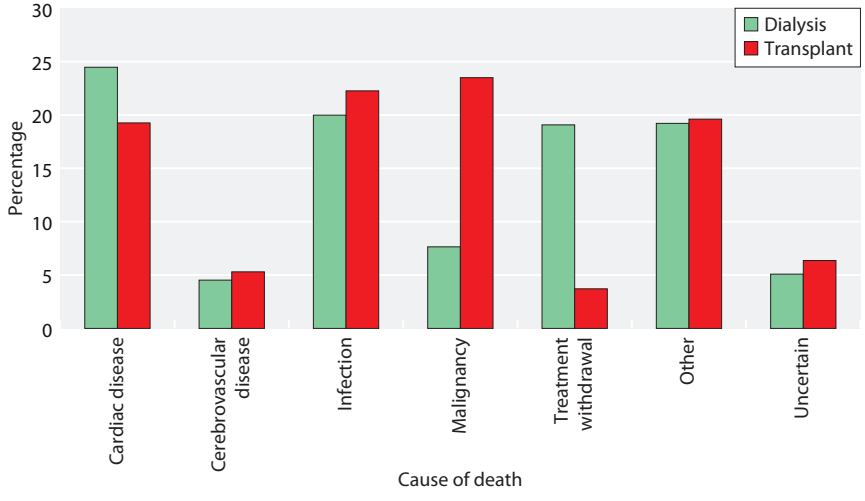

Fig. 3.11. Cause of death by modality for prevalent patients on 1/1/2016, who died in 2016

Table 3.14. Cause of death in prevalent transplant patients on 1/1/2016 by age, who died in 2016

	All age groups		<65 years		⩾65 years	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	109	19	59	23	50	16
Cerebrovascular disease	30	5	15	6	15	5
Infection	126	22	43	17	83	27
Malignancy	133	23	61	24	72	23
Treatment withdrawal	21	4	7	3	14	5
Other	111	20	54	21	57	18
Uncertain	36	6	17	7	19	6
Total	**566**		**256**		**310**	
No cause of death data	311	35	140	35	171	36

disease (43% in 2003 compared to 24% in 2016) with an increase in the proportion ascribed to infection or malignancy (30% in 2003 compared to 45% in 2016). The increased death rate secondary to malignancy and infection may reflect the increasing age of transplant recipients and the increased intensity and duration of immunosuppressive regimens, particularly the use of lymphocyte depleting induction regimes. Forthcoming data linkages with the Hospital Episode Statistics and Office of National Statistics databases will allow better understanding of the causes of death in both transplant and dialysis patients including better understanding those patients opting for treatment withdrawal.

Conflicts of interest: Dr E Sharples has received travel honoraria from Alexion pharmaceuticals.

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Appendix 1: Reporting status of audit measures

Table 3.15. The reporting status of the recommended Renal Association audit measures for the Post-operative Care of Kidney Transplant Recipients (KTR) in the 20th 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 renal centres 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 PatientView	No	Requires linkage with PatientView
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 on proteinuria
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	No	Poor data completeness
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 3.15. 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 bisphosphonate 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	Partly	Reported but not at centre level, due to 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

ACE – angiotensin converting enzyme (inhibitor); ACR – albumin:creatinine ratio; BKN – BK virus nephropathy; CMV – cytomegalovirus; CNI – calcineurin inhibitor; EBV – Epstein Barr Virus; HSV – herpes simplex virus; IL2-RA – interleukin-2 receptor antagonists; MPA – mycophenolic acid; NODAT – new onset of diabetes after transplantation; PCR – protein:creatinine ratio; PTLD – post transplant lymphoproliferative disorder; RAS – renin angiotensin system; TDA – T-cell (lymphocyte) depleting antibodies; VZV – varicella zoster virus

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UK Renal Registry 20th Annual Report: Chapter 4 Demography of the UK Paediatric Renal Replacement Therapy Population in 2016

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Keywords
Adolescents · Aetiology · Children · Demography · Established renal failure · Incidence · Prevalence · Pre-emptive transplantation · Renal replacement therapy · Survival · Young adults

Summary

- In 2016, 964 children and young people aged less than 18 years were receiving long-term renal replacement therapy (RRT) for established renal failure (ERF) at UK paediatric nephrology centres.
- A total of 125 incident patients under 18 years commenced RRT.
- At the census date (31 December 2016), 77% of prevalent paediatric patients aged <16 years had a functioning kidney transplant (43% live and 34% deceased donor), 12% were receiving haemodialysis (HD) and 11% were receiving peritoneal dialysis (PD).
- In 2016, the prevalence of ERF in patients aged less than 16 years was 64.1 per million age-related population (pmarp). The incidence of ERF for 2016 was 9.0 pmarp.
- Using ERA-EDTA Registry classification, tubulointerstitial disease (which includes congenital/structural anomalies) accounted for over half of all primary renal diagnoses in prevalent patients, with a high male : female ratio (3.3 : 1). Over time, there has been a progressive decline in glomerular disease as a primary renal cause of ERF.
- Between 2002 and 2016, a third of prevalent children in ERF aged three months to 16 years who were referred early received a pre-emptive transplant. Males and White ethnic children were significantly more likely to benefit from pre-emptive transplantation, adjusting for time-period, age at RRT start and primary renal diagnosis.
- At the time of transfer to adult services, 89.4% of patients had a functioning kidney transplant.

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Introduction

The UK Renal Registry (UKRR) routinely collects demographic, clinical, haematological and biochemical data for patients receiving long-term renal replacement therapy (RRT) in UK paediatric nephrology centres. In collaboration with the British Association for Paediatric Nephrology (BAPN), this data is analysed and published within the UKRR's annual report.

For UK children and adolescents, RRT for established renal failure (ERF) is managed within one of the thirteen tertiary paediatric nephrology centres. All centres are equipped to provide peritoneal dialysis (PD) and haemodialysis (HD). Ten of these centres also perform kidney transplantation.

Young people aged 16–18 years may be managed in either paediatric or adult services. This is variable across the UK and dependent on local practices, social factors and patient/family wishes. In this chapter, data for patients aged less than 18 years who are managed within UK paediatric nephrology centres are described, with a focus on those aged less than 16 years, as this group represents a complete cohort. Young people aged 16–18 years who have only ever received nephrology care from adult centres are not included in the analyses.

In the UK in 2015, the prevalence rate of treated ERF in children and adolescents aged <16 years was 62.7 per million age-related population (pmarp) and the incidence rate was 10.2 pmarp [1].

The objectives of this chapter are:

1. To describe the UK incidence, prevalence, causes of ERF and modality of treatment of children, adolescents and young adults on RRT on 31 December 2016
2. To describe trends in (1) over the past 15 years
3. To describe pre-emptive transplantation rates and survival of children and adolescents on RRT aged <16 years in the UK.

All 13 paediatric nephrology centres in the UK contribute data to the UKRR, mandated in England by the NHS service specification which requires, '***paediatric renal units to submit data comprising the national renal data set to the UK Renal Registry on all patients on renal replacement therapy***' [2]. In most cases this is via an annual extract of a centre's clinical computer system which is checked, validated and loaded onto the UKRR paediatric database. At each return, missing data items are sought. Centres pay a capitation fee to support the process. The UKRR is currently moving towards a more streamlined means of data extraction through the UK Renal Data Collaboration (UKRDC), which is due to start receiving and testing extracted 2017 data from renal servers in the summer of 2018.

Methods

Centres arranged for their own data to be extracted and sent to the UKRR for processing by clinical informaticians. For 2016, all centres were using electronic clinical data capture systems: seven different systems are used among 13 paediatric renal centres. For this report, data returns were required by 31 March 2017. However, data were still received by the UKRR until January 2018.

The content and analyses contained in the paediatric chapters are discussed and agreed by the BAPN Audit and Research Committee members.

In this report, patient groups are described as:

1. 'Incident' group: patients who started RRT between 1 January and 31 December 2016
2. 'Prevalent' group: patients who were receiving RRT on 31 December 2016
3. 'Five-year' groups: patients who started RRT in the periods of 2002–2006, 2007–2011 and 2012–2016.

RRT is defined as all patients with renal transplants and patients on HD and PD for 90 days or more. Dialysis for acute kidney injury (AKI) is not reported currently. All patients <16 years of age at the start of RRT are included in these analyses. The cohort of patients starting RRT aged ⩾16 years of age was incomplete and includes only those whose treatment was started in a paediatric centre.

The populations used to calculate incidence and prevalence were obtained from the Office for National Statistics (ONS) [3]. The mid-2016 population estimate produced by the ONS, based on the 2011 census, was used to calculate the 2016 incidence and prevalence rate; the 2004 population estimate data were used for the 2002–2006 group, the 2009 data for the 2007–2011 group and the 2014 data for the 2012–2016 group. Incidence and prevalence for 16–18-year olds are not reported because data would not be representative of the UK as these young people may also be managed in adult services.

Ethnicity is defined as stated by the patient/family and is reported as White, South Asian, Black and Other. The South Asian ethnicity includes those of Indian, Pakistani or Bangladeshi origin only. The Other ethnicity group includes those from Chinese, other South Asian groups (e.g. Vietnamese, Malaysian), Arabic, mixed race ethnic origin or any other group. Black ethnicity includes those of Black-African, Black-Caribbean origin and Black-other groups.

In previous years, primary renal disease was described according to a registry derived grouping system established in 2002 [4]. For ease of coding and increased comparability, a decision was made to move to 2012 diagnostic groupings used by the ERA-EDTA Registry: these include tubulointerstitial disease, glomerular disease, familial and hereditary nephropathies, systemic disease

affecting the kidney and miscellaneous. Further details on how primary diagnoses are coded and grouped can be found on the ERA-EDTA Registry website (www.era-edta-reg.org/index.jsp?p=37).

Statistical analyses were performed using SAS 9.3, with group analyses using the chi-squared test and median analyses using the Kruskal-Wallis test. Infants under the age of three months and late presenters (defined as those commencing dialysis within three months following first review by a paediatric nephrologist) were excluded from analyses when calculating pre-emptive transplantation rates. Multivariable logistic regression was used to analyse odds of pre-emptive transplantation by age, sex and other demographic variables. For survival analysis, patients starting RRT between 1 January 2002 and 31 December 2015 and receiving RRT for at least 90 days were included to ensure a minimum of one-year follow-up at the census date. These patients were followed up to a maximum age of 16 years, transfer out of paediatric service or death; whichever occurred first. 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 over eight years, or five-year survival probability for children starting RRT aged over 12 years. A Cox regression model was used to calculate hazard ratios for patient survival, adjusting for sex, age at start of RRT and RRT modality as a time dependent variable. Survival probabilities were calculated using Kaplan-Meier curves.

Results

Data returns

Overall data completeness was excellent for the following: age and sex (100%), ethnicity (98.7%), start and 90-day treatment modality (99.6%) and start date (99.4%). Completeness of other data items ranged from 83.5% to 99.4% (table 4.1). Centre size and type (if undertaking paediatric kidney transplantation) are also displayed. Of note, height at RRT has the lowest level of completeness. While the proportion of missing data is improving over time, lack of height data at RRT start is associated with age, which in part may reflect difficulties in obtaining measurements for very young children (<2 years).

The UK paediatric prevalent ERF population in 2016

A total of 964 children and young people aged <18 years with ERF were receiving treatment at paediatric nephrology centres in 2016 (table 4.1). Of these, 794 (82.4%) were <16 years of age. Table 4.2 shows the number of these patients receiving RRT and prevalence rate by age group and sex. More than ten times the number of teenagers received RRT compared with infants. The prevalence of RRT increased with age and was higher in males across all age groups with an overall male to female ratio of 1.7 : 1. The reported prevalence in <16 year olds was 64.1 pmarp.

Table 4.3 shows the prevalence of ERF in children less than 16 years old by age and ethnic group. A higher prevalence is again noted for children of ethnic minority. This was particularly evident for South Asian children whose prevalence was almost double the overall RRT prevalence of 64.1 pmarp.

Table 4.1. Data completeness for the paediatric prevalent ERF population on 31/12/2016

		Percentage completeness				
Centre	*N*	First seen date	Height at RRT start	Weight at RRT start	Creatinine at RRT start	Primary renal diagnosis
Blfst_P*	30	93.3	80.0	90.0	93.3	100.0
Bham_P*	112	95.5	92.9	95.5	95.5	98.2
Brstl_P*	55	96.4	87.3	94.6	98.2	100.0
Cardf_P	35	94.3	91.4	91.4	94.3	97.1
Glasg_P*	60	98.3	81.7	85.0	85.0	100.0
L Eve_P*	108	86.1	68.5	75.0	74.1	99.1
L GOSH_P*	184	96.7	87.5	94.6	94.6	100.0
Leeds_P*	81	100.0	88.9	100.0	100.0	100.0
Livpl_P	55	98.2	78.2	83.6	92.7	100.0
Manch_P*	88	96.6	95.5	97.7	97.7	100.0
Newc_P*	32	96.9	90.6	90.6	81.3	100.0
Nottm_P*	94	95.7	75.5	95.7	96.8	97.9
Soton_P	30	93.3	46.7	46.7	56.7	100.0
UK	**964**	**95.4**	**83.5**	**90.3**	**91.2**	**99.4**

RRT – renal replacement therapy
*Denotes centres undertaking kidney transplantation for children

Table 4.2. The UK paediatric prevalent ERF population <16 years old on 31/12/2016, by age group and sex

Age group (years)	All patients		Males		Females		M : F rate ratio
	N	pmarp	*N*	pmarp	*N*	pmarp	
0–<2	24	15.3	16	19.9	8	10.5	1.9
2–<4	59	36.7	43	52.2	16	20.4	2.6
4–<8	177	53.9	121	72.0	56	34.9	2.1
8–<12	233	75.3	142	89.5	91	60.3	1.5
12–<16	301	106.2	190	130.9	111	80.3	1.6
Under 16	**794**	**64.1**	**512**	**80.7**	**282**	**46.7**	**1.7**

pmarp – per million age related population

Table 4.3. The UK paediatric prevalent ERF population <16 years old in 2016, by age and ethnic group[a]

Age group (years)	White	South Asian	Black	Other
0–<4	53	12	5	9
4–<8	126	21	5	22
8–<12	157	47	10	15
12–<16	220	48	15	16
Under 16	**556**	**128**	**35**	**62**
pmarp (<16)[b]	**55.6**	**120.6**	**64.6**	**78.4**

pmarp – per million age related population
[a]Ethnicity not recorded for 13 children, not included in this table
[b]pmarp was calculated by assuming the same ethnic distribution for <16 years old from the 2011 ONS census, applied to the total UK 2016 population aged <16 years old

Treatment modality

Most prevalent paediatric patients under 16 years old in 2016 had a functioning transplant (77%), as shown in figure 4.1. The ratio of living to deceased donor transplants was 1 : 0.8.

By comparison, 45% of patients started RRT on PD, 33% on HD and 22% with a pre-emptive transplant, as displayed in figure 4.2.

Analysis of current treatment modality by age shows that the majority of patients below the age of four years were receiving dialysis whilst most children over four years had a transplant (table 4.4). Transplantation was not performed in any child under two years of age and living donor transplants were more common than deceased donor transplants in those aged two to twelve years. When comparing current treatment by ethnicity in 2016, White children were more likely to have a functioning transplant compared with non-White children ($p = 0.003$). This finding however was not age-adjusted which given the higher proportion of ethnic minorities

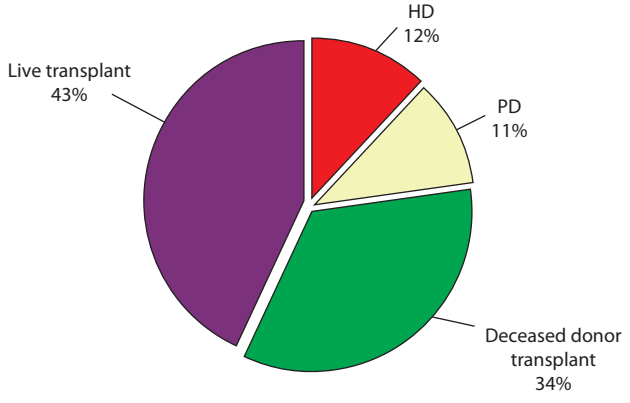

Fig. 4.1. RRT treatment used by prevalent paediatric patients <16 years old on 31/12/2016

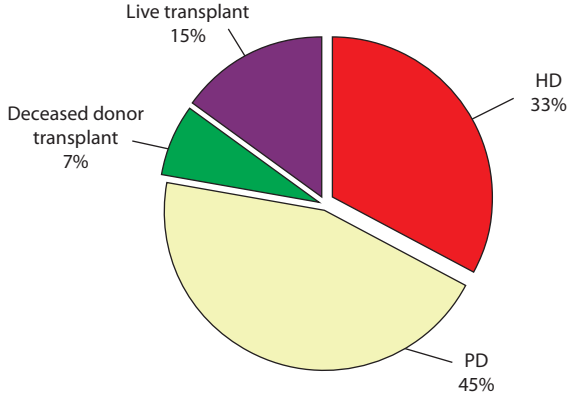

Fig. 4.2. Treatment modality at start of RRT in prevalent paediatric patients <16 years old on 31/12/2016

Table 4.4. Current treatment modality by age group in the UK paediatric prevalent ERF population <18 years old on 31/12/2016

Age group (years)	Total *N*	Current treatment							
		HD		PD		Live transplant		Deceased donor transplant	
		N	%	*N*	%	*N*	%	*N*	%
0–<2	24	7	29.2	17	70.8	0	0.0	0	0.0
2–<4	59	19	32.2	24	40.7	11	18.6	5	8.5
4–<8	177	19	10.7	17	9.6	98	55.4	43	24.3
8–<12	233	26	11.2	10	4.3	113	48.5	84	36.1
12–<16	301	23	7.6	22	7.3	122	40.5	134	44.5
16–<18	170	14	8.2	11	6.5	68	40.0	77	45.3
Under 16	**794**	**94**	**11.8**	**90**	**11.3**	**344**	**43.3**	**266**	**33.5**
Under 18	**964**	**108**	**11.2**	**101**	**10.5**	**412**	**42.7**	**343**	**35.6**

HD – haemodialysis; PD – peritoneal dialysis

Table 4.5. Number and percentage of the prevalent ERF population <16 years old in 2016, by sex and ethnicity

Diagnostic group	*N*	%	Males	Females	Proportion of non-White patients
Tubulointerstitial disease	424	53.4	326	98	26.9
Glomerular disease	134	16.9	65	69	30.8
Familial/hereditary nephropathies	118	14.9	53	65	39.8
Systemic diseases affecting the kidney	34	4.3	18	16	12.1
Miscellaneous	78	9.8	45	33	26.7
Missing	6	0.8	5	1	20.0
Total	**794**		**512**	**282**	**28.8**

aged under four years, may partly explain the differences seen (data not shown).

Cause of ERF

Tubulointerstitial disease (TID) was the commonest renal diagnostic group in prevalent patients under 16 years in 2016 (table 4.5), accounting for over half of all primary renal disease (PRD) diagnoses. The high male to female ratio for this group (3.33 : 1) likely reflects the number of boys with obstructive uropathy due to posterior urethral valves. Based on previous reporting criteria, congenital anomalies of the kidneys and urinary tract (CAKUT) account for almost all the diagnoses within this group (99.8%, data not shown). Congenital nephrotic syndrome accounted for 60% of prevalent glomerular disease requiring RRT (81 patients). In 2016, there were 21 prevalent patients receiving RRT due to malignancy, whilst no patients had a PRD of drug toxicity (both now coded under 'miscellaneous'). Primary renal disease was uncertain or unknown in only 4% of patients.

Overall, White patients constituted 71.2% of the prevalent ERF population, but represented 87.9% of patients with systemic diseases affecting the kidney. This diagnostic group encompasses conditions such as haemolytic uraemic syndrome (HUS) and renovascular disease. Prevalent and incident PRD data by historic UKRR groupings are available for comparison (figure 4.6 and table 4.13 in appendix 1 of this chapter).

Figure 4.3 displays the proportion of patients in each ERA-EDTA diagnostic category for the incident and prevalent cohorts.

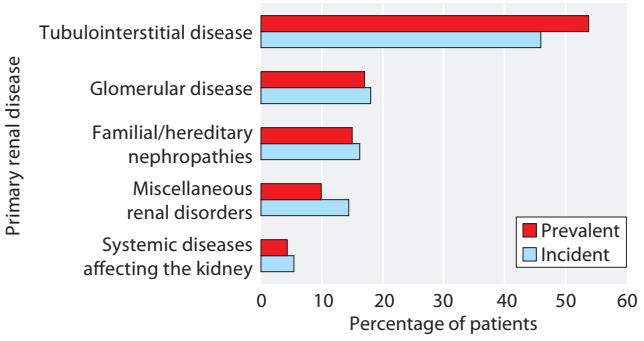

Fig. 4.3. Comparison of PRD groupings in the 2016 UK paediatric incident and prevalent ERF population <16 years old for patients with non-missing data

Table 4.6. The UK paediatric incident ERF population <16 years old in 2016, by age group and sex

	All patients		Males		Females	
Age group (years)	*N*	pmarp	*N*	pmarp	*N*	pmarp
0–<2	24	15.3	14	17.4	10	13.1
2–<4	8	5.0	7	8.5	1	1.3
4–<8	17	5.2	12	7.1	5	3.1
8–<12	25	8.1	15	9.5	10	6.6
12–<16	38	13.4	17	11.7	21	15.2
Under 16	**112**	**9.0**	**65**	**10.2**	**47**	**7.8**

pmarp – per million age related population

The UK paediatric incident ERF population in 2016

There were 125 patients <18 years of age who commenced RRT at paediatric renal centres in 2016. The following analyses are restricted to the 112 patients who were <16 years of age.

The overall incidence of RRT was 9.0 pmarp in 2016. Patients commencing RRT in 2016 are displayed by age and sex in table 4.6; apparent differences may be a result of small group sizes.

Trends in ERF demographics

There were 1,720 children and adolescents <16 years of age who received RRT in the UK between 2002 and 2016. In general, the overall incidence of RRT has remained steady over the past ten years (table 4.7). Relative increases in incidence were seen in younger patients, notably the under two and two to four year age groups, while a decrease was seen for children aged 12 to <16 years. Table 4.8 shows a decrease in the

Table 4.7. Reported numbers and average incidence by age group in five-year time periods of the UK paediatric incident ERF population <16 years old commencing RRT

	2002–2006		2007–2011		2012–2016	
Age group (years)	*N*	pmarp	*N*	pmarp	*N*	pmarp
0–<2	77	11.1	100	12.7	112	14.2
2–<4	33	4.9	59	7.8	75	9.1
4–<8	89	6.2	89	6.4	113	7.1
8–<12	109	7.3	129	9.0	136	9.4
12–<16	210	13.4	213	14.0	176	12.3
Under 16	**518**	**8.8**	**590**	**10.0**	**612**	**10.1**

pmarp – per million age related population

Table 4.8. Number* and percentage of the UK paediatric incident ERF population <16 years old who commenced RRT, by ethnicity and five-year period of starting RRT

	2002–2006		2007–2011		2012–2016	
Ethnic group	*N*	%	*N*	%	*N*	%
White	409	79.4	432	74.1	411	68.6
South Asian	77	15.0	95	16.3	104	17.4
Black	14	2.7	27	4.6	23	3.8
Other	15	2.9	29	5.0	61	10.2
Under 16	**515**		**583**		**599**	

*Three children in 2002–2006, seven in 2007–2011 and 13 in 2012–2016 with no ethnicity recorded are excluded from this table

Table 4.9. Number and percentage of the UK paediatric incident ERF population <16 years old, by renal centre and five-year period of starting RRT

	2002–2006		2007–2011		2012–2016	
Centre	*N*	%	*N*	%	*N*	%
Blfst_P	14	2.7	26	4.4	15	2.5
Bham_P	54	10.4	61	10.3	71	11.6
Brstl_P	35	6.8	35	5.9	31	5.1
Cardf_P	20	3.9	15	2.5	24	3.9
Glasg_P	30	5.8	47	8.0	38	6.2
L Eve_P	43	8.3	70	11.9	69	11.3
L GOSH_P	101	19.5	114	19.3	111	18.1
Leeds_P	51	9.8	47	8.0	55	9.0
Livpl_P	30	5.8	22	3.7	34	5.6
Manch_P	50	9.7	46	7.8	66	10.8
Newc_P	26	5.0	25	4.2	25	4.1
Nottm_P	46	8.9	62	10.5	58	9.5
Soton_P	18	3.5	20	3.4	15	2.5
Under 16	**518**		**590**		**612**	

proportion of White ethnic and an increase in Other ethnic group patients starting RRT over the same time periods. Table 4.9 shows that the overall proportions between paediatric renal centres have fluctuated only slightly over this period.

The proportion of patients starting RRT with deceased donor transplants fell (from 13.4% in 2002–2006 to 7.7% in 2012–2016, figure 4.4) with total numbers down by 30% over this time. Living donor transplantation as a start modality has seen small increases during this period. The proportion of PD use at RRT start continued to fall, having dropped from 48.5% in 2002–2006 to 37.9% in 2012–2016. This reduction is offset mainly by increased use of HD, with patient numbers having almost doubled since 2002–2006 (122 to 228 patients).

The proportion of patients with glomerular disease as a cause of ERF in the prevalent paediatric population has fallen over the last 15 years (table 4.10). Numbers of incident patients commencing chronic RRT for congenital nephrotic syndrome over this time period however have almost doubled (see appendix 1, table 4.13).

Pre-emptive transplantation

Of the 1,720 patients aged <16 years who started RRT between 2002 and 2016, 454 were excluded from this analysis (94 patients due to being aged under three

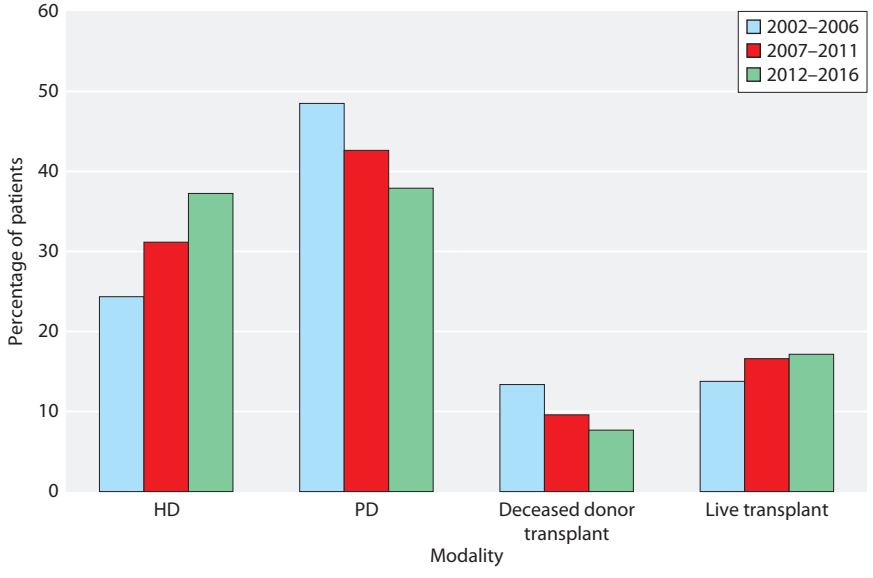

Fig. 4.4. Treatment modality at start of RRT for the UK paediatric incident ERF population <16 years old, by five-year time-period

Table 4.10. Number* and percentage of primary renal diseases in the UK paediatric prevalent ERF population <16 years old, by five-year time-period

	2002–2006		2007–2011		2012–2016		2002–2016
Primary renal diagnosis	*N*	%	*N*	%	*N*	%	% change
Tubulointerstitial disease	259	50.5	284	48.6	310	51.1	0.6
Glomerular disease	116	22.6	115	19.7	104	17.1	−5.5
Familial/hereditary nephropathies	78	15.2	102	17.5	98	16.1	0.9
Systemic diseases affecting the kidney	14	2.7	34	5.8	22	3.6	0.9
Miscellaneous renal disorders	46	9.0	49	8.4	73	12.0	3.1

*Five children in 2002–2006, six in 2007–2011 and five in 2012–2016 with no primary renal diagnosis recorded are excluded from this table

months, 360 due to being late presenters). Table 4.11 shows that one third of included patients ($N = 1,266$) received a pre-emptive transplant.

A significant difference exists in pre-emptive transplantation rates by sex, with higher rates seen in boys ($p = 0.001$); this difference persisted ($p = 0.002$) when adjusted for time-period, ethnicity, age at RRT start and PRD in a logistic regression. Significantly higher rates were also seen in White patients (versus non-White ethnicity, $p = <0.0001$). As expected, fewer pre-emptive transplantations were performed in very young patients (<2 years). When children under two years were excluded from analysis, a significant difference in pre-emptive transplantation rates between age groups persisted ($p = 0.02$), however this was not significant when assuming a linear correlation with age ($p = 0.2$) using the Mantel-Haenszel test.

Pre-emptive transplantation rates differed by PRD according to ERA-EDTA registry groupings ($p = 0.0001$); the lowest rates were seen in patients with glomerular or miscellaneous disease.

Transfer of patients to adult renal services in 2016

Ninety patients transitioned to adult renal services in 2016, similar to the 85 who transferred during 2015. The median age of patients at transfer was 18.0 years with an inter-quartile range of 17.7–18.3 years. Overall, the demographics of this population reflected those of the prevalent paediatric RRT population, but with a higher proportion having a functioning transplant (89.4% versus 77.0%).

Survival of children on RRT during childhood

Of patients under 16 years of age, 1,575 started RRT between 2002 and 2015 at paediatric centres in the UK and were included in survival analyses. At the census date (31 December 2016) there were 75 deaths reported in children aged <16 years, which is the same number as for 2015. The median follow up time (beyond day 90) was 3.3 years (range three days to 14.6 years). Table 4.12 shows the survival hazard ratios by age at start of RRT, sex and RRT modality and highlights that very young children (<2 years) at RRT start had the worst survival outcomes, when compared to 12–16 year olds. Being on dialysis has again shown to lower survival

Table 4.11. Demographic characteristics of pre-emptive transplantation in the UK paediatric ERF population aged three months to 16 years, 2002–2016, by five-year time-period, sex, ethnicity, age at start of RRT and PRD

Characteristic	*N*	*N* (%) pre-emptively transplanted
Total cohort analysed (2002–2016)	1,266	423 (33.4)
Time period		
2002–2006	393	130 (33.1)
2007–2011	410	144 (35.1)
2012–2016	463	149 (32.2)
Sex		
Male	797	287 (36.0)
Female	469	136 (29.0)
Ethnicity		
White	918	337 (36.7)
South Asian	207	48 (23.2)
Other	76	24 (31.6)
Black	45	7 (15.6)
Age at start of RRT (years)		
3 months–<2	141	8 (5.7)
2–<4	144	39 (27.1)
4–<8	232	99 (42.7)
8–<12	291	103 (35.4)
12–<16	458	172 (38.0)
Primary renal diagnosis		
Tubulointerstitial disease	678	295 (43.5)
Glomerular disease	245	19 (7.8)
Familial/hereditary nephropathies	195	65 (33.3)
Miscellaneous renal disorders	91	24 (26.4)
Systemic diseases affecting the kidney	44	17 (38.6)

Table 4.12. Survival hazard ratio during childhood for the UK paediatric ERF population <16 years old, for age at start of RRT, sex and RRT modality

Characteristic	Hazard ratio	Confidence interval	p-value
Age			
0–<2 years	3.0	1.3–6.9	0.012
2–<4 years	2.0	0.7–5.4	0.18
4–<8 years	2.2	0.9–5.5	0.08
8–<12 years	1.0	0.3–2.7	0.9
12–<16 years	1.0		
Sex			
Female	1.1	0.7–1.7	0.7
Male	1.0		
RRT modality			
Dialysis	7.4	3.9–14.1	<0.0001
Transplant	1.0		

significantly compared to having a functioning transplant, with a hazard ratio of 7.4 (CI 3.9–14.1, $p < 0.0001$). Figure 4.5 shows unadjusted Kaplan-Meier survival probabilities and demonstrates worse outcomes for children aged less than two years, particularly in the first 12 months. By comparison, children and young people aged 8–16 years have very good one year survival rates, with no deaths reported.

Mortality data in 2016

Ten deaths occurred in children under 16 years in 2016; the median age at death was 7.7 years (range 0.4–15.5 years). In children aged <16 years with treated ERF, the reported mortality in UK paediatric centres was 1.3% (10/794).

Transplant deaths

One patient had a functioning kidney transplant at time of death. The cause of death was unexplained.

Dialysis deaths

In 2016, six patients were on dialysis at time of death (three PD, three HD). One patient died of malignancy, one of pancreatitis, two of septicaemia and another due to cardiac failure secondary to a metabolic disorder. Cause of death was not established in one patient. Three further patients had dialysis withdrawn due to medical (non-renal) reasons.

Discussion

This report continues to provide important insights into the demography of UK children and young people on long-term RRT with comparison of trends over time. Information gleaned from the registry is not only vital for planning and financing tertiary services but has the potential to facilitate translation of research into clinical practice, thus driving improvements in patient care [5]. Moreover, moving towards a more standardised method of coding for primary renal disease, further comparisons with international registries will be possible.

Data returns

One of the key aims of the UKRR is to provide contemporaneous epidemiological data on the paediatric RRT cohort. This is dependent on centres submitting data to the UKRR in a timely fashion, thus allowing

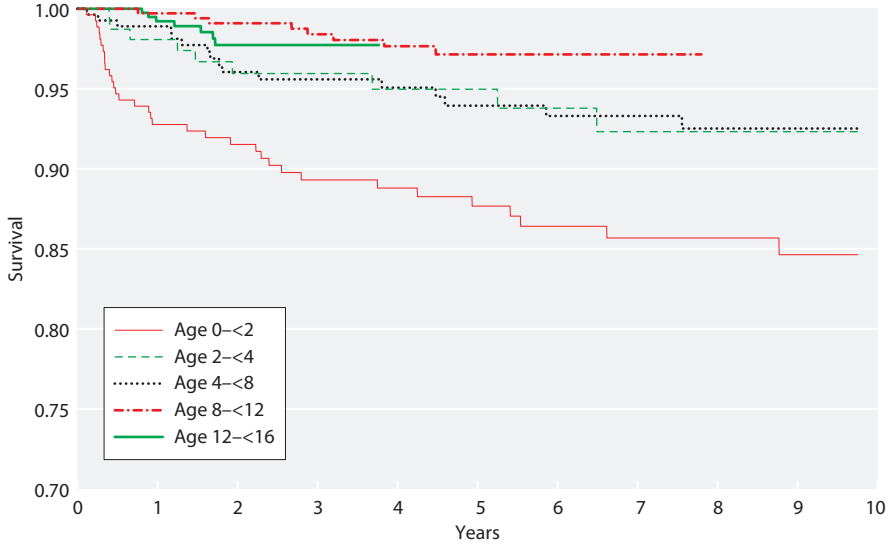

Fig. 4.5. Unadjusted Kaplan-Meier survival in the UK paediatric ERF population <16 years old starting RRT between 2002 and 2015, by age at start

thorough data checks and validation to occur prior to analysis.

For the paediatric dataset, this process has its own inherent challenges and limitations. Firstly, some renal computer systems extract adult and paediatric data together despite differences in the data fields requested, which results in requests for additional paediatric data from centres. Secondly, important missing data fields that have not been automatically populated by local systems require contact with lead clinicians in each centre to 'fill in the gaps'. Understandably, this can cause a delay in data cleaning and validation while placing an additional burden on busy clinical teams. Suggestions on how to improve and streamline this process are welcomed.

Highlights from the 2016 data

Overall, there has been little change in the reported age-adjusted prevalence and incidence of the paediatric RRT population. Teenagers account for a high proportion of the prevalent population, although their incidence remained stable over time. Conversely, children under two years accounted for a small proportion of the prevalent population in 2016 (3%), yet incident numbers starting chronic RRT were increasing year-on-year. Based on 2016 population census figures, ethnic minorities continued to record a high prevalence of patients on RRT, with South Asian ethnicity accounting for the highest.

Most prevalent patients had a functioning transplant which is encouraging, further still was the high proportion of young people transitioning to adult care dialysis-free (89.4%). As expected, high proportions of younger children (<4 years) were reliant on dialysis, with few receiving a kidney transplant.

As reported in the last audit, less than a quarter of UK children commencing RRT received a pre-emptive transplant, with disparities seen amongst the sexes and ethnic groups despite adjusting for potential confounders. Sex differences in paediatric access to transplantation echo findings reported by the ERA-EDTA Renal Registry: females were 23% less likely than males to receive a pre-emptive transplant with medical factors explaining only 70% of the variation seen [6]. This analysis was unable to account for non-clinical characteristics such as socio-economic status (SES). In addition, the US Renal Data System has reported reduced access to living donor pre-emptive transplantation in ethnic minorities, with black patients 66% and Hispanics 52% less likely to benefit from pre-emptive transplantation, despite adjustment for SES [7]. An analysis of UKRR data to explore whether SES is associated with access to pre-emptive transplantation has been approved and is planned for this coming year.

RRT start modality

PD remained the most popular start modality in 2016, used in just under half of all patients commencing RRT. Over time however, its use and that of deceased donor transplantation is falling, with concurrent increases in HD use seen. When analysed by time-period, the numbers of patients starting on HD and PD for 2012–2016 were similar (228 versus 232 respectively). Whilst living donor transplantation is increasing over time, the reason for the noticeable increases in HD use (over PD or deceased donor transplantation) is unclear and requires further investigation.

Primary renal disease

This year, the UKRR paediatric dataset has moved to the 2012 ERA-EDTA diagnostic grouping system to categorise primary renal disease. However, reference to previous UKRR groupings is made. Tubulointerstitial disease, which encompasses structural and congenital anomalies, accounts for over half of all prevalent cases of ERF.

Numbers of patients with glomerular disease as a primary cause for ERF is falling over time. As the UKRR expands to collect data on patients with earlier pre-dialysis stages of CKD (4 and 5), understanding will increase as to whether this observation is due to improved disease control or a true reduction in disease leading to glomerular pathology. It is also noted that fewer patients with glomerular or miscellaneous disease are pre-emptively transplanted. As these groupings may encompass disease processes with a rapid decline in function (miscellaneous includes codes for acute kidney injury), this may preclude patients from early transplantation.

Comorbidity

Reporting of comorbidities in the paediatric RRT population has been challenging for some time. Data completeness remained low and recorded comorbidity varied greatly between centres. This has led to concerns regarding the representativeness of the burden of disease faced by the paediatric nephrology community. In view of this, and in eager anticipation of findings from the 2016–2017 BAPN comorbidities audit, it was decided that UKRR collated information would not be included in this year's report. Furthermore, research is planned that aims to compare and validate UKRR recorded

comorbidity with Hospital Episode Statistics (HES) data, thus enhancing our knowledge of this cohort.

Survival

Survival data from the UKRR continued to show the negative effect of younger age on mortality risk and medium-term survival compared with older age groups. Dialysis use also confers substantial mortality risk. A recent UK publication describing survival of young people aged 11–30 years reinforces these findings and highlights that this risk is further amplified for patients who are not wait-listed for transplant (HR 16.6, 95% CI 10.8–25.4, $p = <0.0001$) [8]. Although few paediatric deaths are reported each year, it is becoming apparent that cause of death, often due to a complex interaction between renal and extra-renal factors, in many cases is not fully captured by a single code-reporting system. A BAPN-UKRR audit of RRT deaths is planned this year to ascertain how best to collect and report this data for audit and research purposes.

Current and future work

Several paediatric based projects are underway or planned in collaboration with the UK Renal Registry this coming year. It is encouraging to note that of the submitted applications to the UKRR for data in 2017–2018, half are paediatric based or include a paediatric element.

Several projects have been developed jointly with the BAPN. The need for improved comorbidity reporting in the RRT cohort has led to the development and completion of a UK-wide survey by paediatric nephrology centres. Results have now been received by the UKRR, with a report of findings expected later this year.

Another BAPN-UKRR project is planned for later this year which will audit cause of death data for RRT patients with paediatric centre-held medical records. As previously described, the aims of this project are to 1) understand risk factors for death by age and disease group and 2) determine whether current coding systems accurately capture cause of death for the paediatric population.

As the UKRR expands its dataset to include patients under pre-dialysis care, little is known about children who develop ERF but in whom a decision is made not to pursue renal replacement therapy. It is not clear whether these children are known to nephrology services, what factors are implicated in the decision for conservative management, or whether decisions regarding life-sustaining treatment are made in accordance with national and international guidance. An initial proposal to explore this issue in greater detail has been submitted and approved by the British Paediatric Surveillance Unit (BPSU). It is hoped this prospective study will provide a more accurate picture of childhood ERF in the UK and will also inform future data collection through the UKRR.

Approved paediatric/young adult research projects using UKRR data include an analysis of risk factors implicated in graft survival and rate of function decline post-transplantation; exploring the association of non-clinical variables in timing and access to specialist services and an analysis of the benefits of transplant versus dialysis for children using a marginal structural modelling approach. A follow-up report on children who commenced dialysis aged less than two years is also planned.

Applications are welcomed for paediatric and young adult research projects using UKRR data. Further details regarding the application process can be found on the UKRR website: www.renalreg.org/about-us/working-with-us/.

Conflicts of interest: the authors declare no conflicts of interest

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Appendix 1: Historic UKRR diagnostic groupings

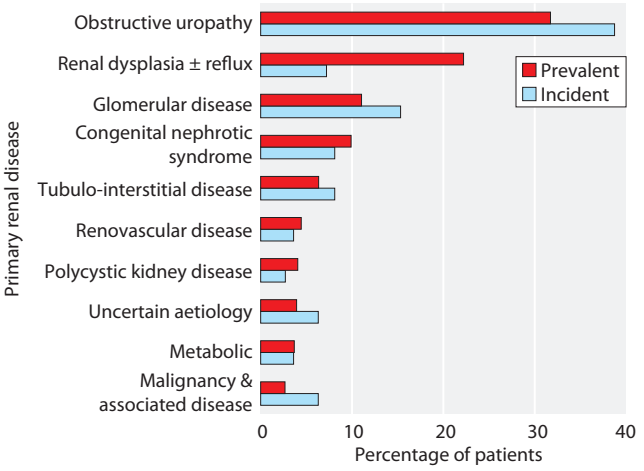

Fig. 4.6. Proportion of primary renal disease by historic UKRR diagnostic groupings in incident and prevalent paediatric patients in 2016 for whom a causative diagnosis was reported

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 (using historic UKRR groupings), by 5-year time period

	2002–2006		2007–2011		2012–2016	
Primary renal diagnosis	*N*	%	*N*	%	*N*	%
Congenital nephrotic syndrome	25	4.9	35	6.0	49	8.1
Glomerular disease	103	20.1	118	20.2	74	12.2
Polycystic kidney disease	15	2.9	19	3.3	22	3.6
Metabolic	21	4.1	31	5.3	28	4.6
Obstructive uropathy	83	16.2	95	16.3	204	33.6
Renal dysplasia + reflux	168	32.7	181	31.0	105	17.3
Tubulo-interstitial diseases	42	8.2	49	8.4	44	7.2
Malignancy & associated disease	11	2.1	6	1.0	16	2.6
Uncertain aetiology	26	5.1	25	4.3	41	6.8
Drug nephrotoxicity	6	1.2	3	0.5	0	0.0
Renovascular disease	13	2.5	22	3.8	24	4.0
Total	**513**		**584**		**607**	

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UK Renal Registry 20th Annual Report: Chapter 5 Survival and Cause of Death in UK Adult Patients on Renal Replacement Therapy in 2016: National and Centre-specific Analyses

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Keywords

Cause of death · Comorbidity · Dialysis · End stage renal disease (ESRD) · Established renal failure (ERF) · Haemodialysis · Outcome · Peritoneal dialysis · Renal replacement therapy (RRT) · Survival · Transplant · Vintage

Summary

- Short-term (90 day) age adjusted survival of incident RRT patients in the 2015 cohort was similar to the 2014 cohort (96.5% versus 96.8%).
- One year after 90 day age adjusted survival for incident RRT patients in the 2015 cohort fell slightly to 90.0% compared with the previous year (90.2%).
- There was a difference in one year after 90 day incident survival by age group and diagnosis of diabetes: patients with diabetes aged <65 years had worse one year after 90 day survival than patients without diabetes, but for older patients with diabetes (⩾65 years) survival was similar compared to those patients without diabetes.
- One year age adjusted survival for prevalent dialysis patients was similar at 88.0% in the 2015 cohort, compared with 88.3% in the 2014 cohort. Age adjusted one year survival for prevalent dialysis patients with diabetic primary renal disease has been declining slightly from 2012 onwards.
- Centre and UK country variability was evident in incident and prevalent patient survival after adjusting to age 60. Further adjustment for comorbidity was not possible due to missing data.
- The relative one year risk of death for prevalent RRT patients compared with the general population was approximately 21 for age group 35–39 years compared with 1.5 at age 85+ years, but the relative risk of death for younger patients has improved over time.
- In the prevalent RRT population, cardiovascular disease was the most common cause of death and accounted for 24% of deaths, with infection accounting for 20%. Treatment withdrawal accounted for 17% of deaths and has increased in recent years from historical levels.

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Introduction

The analyses presented in this chapter examine a) survival from the start of renal replacement therapy (RRT) of adult patients; b) survival amongst prevalent adult dialysis patients alive on 31 December 2015; c) the death rate in the UK compared to the general population; d) the cause of death for incident and prevalent adult patients. They encompass the outcomes of the total incident adult UK RRT population (2015) reported to the UK Renal Registry (UKRR), including the 19% who started on peritoneal dialysis (PD) and the 8% 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. These are raw data that must be interpreted with caution. The UKRR adjusts for the different age distributions of patients in different centres, but lacks sufficient data from many participating centres to allow adjustment for primary renal diagnosis, other comorbidities at start of RRT (comorbidity, especially diabetes, is a major factor 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 data on the centre level case-mix makes interpretation of any apparent difference in survival between centres and UK countries difficult. Despite the uncertainty about apparent differences in outcome, any centre which appears to be an outlier will be subject to the UKRR clinical governance procedures as set out in chapter 2 of the 2009 UKRR Annual 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 by plotting the log(−log(survival)) versus the log of survival time or by testing time dependent covariates in the model.

To allow for comparisons between centres with differing age distributions, survival analyses were 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 17 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.

Centre variability for incident and prevalent patient survival was analysed using a funnel plot. For any number of patients in the incident or prevalent cohort (x-axis), one can identify whether any given survival probability (y-axis) falls within, plus or minus two standard deviations (SDs) from the national mean (solid lines, 95% limits) or three SDs (dotted lines, 99.9% limits). All analyses were undertaken using SAS 9.3.

Cambridge renal centre (Addenbrooke's) was unable to submit 2015 or 2016 data at patient level prior to the UKRR closing the database and only provided summary numbers of patients starting RRT by treatment modality. This centre is therefore excluded from analyses in this chapter for 2015 and 2016.

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 ERF.

Previously, the UKRR asked clinicians to re-enter a code for ERF 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 ERF 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 (HD) 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 month immediately prior to the start date of RRT provided by clinicians highlighted additional inconsistencies in the definition of this first date when patients started on PD, 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 Annual 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 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 who started RRT at UK renal centres. 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 RRT 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 recovered renal function after more than 90 days but subsequently returned to RRT and for these patients the most recent start of RRT was used.

The incident survival cohort was **NOT** censored at the time of transplantation and therefore included the survival of the 8% 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 fitter patients. However, censoring at transplantation was performed in the 1997–2015 cohort to establish the effect on long term survival by age group and also in the 2012–2015 cohort to investigate the effect on the outlying status of centres.

The one year incident survival is for patients who started RRT from 1 October 2014 until the 30 September 2015 and followed up for one full year (e.g. patients starting RRT on 1 December 2014 were followed through to 30 November 2015). The 2016 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 1 October 2014 until 30 September 2015 were included in the cohort and they were followed up for a full year after the first 90 days of RRT.

Two years incident data (2014–2015) were combined to increase the size of the patient cohort, so that any differences between the four UK countries could 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 RRT cohort from 2012 to 2015 was also undertaken. A 10 year rolling cohort was used when analysing trends over time and for long term survival, a cohort from 1997 to 2015 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 RRT cohort from 2012 to 2015. Twenty-nine 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 diagnoses for the 29 centres. The individual centre data were then further adjusted for average distribution of comorbidity present at these centres.

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 31 December 2015 who had been on dialysis for at least 90 days at one of the UK adult renal centres. Prevalent dialysis patients on 31 December 2015 were followed-up in 2016 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 about 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 2015 cohort to investigate the effect on the outlying status of centres.

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

Data on the UK population in mid-2016 and the number of deaths in each age group in 2016 were obtained from the Office of National Statistics [8]. 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 2016 in RRT patients. The RRT observed death rate was calculated as number of deaths observed in 2016 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 31 December 2015.

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 2000–2015. Analysis of prevalent patients included all those aged over 18 years and receiving RRT on 31 December 2015 and followed-up for one year in 2016.

Results

Incident (new RRT) patient survival

Overall survival

The 2015 incident RRT cohort included 7,626 patients who started RRT. Survival at 90 days (adjusted to age 60) for the 2015 cohort was 96.5% and was similar compared to the previous year (96.8%) (table 5.1). One year after 90 days survival for incident patients starting RRT in 2015, (adjusted to age 60) fell slightly compared to the previous year: 90.0% compared to 90.2% in the 2014 cohort (table 5.1).

Survival by UK country

Survival at 90 days was highest in Northern Ireland and Scotland compared with the other nations (table 5.2), while one year after 90 day survival differed between the UK countries, with Northern Ireland having the highest survival (table 5.2). However, there are two important caveats for the interpretation of these data; the data have not been adjusted for differences in primary renal diagnosis, ethnicity, socio-economic status or comorbidity, which may differ by country. Secondly, there are known regional differences in the life expectancy of the general population within the UK (which may be explained by some of the factors outlined above). These general population differences are likely

Table 5.1. Survival of incident RRT patients, 2015 cohort

Interval	Unadjusted survival (%)	Adjusted survival (%)	*95% CI*	*N*
Survival at 90 days	95.0	96.5	*96.0–97.0*	7,626
Survival one year after 90 days	87.3	90.0	*89.2–90.8*	7,204

Table 5.2. Incident RRT survival across the UK countries, combined two year cohort (2014–2015), adjusted to age 60

Interval	England	N Ireland	Scotland	Wales	UK
Survival at 90 days (%)	96.5	97.8	97.8	96.5	**96.6**
95% CI	*96.1–96.8*	*96.6–99.1*	*97.0–98.6*	*95.4–97.6*	***96.3–97.0***
Survival 1 year after 90 days (%)	90.2	91.5	89.4	88.8	**90.1**
95% CI	*89.6–90.8*	*89.0–94.0*	*87.7–91.2*	*86.9–90.9*	***89.6–90.7***

Table 5.3. Life expectancy in years in the UK countries, 2014–2016 (source ONS [8])

	At birth		At age 65	
Country	Male	Female	Male	Female
England	79.5	83.1	18.8	21.1
Northern Ireland	78.5	82.3	18.3	20.6
Scotland	77.1	81.2	17.4	19.7
Wales	78.4	82.3	18.2	20.6
UK	**79.2**	**82.9**	**18.6**	**21.0**

to contribute to the variation in survival between renal centres and UK countries. To illustrate this, table 5.3 shows general population life expectancy of the UK countries for the period 2014–2015.

Survival by modality

It is not possible to make truly valid comparisons of survival of cohorts of patients starting different RRT modalities, as modality selection is not random. In the UK, the cohort of patients starting PD was younger and received a transplant more quickly than those starting HD. The age adjusted one year after 90 days survival estimates for incident patients starting RRT on HD and PD in 2015 were 88.3% and 92.5% respectively, with both HD and PD patient survival falling slightly from the previous year (figure 5.1). This is the second year that the one year after 90 days survival on HD and PD has declined (figure 5.1).

Survival by age

Tables 5.4 and 5.5 show survival for the 2015 incident RRT cohort divided by age (⩾65 years and <65 years). Short term survival (at 90 days) was similar to the previous year for the younger age group, while it decreased for those ⩾65 years compared with the 2014 cohort (97.8% to 97.7% for those aged 18–64 years and 93.2% to 92.2% for those ⩾65 years respectively). There was a small decline in one year after 90 day survival for younger patients (<65 years) and an increase in survival for patients aged ⩾65 years compared to the 2014 cohort (80.6% to 81.3%). There was a steep decline in survival with advancing age (figure 5.2).

Table 5.4. Unadjusted 90 day survival of incident RRT patients, 2015 cohort, by age

Age group	Survival (%)	*95% CI*	*N*
18–64	97.7	*97.2–98.1*	3,884
⩾65	92.2	*91.3–93.0*	3,742
All ages	**95.0**	***94.5–95.5***	**7,626**

Table 5.5. Unadjusted one year after day 90 survival of incident RRT patients, 2015 cohort, by age

Age group	Survival (%)	*95% CI*	*N*
18–64	92.9	*92.0–93.7*	3,765
⩾65	81.3	*79.9–82.5*	3,439
All ages	**87.3**	***86.5–88.1***	**7,204**

There was a curvilinear increase in the death rate per 1,000 patient years with increasing age for the one year period from 90 days after RRT start (figure 5.3). The overall death rate in Wales was higher than in the other UK countries, mostly due to a higher death rate in Wales for patients ⩾55 years old (figure 5.3) and a higher overall median age compared to the other UK countries. A similar finding is reported in table 5.12, where there was evidence that the one year death rate in prevalent dialysis patients (2015 cohort) was higher in Wales compared to England and Northern Ireland. This is also

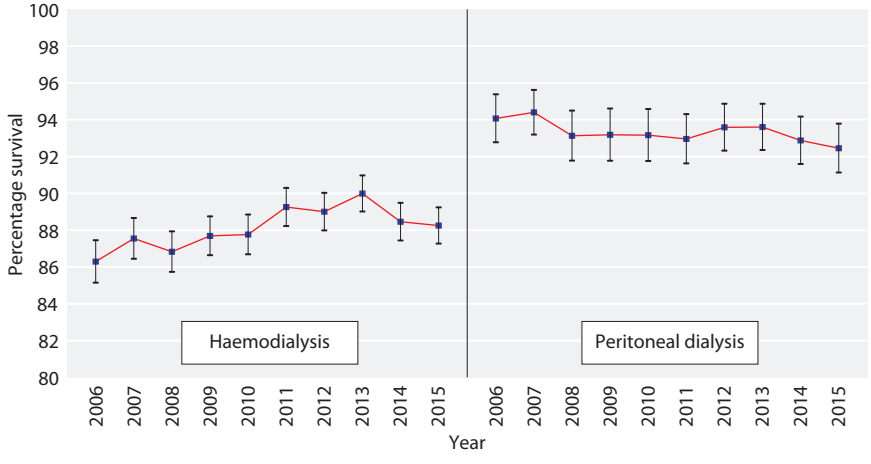

Fig. 5.1. Trend in one year after 90 day incident patient survival by first modality, 2006–2015 cohorts (adjusted to age 60, excluding patients whose first modality was transplantation)

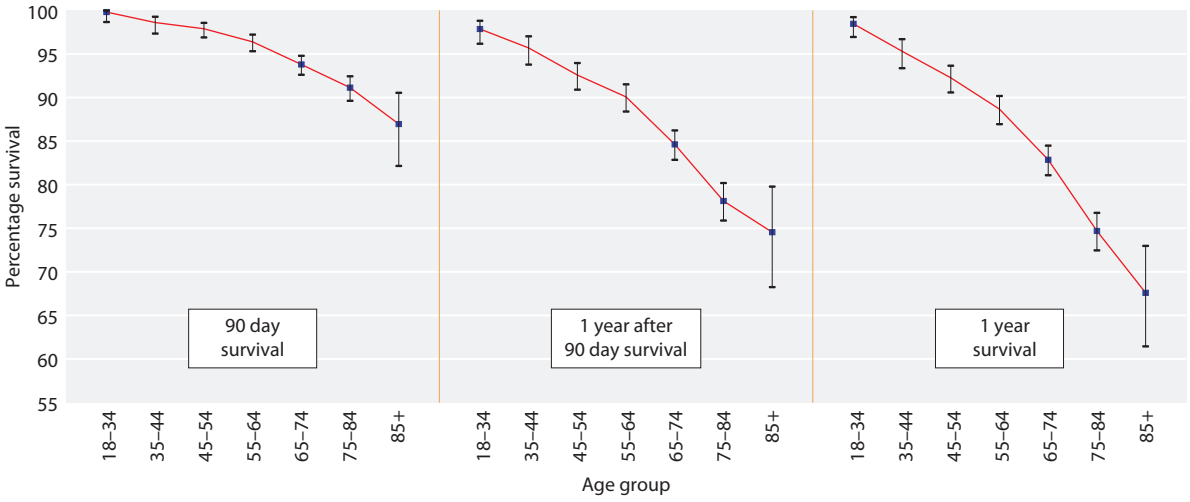

Fig. 5.2. Unadjusted survival of incident RRT patients by age group, 2015 cohort

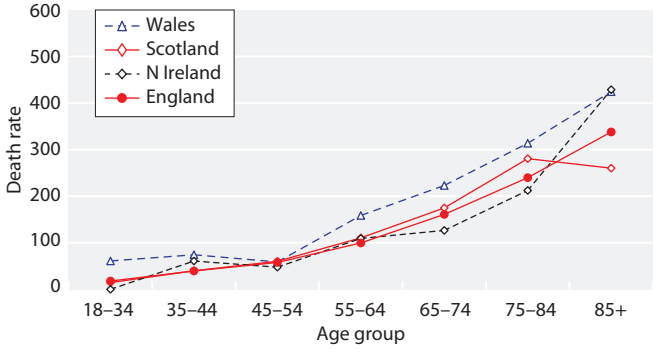

Fig. 5.3. One year after 90 days death rate per 1,000 patient years by UK country and age group for incident RRT patients, 2012–2015 cohort

consistent with the survival figures reported in table 5.2. In patients over 85 years of age, the death rate was again lower in Scotland as was seen in the previous year, although the number of patients in this age group was relatively small ($N = 31$).

Figure 5.4 shows the long-term survival of incident patients from start of RRT (day 0), according to age at RRT start. More than 50% of patients who were aged between 45–54 years when starting RRT survived for over ten years. Median survival for those aged between 55–64 years at RRT start was around six years and median survival for those aged between 65–74 years was approximately 3.5 years.

Figure 5.5 illustrates the survival of incident patients, excluding those who died within the first 90 days and shows that the median survival of patients aged between 55–64 years was approximately 6.5 years and the median survival of patients aged between 65–74 years was approximately four years. These survival results are slightly better than survival from day 0 for the same age groups, as would be expected due to the higher mortality observed in the first 90 days of treatment.

Censoring at transplantation removes the fittest patients from the survival cohort and affects the appearance of the longer-term outcomes of the younger patients

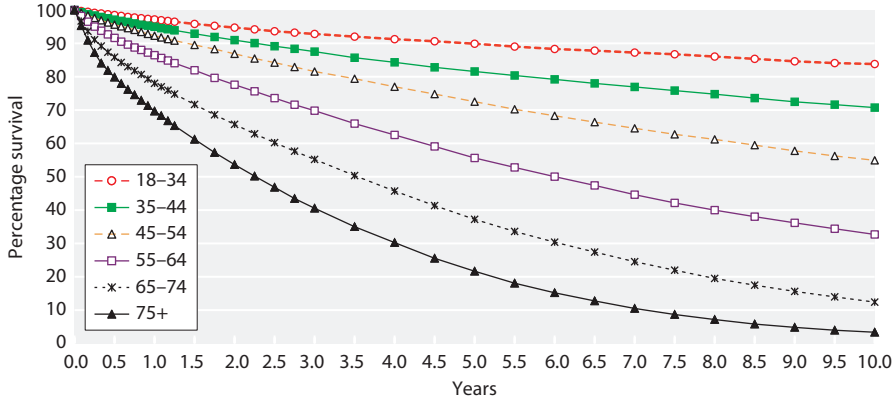

Fig. 5.4. Survival of incident RRT patients (unadjusted), 1997–2015 cohort (from day 0)

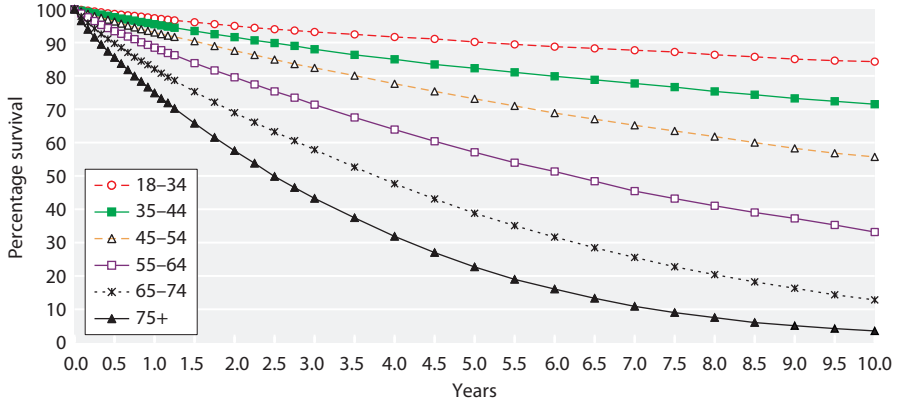

Fig. 5.5. Survival of incident RRT patients (unadjusted), 1997–2015 cohort (from day 90)

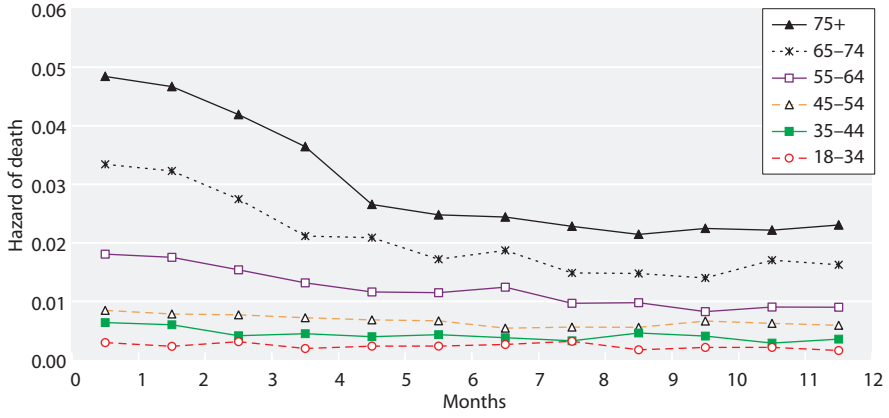

Fig. 5.6. First year monthly hazard of death, by age group, 1997–2015 combined incident RRT cohort

(who are most likely to have undergone transplantation). Without censoring, the ten year survival for patients aged 18–34 years was 83.8% (figure 5.4), however if survival is censored at transplantation this falls dramatically to 56.6% (data not shown). The ten year survival without and with censoring at transplantation were 70.7% and 43.9% for age group 35–44 years and 54.9% and 30.0% for age group 45–54 years respectively. This difference in survival becomes less pronounced with increasing age, especially for patients aged 65+. This was previously examined in more detail in the 2008 Annual 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), after which time the hazard remained relatively stable up to one year.

The hazard of death at 90 days per ten year increase in patient age increased from 1.61 (2014 cohort) to 1.64 (2015 cohort) while the hazard in the first year after 90 days slightly decreased (1.59 in the 2014 cohort compared to 1.54 in the 2015 cohort) (table 5.6).

Survival by gender

There was no survival difference between genders in the incident RRT cohort of patients starting RRT from 2004 to 2013 and followed up for a minimum of three years until 2016 (figure 5.7). There was also no evidence of a survival difference between genders in the first 90 days and one year after the first 90 days (data not shown).

Survival in the 2006–2015 cohort

The death rate per 1,000 patient years in the first year of starting RRT from 2006 to 2015 is shown in figure 5.8. Death rates were gradually increasing from 2013 onwards after a declining trend in the death rate over the past decade. It is important to note that these death rates

Table 5.6. Increase in proportional hazard of death for each 10 year increase in age, 2015 incident RRT cohort

Interval	Hazard of death for 10 year age increase	*95% CI*
First 90 days	1.64	*1.51–1.78*
1 year after first 90 days	1.54	*1.46–1.62*

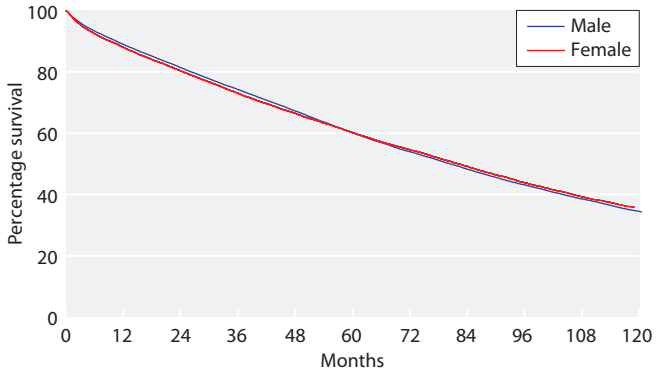

Fig. 5.7. Long term survival of incident RRT patients by gender, 2004–2013 combined cohort, adjusted to age 60, followed-up for a minimum of three years

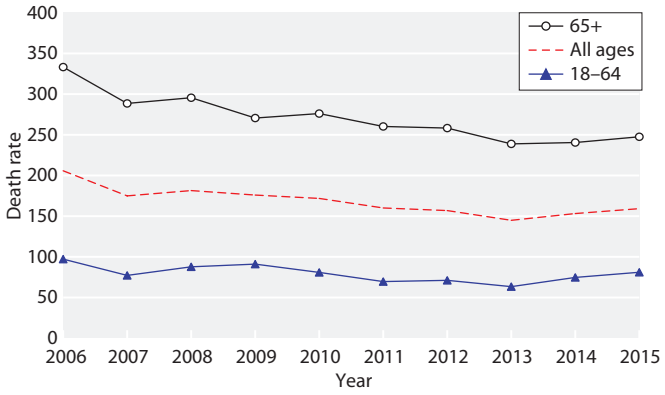

Fig. 5.8. One year incident RRT death rate per 1,000 patient years by age group, 2006–2015 cohort

may not be directly comparable with those produced by other registries (for instance the USRDS) if the first 90 day period, when death rates are higher than subsequent time periods, are excluded.

The time trend changes in one year after 90 days incident survival over the period 2006–2015 are shown in figure 5.9. The percentage of patients surviving one year after 90 days fell slightly in 2015 compared with the preceding year (from 90.3% to 90.0% for all renal centres).

One year after 90 days incident RRT patient survival in the 2006–2015 cohort by centre, UK country and overall, can be found in appendix 1: Survival tables, table 5.22.

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

The unadjusted survival analyses (tables 5.7, 5.8, figures 5.10, 5.11) show an overall improvement in longer term survival between 1998 and 2015 for both those aged <65 years and those aged ⩾65 years. For example, five year survival amongst patients aged <65 years at start of RRT has improved from 64.3% in the 1998 cohort to 74.5% in the 2011 cohort. For those aged ⩾65 years at RRT initiation during the same period, five year survival improved from 19.5% (1998) to 32.5% (2011).

Although survival improved overall between the 1998 and 2015 cohorts, the improvement was more pronounced in patients aged ⩾65. There has been a 15.5% absolute improvement in one year survival from the 1998 to 2015 cohorts (table 5.8) versus 4.8% in those aged <65 years during the same period. It is not possible to ascertain the specific reasons for this reduction in risk of death.

Survival by RRT vintage

Figure 5.12 shows the six monthly hazard of death for incident patients, by age group. There is little evidence of a worsening prognosis with increasing time on RRT (vintage) for the majority of incident RRT patients in the UK, except in incident patients aged 65 years and over where an increased hazard over time is evident. When the analysis is repeated with censoring for transplantation an apparent vintage effect is evident (data

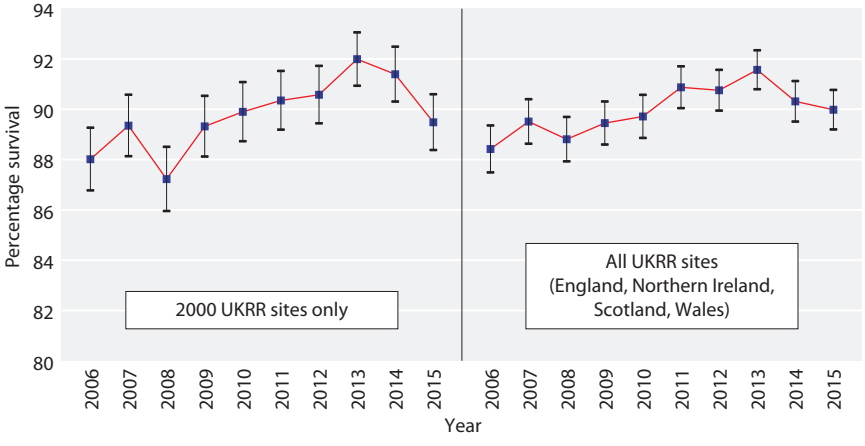

Fig. 5.9. Change in one year after 90 day survival, 2006–2015 incident RRT cohort (adjusted to age 60)
Showing 95% confidence intervals

Table 5.7. Unadjusted percentage survival of incident RRT patients, 1998–2015 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*
2015	**92.2**										***91.3–93.0***	**3,884**
2014	92.8	86.8									*85.7–87.9*	3,671
2013	93.9	88.3	83.1								*81.8–84.3*	3,577
2012	93.2	87.5	82.0	76.9							*75.5–78.3*	3,534
2011	93.3	88.6	83.6	79.0	74.5						*73.0–76.0*	3,348
2010	92.3	86.6	81.7	77.3	72.8	69.6					*68.0–71.1*	3,367
2009	91.3	85.1	80.5	76.4	71.2	67.1	63.8				*62.2–65.4*	3,385
2008	91.6	86.1	81.2	76.9	73.2	69.6	65.6	62.3			*60.7–63.9*	3,441
2007	92.6	87.0	81.8	76.8	73.1	69.3	65.9	62.6	59.2		*57.5–60.9*	3,327
2006	90.8	85.2	80.2	75.8	72.1	68.3	64.1	61.2	58.2	55.5	*53.7–57.2*	3,158
2005	89.8	83.8	78.7	74.0	69.3	65.7	62.7	59.6	56.6	54.1	*52.2–55.9*	2,828
2004	89.7	83.4	78.0	72.5	67.8	64.1	60.9	57.0	54.6	53.0	*51.0–54.9*	2,554
2003	89.6	82.9	77.4	72.5	67.4	63.2	59.5	56.7	54.1	51.6	*49.5–53.7*	2,254
2002	88.9	80.9	75.0	69.4	65.3	61.4	57.9	54.8	51.8	49.7	*47.5–51.9*	2,013
2001	88.1	81.0	75.5	70.1	65.2	60.4	56.5	52.9	50.0	47.7	*45.3–50.1*	1,729
2000	89.3	81.3	74.4	69.3	63.8	59.0	55.5	52.3	49.9	47.1	*44.5–49.6*	1,520
1999	87.2	81.0	73.4	67.9	62.3	58.3	54.0	51.0	48.6	47.0	*44.3–49.7*	1,344
1998	87.5	80.2	74.0	69.6	64.3	59.2	55.1	53.0	50.0	47.5	*44.5–50.3*	1,163

Table 5.8. Unadjusted percentage survival of incident RRT patients, 1998–2015 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*
2015	**78.4**										***77.0–79.7***	**3,742**
2014	78.8	64.4									*62.8–66.0*	3,581
2013	79.0	65.0	53.5								*51.8–55.2*	3,422
2012	77.6	65.5	54.5	44.3							*42.6–46.0*	3,318
2011	77.4	62.9	51.5	41.3	32.5						*30.9–34.1*	3,351
2010	76.3	63.3	51.4	42.0	32.4	25.6					*24.1–27.1*	3,271
2009	76.7	63.3	52.6	41.6	33.0	26.2	20.1				*18.7–21.4*	3,362
2008	74.9	61.3	49.9	40.5	32.2	25.7	20.6	16.2			*14.9–17.5*	3,166
2007	75.3	61.4	49.8	40.5	32.0	25.4	20.2	15.5	11.9		*10.8–13.0*	3,201
2006	72.4	58.5	47.2	37.5	29.1	23.2	17.6	13.5	10.7	8.5	*7.6–9.6*	3,097
2005	71.5	57.6	45.7	36.4	28.0	21.3	16.7	12.5	10.0	7.8	*6.8–8.8*	2,924
2004	69.3	54.2	42.6	34.1	26.9	21.0	16.3	12.9	9.8	7.5	*6.5–8.6*	2,609
2003	68.6	53.8	41.8	31.8	24.3	18.1	14.1	10.9	8.2	6.5	*5.6–7.6*	2,306
2002	66.6	51.2	40.7	32.1	24.0	18.3	13.7	10.9	8.2	6.3	*5.3–7.5*	2,066
2001	66.8	52.0	38.4	28.9	21.6	15.8	11.8	8.8	7.0	5.4	*4.4–6.6*	1,692
2000	66.3	52.3	39.5	28.6	22.2	16.9	12.8	9.3	7.2	5.4	*4.3–6.6*	1,482
1999	68.6	52.0	39.3	30.0	22.3	16.1	11.5	8.2	6.0	4.7	*3.6–6.0*	1,204
1998	62.8	45.3	35.7	26.4	19.5	13.7	10.2	7.3	5.4	4.4	*3.2–5.8*	1,008

not shown) and this is, at least in part, because younger and healthier patients are only included in the survival calculation up to the date of transplantation. In the oldest age group, the number of patients surviving beyond seven years was small, accounting for the variability seen. Figures 5.13 and 5.14 show the same analysis for patients without diabetes and with diabetes respectively. An increased hazard of death over time is evident for patients with diabetes predominantly over ⩾65 years of age.

Centre variability in one year after 90 days survival

Due to small numbers of incident patients in any given year in each centre and resultant wide confidence intervals, variability by renal centre was assessed in a larger cohort across several years. Similar to previous years, sustained performance was assessed in a rolling four year cohort from 2012 to 2015. 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

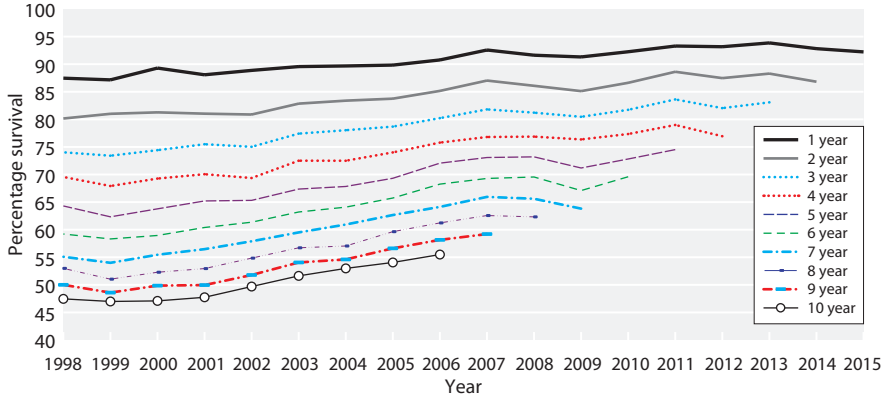

Fig. 5.10. Change in long term survival by year of starting RRT (1998–2015), for incident RRT patients aged 18–64 years

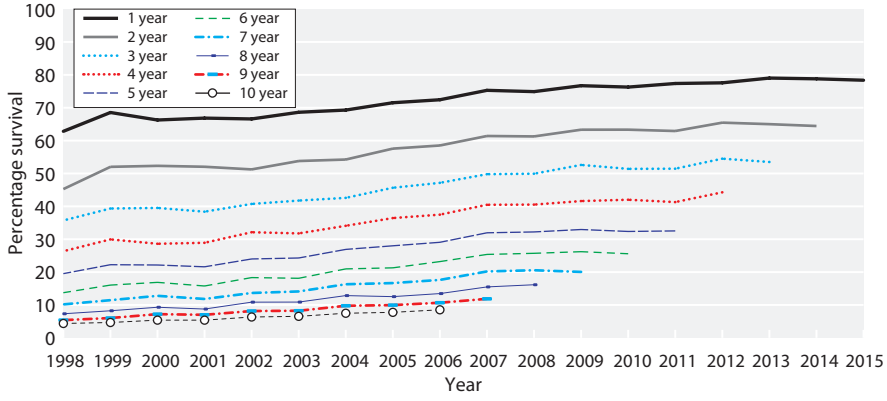

Fig. 5.11. Change in long term survival by year of starting RRT (1998–2015), for incident RRT patients aged ⩾65 years

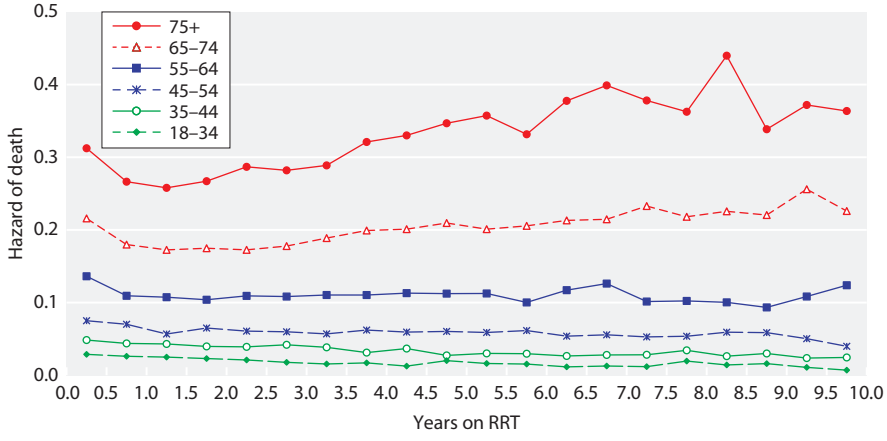

Fig. 5.12. Six monthly hazard of death, by vintage and age group, 1997–2015 incident RRT cohort after day 90

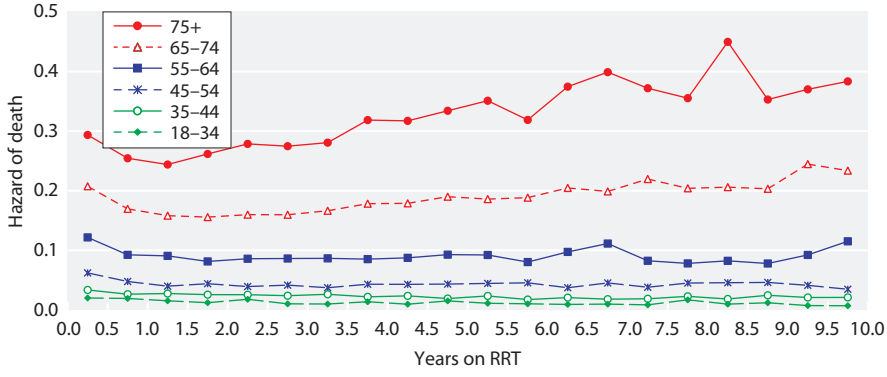

Fig. 5.13. Six monthly hazard of death, by vintage and age group, 1997–2015 incident RRT cohort without diabetes after day 90

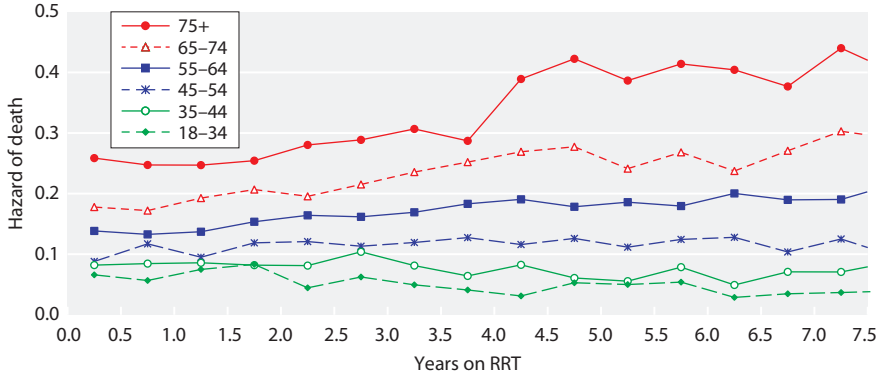

Fig. 5.14. Six monthly hazard of death, by vintage and age group, 1997–2015 incident RRT cohort with diabetes after day 90

patients treated by the centre and then looking up the corresponding number on the x-axis. Four centres (Wolverhampton, Cardiff, Swansea, Glasgow) had survival below the 95% lower limit whilst three centres (Gloucester, Reading, West Northern Ireland) had survival above the 95% upper limit and one centre (London West) above the 99% upper limit. This is compared with last year when three centres were survival outliers below the 95% lower limit and two centres above the 95% upper limit. With 71 centres included in the analysis it would be expected that three centres would be outside these limits by chance. It is important to highlight that these data have only been adjusted for age (i.e. no other patient factors such as comorbidity, primary renal disease or ethnicity) and have not been censored at transplantation. Therefore the effect of differing rates of transplantation by centre was not taken into account. Please see the following section for the effects of adjustment for primary renal disease and comorbidity.

Appendix 1 of this chapter contains additional tables related to these survival analyses; table 5.22 and 5.23 show unadjusted and adjusted survival together with 95% confidence intervals for incident patient survival one year after 90 days and at 90 days for the 2015 single year cohort. Table 5.24 in appendix 1 shows the one year after 90 day incident survival by centre for incident RRT cohort years 2006–2015, adjusted to age 60. One to five year survival after the first 90 days of RRT adjusted to age 60 is included in appendix 1, table 5.25 for incident RRT cohorts 2011–2015.

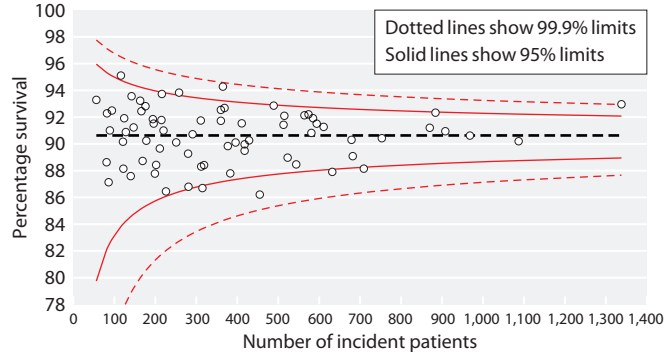

Fig. 5.15. Funnel plot for age adjusted one year after 90 days survival, 2012–2015 incident RRT cohort

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

Although comorbidity returns to the UKRR have remained poor, some centres have consistently returned ⩾85% comorbidity data for incident patients. The analyses in this section use a combined incident RRT cohort from 2012–2015 for the 29 centres who consistently returned comorbidity data for ⩾85% of patients during this period and demonstrate the impact of sequential adjustment for age, primary renal diagnosis and comorbidity (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 of incident patients was over 60 years. There were only minor changes in survival for most centres after adjustment for primary renal diagnosis, but survival did increase by ⩾0.8% for three centres (Shrewsbury, Swansea, York). In five centres (Newcastle, Swansea, Cardiff, Bradford, Clwyd) adjustment for comorbidity had a noticeable effect (⩾1% increase) on adjusted survival (table 5.10, figure 5.16). After adjustment for age, primary renal diagnosis and comorbidity, Swansea, Antrim, Bangor and Clwyd had the largest improvement in survival of 8.3%, 8.0%, 6.5% and 6.1% respectively.

One of the largest survival improvements, as a result of adjustment for comorbidity was seen in Swansea. Adjustment for comorbidity may have an important differential effect for renal centres that have a higher comorbid burden in their RRT population. This could affect the

Table 5.9. Age adjusted (to age 60) one year after 90 day survival, 2012–2015 incident RRT cohort

	1 year after 90 days			
			Limits for funnel plot	
Centre	*N*	Adjusted survival %	*Lower 95% limit*	*Upper 95% limit*
D&Gall	56	93.3	79.7	96.0
Bangor	81	88.6	82.1	95.3
Inverns	82	92.3	82.2	95.3
Clwyd	86	87.1	82.4	95.2
Newry	89	91.0	82.6	95.2
Ulster	94	92.5	82.9	95.1
West NI	116	95.1	83.8	94.8
Colchr	121	90.2	84.0	94.7
Antrim	122	88.1	84.0	94.7
Sthend	124	91.9	84.1	94.7
Krkcldy	128	90.9	84.2	94.6
Klmarnk	140	87.6	84.6	94.5
Carlis	142	93.6	84.6	94.4
Wrexm	147	91.2	84.7	94.4
Ipswi	163	93.2	85.1	94.2
Dundee	166	92.4	85.2	94.2
Basldn	169	88.7	85.2	94.2
Truro	176	92.8	85.3	94.1
Donc	178	90.2	85.4	94.1
Chelms	194	91.9	85.6	94.0
Dudley	196	91.5	85.7	94.0
York	199	87.8	85.7	94.0
Wirral	202	88.4	85.8	93.9
Liv Ain	211	89.7	85.9	93.9
Plymth	215	91.8	85.9	93.9
Abrdn	216	93.7	86.0	93.9
Airdrie	220	91.0	86.0	93.8
Shrew	226	86.4	86.1	93.8
Sund	251	90.1	86.4	93.7
Glouc	258	93.8	86.4	93.6
Derby	280	89.3	86.6	93.5
Bradfd	281	86.8	86.6	93.5
Dorset	291	90.7	86.7	93.5
Belfast	311	91.7	86.9	93.4
Edinb	312	88.3	86.9	93.4
Wolve	315	86.7	86.9	93.4
Norwch	319	88.4	86.9	93.4
Hull	360	91.7	87.2	93.2
L St.G	360	92.5	87.2	93.2
Redng	365	94.3	87.2	93.2
Camb	369	92.7	87.2	93.2
Stoke	377	89.8	87.2	93.2
Newc	383	87.8	87.3	93.2
B Heart	396	90.1	87.3	93.1
Nottm	411	91.5	87.4	93.1
Covnt	418	90.0	87.4	93.1
Liv Roy	418	89.5	87.4	93.1
Middlbr	429	90.3	87.5	93.0
Swanse	455	86.2	87.6	93.0
Exeter	489	92.9	87.7	92.9
Kent	513	91.4	87.8	92.9
Stevng	515	92.1	87.8	92.9
Brightn	523	89.0	87.8	92.8
Salford	544	88.5	87.9	92.8
Sheff	564	92.1	87.9	92.8
L Guys	574	92.2	88.0	92.8
Bristol	581	90.8	88.0	92.7
Prestn	585	91.9	88.0	92.7
L Kings	594	91.5	88.0	92.7
Leeds	611	91.3	88.1	92.7
Cardff	632	87.9	88.1	92.7
Oxford	679	90.3	88.2	92.6
M RI	682	89.1	88.2	92.6
Glasgw	709	88.1	88.3	92.6
Ports	753	90.4	88.3	92.5
B QEH	870	91.2	88.5	92.4
L Rfree	884	92.3	88.5	92.4
Carsh	908	90.9	88.6	92.4
Leic	968	90.6	88.6	92.3
L Barts	1,087	90.2	88.7	92.2
L West	1,338	93.0	88.9	92.1

*Cambridge included for 2012–2014 as no patient level data was received for 2015 and 2016

status of centres as a survival outlier as shown in figure 5.15, such as Swansea, Cardiff, Wolverhampton and Glasgow. However due to poor comorbidity returns for many renal centres, comorbidity adjustment for the entire incident RRT population is not yet possible. Data completeness and data quality both have significant implications for the accuracy of analyses such as these. Case-mix adjustment performed in a cohort of incident patients starting RRT in England from 2002 to 2006 which was linked to the Hospital Episodes Statistics (HES) data, found that three of the four survival outliers at that time were no longer outliers after adjustment for HES-derived case-mix. Case-mix adjusted survival for Wolverhampton was shown to increase substantially in this research. Swansea, Cardiff and Glasgow could not be evaluated in this research as this HES research only included English hospitals, but the study results highlight that observed variability in survival between centres is affected by case-mix [10]. High levels of deprivation such as in parts of Glasgow, Wales and some other

Table 5.10. The effect of adjustment for age, primary renal diagnosis and comorbidity on survival, 2012–2015 incident RRT cohort, percentage survival one year after 90 days

Centre*	Unadjusted	Age adjusted	Age, PRD adjusted	Age, PRD and comorbidity adjusted
Swanse	79.6	86.1	86.9	88.0
Bangor	80.8	87.0	87.0	87.3
Antrim	81.1	87.6	88.2	89.0
Shrew	82.0	86.7	88.3	87.9
Cardff	83.9	87.6	88.0	89.0
Bradfd	85.2	86.8	87.3	88.3
Clwyd	85.2	89.8	90.2	91.4
York	85.4	88.9	89.7	90.1
Dorset	85.8	90.6	90.7	91.2
Basldn	86.2	89.8	89.6	89.8
Newc	86.6	89.0	89.6	90.9
Wrexm	86.6	90.9	91.2	91.5
B Heart	86.9	90.4	91.0	91.0
Middlbr	87.2	89.8	90.4	91.0
Kent	87.8	91.2	91.6	90.9
Sund	88.2	90.8	91.0	91.0
Bristol	88.2	91.3	91.6	92.1
Newry	88.3	90.6	91.3	91.5
Ulster	88.3	92.2	92.6	92.5
Oxford	88.3	90.4	90.6	91.2
Nottm	88.3	91.2	91.7	91.5
L Kings	89.3	91.3	91.2	91.5
Exeter	89.6	93.4	93.7	93.7
Hull	90.0	92.0	92.1	92.1
B QEH	90.3	92.3	92.9	92.1
Leeds	90.5	91.5	91.5	91.9
Derby	90.8	92.0	92.6	92.5
Redng	91.7	94.1	94.5	95.2
L Guys	94.4	94.9	95.1	94.8
All 29 centres	**87.7**	**90.6**	**91.0**	**91.3**

PRD primary renal diagnosis
*Centre included if ⩾85% comorbidity data returned

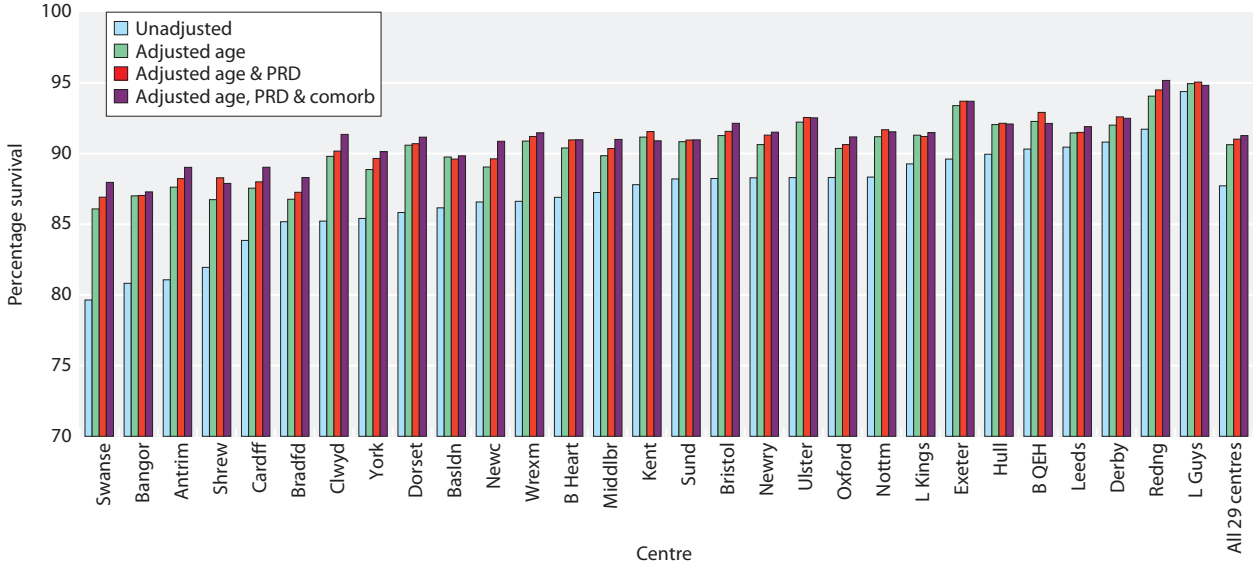

Fig. 5.16. The effect on one year after 90 day survival after sequential adjustment for age, primary renal diagnosis and comorbidity, 2012–2015 incident RRT cohort

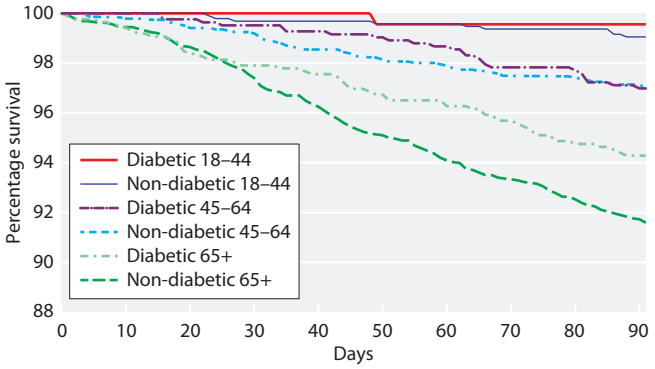

Fig. 5.17. Survival at 90 days for incident RRT patients with and without diabetes by age group, 2015 cohort

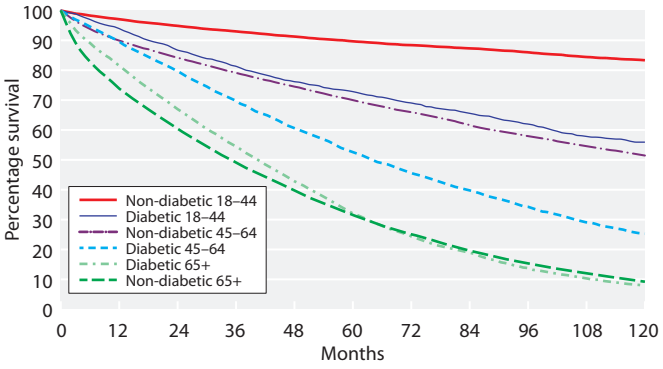

Fig. 5.19. Long term survival for incident RRT patients with and without diabetes by age group, 2004–2013 cohort, followed up for a minimum of three years

areas have not been adjusted for and may impact on the mortality rate in these areas.

Survival in patients with diabetes

Patients with diabetes have been shown to have worse long term survival compared to patients without diabetes [3]. In the following analyses, 90 day survival, 1 year after 90 day survival and long term survival are presented according to the presence or absence of a diagnosis of diabetes as the primary renal disease.

In the UK in 2015, 90 day survival for incident patients with diabetes was better than those without diabetes across the age categories of 18–44 years, 45–64 years and 65 years and over (figure 5.17). For one year survival after 90 days in the 2015 cohort, young patients (18–44 years) without diabetes had better survival than their counterparts with diabetes, whereas for the 45–64 years group and those 65 years and over, the survival was more similar (figure 5.18).

Long term survival for patients with diabetes and patients without diabetes is presented for the incident RRT cohort of patients starting RRT from 2004 to 2013 with a minimum of three years follow up (figure 5.19). These data show large differences between survival for those with diabetes and those without diabetes in the age groups 18–44 years and 45–64 years. In the age group 18–44 years, 89.7% of patients without diabetes were alive five years after start of RRT compared to 72.8% for patients with diabetes. In the age group 45–64 years, 69.9% of patients without diabetes were alive five years after start of RRT compared to 52.5% for patients with diabetes (figure 5.19). The initial survival difference where incident RRT patients without diabetes in the older age group (⩾65 years) had poorer survival than incident patients with diabetes in the same age group, diminished over the years until there was very little difference in five year survival between these groups.

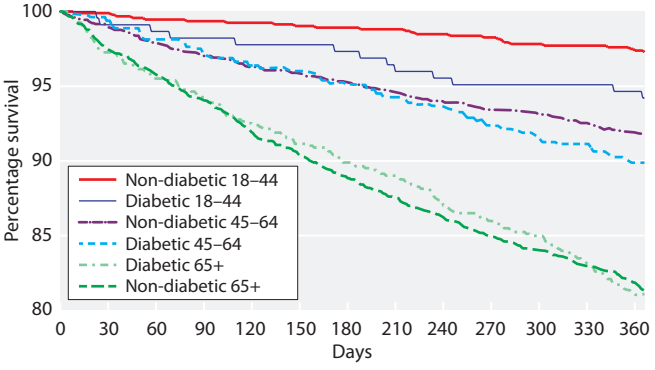

Fig. 5.18. Survival at one year after 90 days for incident RRT patients with and without diabetes by age group, 2015 cohort

Survival in prevalent dialysis patients

Overall survival

Table 5.11 shows the one and two year survival for prevalent patients on dialysis. One year age adjusted survival for prevalent dialysis patients was essentially stable at 88.0% in the 2015 cohort compared to 88.3% in the 2014 cohort. Two year survival dropped slightly from 71.1% in the 2014 cohort to 69.9% in the 2015 cohort.

Survival by UK country

The one year death rate for prevalent dialysis patients in 2015 for each UK country is shown in table 5.12. The death rate rose in every UK nation compared to the 2014 cohort, except in Northern Ireland; the median age of prevalent dialysis patients remained similar in England and Wales, decreased slightly in Scotland and increased in Northern Ireland. The one year unadjusted death rate in Wales was significantly higher than in England and Northern Ireland. However, the higher median age in Wales and

Table 5.11. One and two year survival of prevalent dialysis patients

Patient group	Patients *N*	Deaths *N*	Survival %	*95% CI*
1 year survival – 2015 cohort				
Unadjusted	26,582	4,092	83.9	*83.5–84.4*
Adjusted to age 60	26,582	4,092	88.0	*87.5–88.4*
2 year survival – 2014 cohort				
Unadjusted	26,331	7,328	69.9	*69.4–70.5*

2015 cohort: all dialysis patients alive on 31/12/2015
2014 cohort: all dialysis patients alive on 31/12/2014

Table 5.12. One year death rate per 1,000 prevalent dialysis patient years in the 2015 cohort and median age of prevalent dialysis patients by UK country

	England	N Ireland	Scotland	Wales
Death rate	172	157	190	234
95% CI	*166–177*	*127–191*	*169–211*	*206–264*
Median age	67.0	71.5	65.0	69.0

socio-economic factors such as general population life expectancy and area deprivation, may contribute to the death rate in Wales. These results are unadjusted for age, primary renal diagnosis or comorbidity.

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 5.20). As there are 70 centres included in the analyses, it would be expected that three centres would fall outside the 95% (1 in 20) confidence limits, entirely by chance. The survival for patients attending Salford was below the 95% confidence limit and there were no centres below the 99% confidence limit. Comparing data over a number of years, there was no centre that had consistently been below the 95% confidence limit. Five centres (Newry, Birmingham Queen Elizabeth Hospital, Aberdeen, London St Bartholomew's, London West) were above the 95% confidence limit and one centre (London St George's) was above the 99% confidence limit. A sensitivity analysis was performed without censoring at transplantation and the results for outlying centres were unchanged. These observed differences may have occurred by chance, may be true differences or may reflect differences in the case-mix of the renal centres. Transplantation listing practice (percentage of patients wait-listed within two years of RRT start, median time to wait-listing) and pre-emptive transplant rates in renal centres may have an impact on the survival results for prevalent dialysis patients.

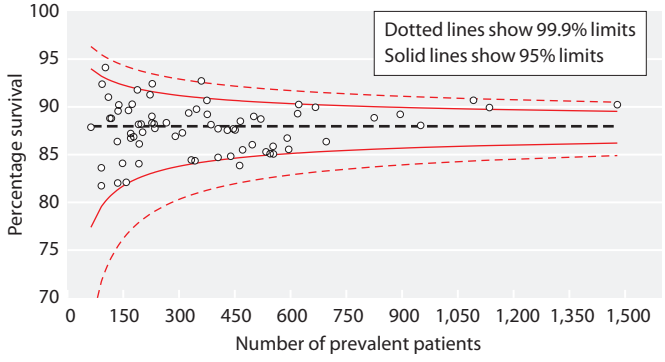

Fig. 5.20. One year survival funnel plot of prevalent dialysis patients by centre adjusted to age 60, 2015 cohort

Table 5.13 allows centres in figure 5.20 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 prevalent dialysis patients by centre is illustrated in figures 5.21 and 5.22 for patients aged <65 years and those aged ⩾65 years.

Survival by age group

Figure 5.23 shows the one year survival of prevalent dialysis patients who were alive and receiving dialysis on 31 December 2015, stratified by age group. This demonstrates a curvilinear decrease in survival with increasing age.

One year death rate in prevalent dialysis patients by age group, 2015 cohort

The death rates for prevalent patients on dialysis by age group are shown in figure 5.24. The younger patients included in this analysis are a selected higher risk group, as they remained on dialysis rather than undergoing transplantation. The increase in the death rate with age was not linear; in those aged <45 years, a ten year

Table 5.13. One year survival of prevalent dialysis patients in each centre (adjusted to age 60), 2015 cohort

Centre*	N	Adjusted one year survival	Limits for funnel plot		Centre*	N	Adjusted one year survival	Limits for funnel plot	
			Lower 95% limit	*Upper 95% limit*				*Lower 95% limit*	*Upper 95% limit*
D&Gall	63	87.9	*77.4*	*94.0*	Newc	333	84.4	*84.0*	*91.1*
Clwyd	91	83.6	*79.5*	*93.2*	Middlbr	343	84.4	*84.1*	*91.0*
Bangor	91	81.7	*79.5*	*93.2*	Redng	347	89.8	*84.1*	*91.0*
Inverns	93	92.4	*79.7*	*93.2*	L St.G	360	92.7	*84.2*	*90.9*
Newry	102	94.1	*80.1*	*93.0*	Norwch	375	90.7	*84.3*	*90.9*
Ulster	110	91.0	*80.5*	*92.9*	Wolve	376	89.2	*84.3*	*90.9*
Carlis	114	88.8	*80.6*	*92.8*	Stoke	386	88.1	*84.3*	*90.9*
Colchr	118	88.8	*80.8*	*92.7*	Hull	405	87.7	*84.4*	*90.8*
Antrim	134	86.4	*81.3*	*92.5*	Swanse	405	84.7	*84.4*	*90.8*
Sthend	135	82.0	*81.3*	*92.5*	Covnt	430	87.6	*84.5*	*90.7*
Wrexm	136	89.6	*81.3*	*92.5*	Liv Roy	439	84.8	*84.6*	*90.7*
West NI	138	90.2	*81.4*	*92.4*	B Heart	446	87.7	*84.6*	*90.7*
Krkcldy	148	84.1	*81.7*	*92.3*	Nottm	451	87.6	*84.6*	*90.7*
Klmarnk	158	82.1	*81.9*	*92.2*	Salford	463	83.9	*84.7*	*90.6*
Truro	164	89.6	*82.0*	*92.1*	Brightn	465	88.5	*84.7*	*90.6*
York	170	87.2	*82.2*	*92.1*	Kent	471	85.5	*84.7*	*90.6*
Plymth	170	86.7	*82.2*	*92.1*	Oxford	497	86.0	*84.8*	*90.5*
Ipswi	174	90.3	*82.2*	*92.0*	Exeter	501	89.0	*84.8*	*90.5*
Chelms	178	86.9	*82.3*	*92.0*	Stevng	520	88.7	*84.9*	*90.5*
Liv Ain	188	91.8	*82.5*	*91.9*	Leeds	534	85.3	*84.9*	*90.5*
Donc	191	88.2	*82.5*	*91.9*	Cardff	545	85.1	*85.0*	*90.4*
Airdrie	192	84.1	*82.6*	*91.9*	Bristol	553	85.9	*85.0*	*90.4*
Dundee	193	86.1	*82.6*	*91.9*	M RI	554	85.1	*85.0*	*90.4*
Basldn	198	88.2	*82.7*	*91.8*	Prestn	591	86.7	*85.1*	*90.4*
Wirral	202	87.4	*82.7*	*91.8*	Glasgw	595	85.6	*85.1*	*90.3*
Belfast	222	91.3	*83.0*	*91.6*	L Kings	619	89.3	*85.2*	*90.3*
Sund	227	88.3	*83.1*	*91.6*	Sheff	622	90.3	*85.2*	*90.3*
Shrew	227	89.0	*83.1*	*91.6*	L Guys	667	90.0	*85.3*	*90.2*
Abrdn	228	92.4	*83.1*	*91.6*	Ports	696	86.4	*85.3*	*90.2*
Dudley	233	88.2	*83.1*	*91.6*	L Rfree	825	88.9	*85.6*	*90.0*
Bradfd	235	87.8	*83.2*	*91.5*	Carsh	895	89.2	*85.7*	*89.9*
Glouc	266	88.3	*83.5*	*91.4*	Leic	950	88.1	*85.7*	*89.9*
Edinb	290	86.9	*83.7*	*91.2*	B QEH	1,092	90.7	*85.9*	*89.8*
Derby	309	87.3	*83.8*	*91.2*	L Barts	1,135	89.9	*85.9*	*89.7*
Dorset	326	89.4	*84.0*	*91.1*	L West	1,479	90.2	*86.2*	*89.5*

*Cambridge not included in the 2015 cohort as no patient level data was received for 2015 and 2016

increase in age was associated with a rise in the death rate of approximately 25 deaths per 1,000 patient years compared with those ⩾75 years where a ten year increase in age was associated with a rise of about 80 deaths per 1,000 patient years.

Time trends in survival, 2006 to 2015

Figure 5.25 illustrates that one year survival for prevalent dialysis patients in England gradually improved from 2006 to 2011 with a gradual decrease thereafter. The numbers of patients were smaller in Scotland, Northern Ireland and Wales which resulted in variability and wide confidence intervals, so no firm conclusions can be drawn, but survival in Scotland and Wales is also showing a gradual decrease from around 2010. The change in prevalent survival by centre from 2006 to 2015 is included in appendix 1: Survival tables, table 5.26.

Survival in prevalent dialysis patients with diabetes

In patients aged <65 years, one year survival for prevalent dialysis patients with diabetes was approximately 8.0% lower compared to the same age group without diabetes. In contrast, for prevalent dialysis patients aged 65+ years, the survival difference was smaller between those with and without diabetes (2.5% lower, table 5.14).

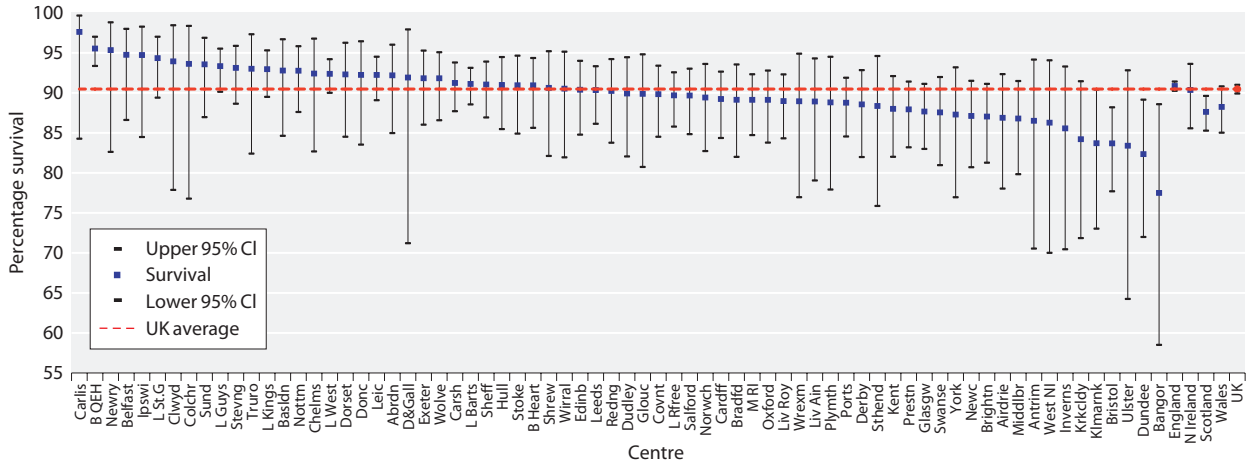

Fig. 5.21. One year survival of prevalent dialysis patients aged less than 65 years by centre, 2015 cohort

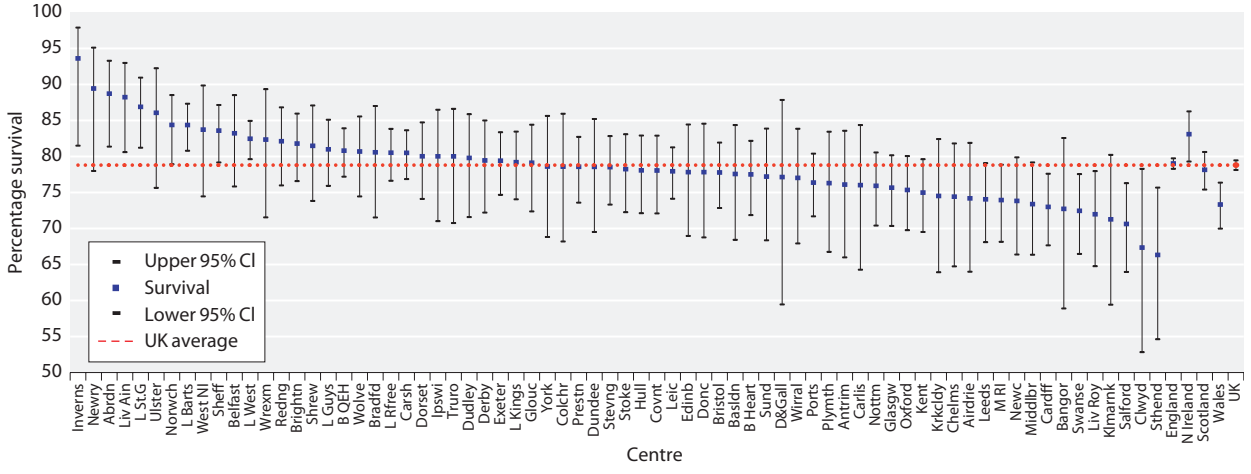

Fig. 5.22. One year survival of prevalent dialysis patients aged 65 years and over by centre, 2015 cohort

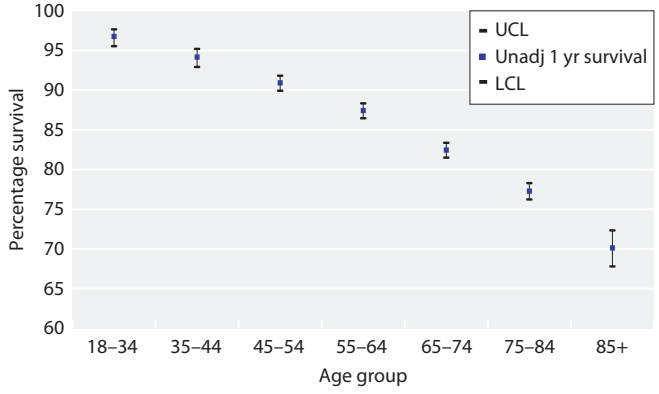

Fig. 5.23. One year survival of prevalent dialysis patients by age group, 2015 cohort

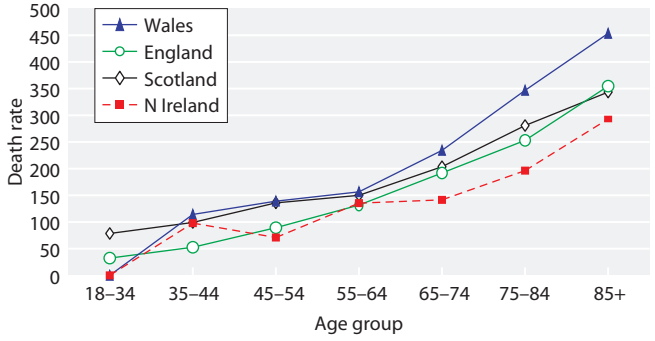

Fig. 5.24. One year death rate per 1,000 patient years by UK country and age group for prevalent dialysis patients, 2015 cohort

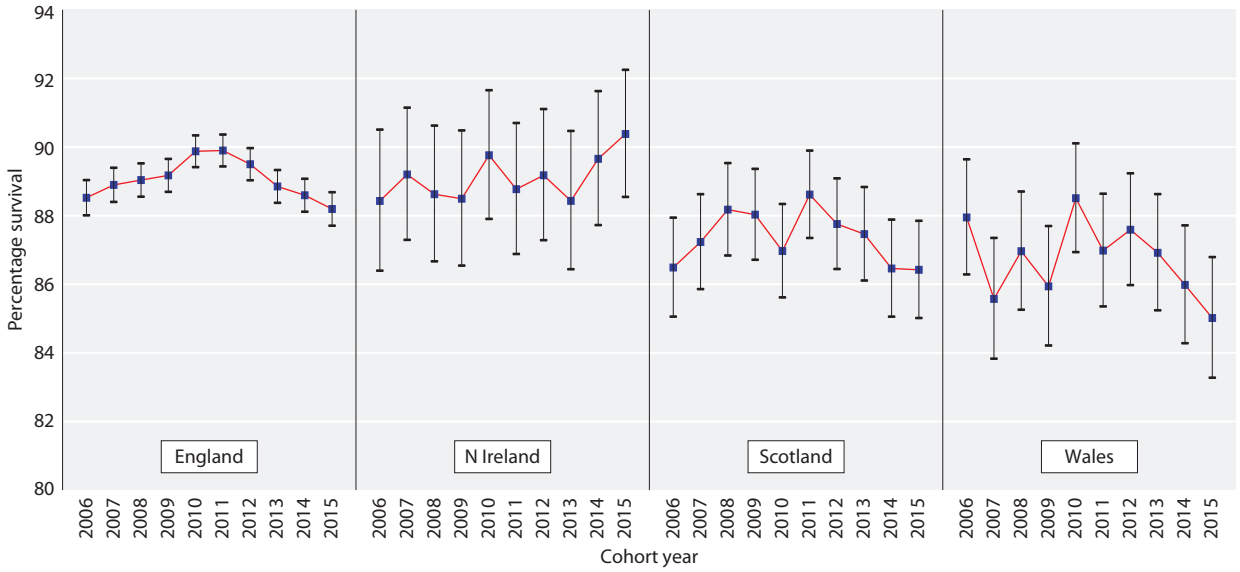

Fig. 5.25. Serial one year survival for prevalent dialysis patients by UK country, 2006 to 2015 cohort years, adjusted to age 60

Time trends in patients with a primary diagnosis of diabetes

The age adjusted one year survival for prevalent dialysis patients with a reported primary renal disease of diabetic nephropathy are shown in table 5.15.

Death rate on RRT compared with the UK general population

The death rate of patients on all RRT modalities compared to the general population is shown in table 5.16.

Table 5.14. One year survival of prevalent dialysis patients in the UK by age group and diagnosis of diabetes, 2015 cohort

Patient group	Patients *N*	Deaths *N*	Survival %	*95% CI*
Dialysis patients 2015 cohort				
All age <65	12,101	1,064	90.5	*89.9–91.0*
Non-diabetic <65	9,266	648	92.4	*91.8–92.9*
Diabetic <65	2,835	416	84.6	*83.1–85.9*
All age 65+	14,481	3,028	78.8	*78.1–79.5*
Non-diabetic 65+	11,088	2,252	79.4	*78.6–80.1*
Diabetic 65+	3,393	776	76.9	*75.5–78.3*

The relative risk of death on RRT decreased with age from a peak of approximately 25 times that of the general population at age 20–24 years to 1.5 times the general population at age 85 and over. Figure 5.26 shows that the relative risk of death has decreased substantially for the younger age groups (<50 years) in recent years, whereas the relative risk of death in patients aged over 50 has not changed greatly in the 2015 cohort compared to the 1998–2001 cohort. The overall relative risk of death was 5.6 in the 2015 cohort and was slightly lower compared to the previous year (relative risk of death 6.1).

Cause of death

Data completeness

Overall completeness of data for cause of death in the UK was similar to the previous year: 63.5% in 2015 and 63.2% in 2016. Cause of death data completeness declined in England and Northern Ireland by −1.7% and −0.8% respectively but increased by 9.4% and 5.3% in Scotland and Wales respectively (appendix 1: Survival tables, table 5.27). There was substantial variability in the completeness of cause of death data between centres, with

Table 5.15. Serial one year survival of prevalent dialysis patients with a primary diagnosis of diabetes, 2006–2015 cohort years

	Year									
Survival	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1 year survival (%)	85.0	83.6	84.0	83.4	85.0	85.2	84.7	83.4	83.2	83.1
Number of patients	3,955	4,361	4,706	5,048	5,214	5,443	5,637	5,833	5,995	6,228

Table 5.16. Death rate by age group for prevalent RRT patients, 2015 cohort, compared with the general population and with previous analyses in the 1998–2001 cohort

Age group	UK population mid 2016 (thousands)	UK deaths in 2016	Death rate per 1,000 population	Expected number of deaths in UKRR population	UKRR deaths in 2016	UKRR death rate per 1,000 prevalent RRT patients	Relative risk of death in 2016	Relative risk of death 1998–2001 cohort
20–24	4,254	1,636	0.4	0	9	10	24.7	41.1
25–29	4,511	2,176	0.5	1	17	11	23.0	41.8
30–34	4,408	3,004	0.7	2	32	14	21.0	31.2
35–39	4,180	3,861	0.9	3	57	20	21.2	26.0
40–44	4,174	6,248	1.5	6	97	25	16.6	22.6
45–49	4,619	9,981	2.2	12	191	34	15.8	19.0
50–54	4,632	14,801	3.2	22	273	41	12.7	12.8
55–59	4,067	20,356	5.0	33	382	57	11.4	10.1
60–64	3,534	27,993	7.9	49	476	77	9.7	10.4
65–69	3,637	44,527	12.2	78	690	109	8.9	7.9
70–74	2,852	56,421	19.8	102	799	155	7.8	7.2
75–79	2,155	73,524	34.1	149	884	203	5.9	5.3
80–84	1,607	96,298	59.9	165	804	293	4.9	4.0
85+	993	231,386	233.0	315	481	356	1.5	3.0
Total	**49,623**	**592,212**	**11.9**	**935**	**5,192**	**92**	**5.6**	**7.7**

some returning no data whilst others achieved 100% completeness. Several centres have shown substantial improvement in data returns (appendix 1, table 5.27).

Cause of death in incident RRT patients

The number and proportion of patients in the cohort with missing data for cause of death is shown in the last row of each cause of death table (tables 5.17 to 5.21).

Cause of death within the first 90 days

In the first 90 days after start of RRT, cardiac disease was the most common cause of death in both age groups. Infection and treatment withdrawal as a cause of death were more common in older patients (aged 65+), whereas malignancy was more common in younger patients (<65 years old) (table 5.17).

Cause of death within one year after 90 days

In the year after the first 90 days, treatment withdrawal as a cause of death was more common in older patients (aged 65+), whereas cardiac disease was more common in younger patients (<65 years old) (table 5.18). Although cardiac disease remained the leading cause of death in both older and younger age groups at one year after the first 90 days, it has decreased over time.

Cause of death in prevalent RRT patients in the 2015 cohort

Table 5.19 shows the comparison of cause of death for prevalent dialysis and transplant patients in the 2015 cohort. Cardiac disease as a cause of death was less common in patients with a transplant who were a highly selected group of patients. Malignancy was responsible for a far greater percentage of deaths in prevalent patients

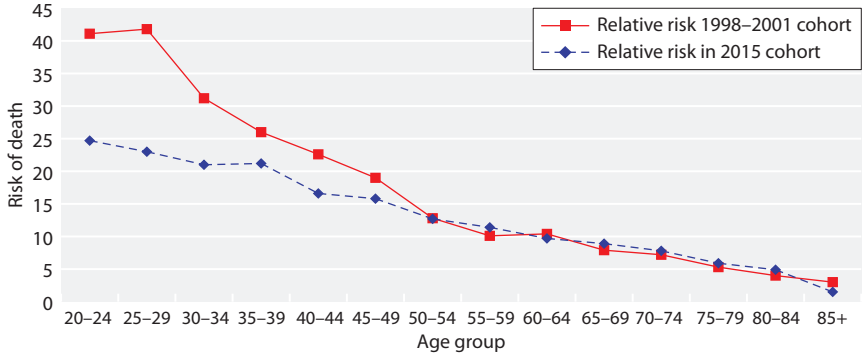

Fig. 5.26. Relative risk of death in prevalent RRT patients in the 2015 cohort compared to the 1998–2001 cohort

Table 5.17. Cause of death in the first 90 days for incident RRT patients by age group, 2000–2015 cohort

	All age groups		<65 years		⩾65 years	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	847	26	195	27	652	25
Cerebrovascular disease	146	4	30	4	116	4
Infection	597	18	112	15	485	19
Malignancy	313	9	100	14	213	8
Treatment withdrawal	538	16	77	11	461	18
Other	727	22	181	25	546	21
Uncertain	140	4	29	4	111	4
Total	**3,308**		**724**		**2,584**	
Missing data	2,873	46	642	47	2,231	46

Table 5.18. Cause of death one year after 90 days for incident RRT patients by age group, 2000–2015 cohort

	All age groups		<65 years		⩾65 years	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	1,460	22	472	25	988	20
Cerebrovascular disease	319	5	99	5	220	5
Infection	1,273	19	343	18	930	19
Malignancy	777	12	244	13	533	11
Treatment withdrawal	1,135	17	175	9	960	20
Other	1,397	21	439	23	958	20
Uncertain	374	6	108	6	266	5
Total	**6,735**		**1,880**		**4,855**	
Missing data	5,453	45	1,528	45	3,925	45

Table 5.19. Cause of death in prevalent RRT patients by modality, 2015 cohort

	All modalities		Dialysis		Transplant	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	807	24	698	24	109	19
Cerebrovascular disease	159	5	129	5	30	5
Infection	696	20	570	20	126	22
Malignancy	351	10	218	8	133	23
Treatment withdrawal	565	17	544	19	21	4
Other	659	19	548	19	111	20
Uncertain	181	5	145	5	36	6
Total	**3,418**		**2,852**		**566**	
Missing data	1,775	34	1,464	34	311	35

with a transplant than in those receiving dialysis; infection was also more common. Treatment withdrawal was a more common cause of death in the prevalent dialysis population.

Table 5.20 shows the cause of death for prevalent dialysis patients in the 2015 cohort, divided into subgroups according to age. Again, cardiac disease was the leading cause of death overall. Cardiac disease represented a higher proportion of all deaths (amongst those where cause of death was known) in younger (<65 years) dialysis patients, although the absolute number of cardiac deaths were higher amongst those

Table 5.20. Cause of death in prevalent dialysis patients by age group, 2015 cohort

	All age groups		<65 years		⩾65 years	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	698	24	251	34	447	21
Cerebrovascular disease	129	5	35	5	94	4
Infection	570	20	148	20	422	20
Malignancy	218	8	57	8	161	8
Treatment withdrawal	544	19	71	10	473	22
Other	548	19	139	19	409	19
Uncertain	145	5	43	6	102	5
Total	**2,852**		**744**		**2,108**	
No cause of death data	1,464	34	395	35	1,069	34

Table 5.21. Cause of death in prevalent transplant patients by age group, 2015 cohort

	All age groups		<65 years		⩾65 years	
Cause of death	*N*	%	*N*	%	*N*	%
Cardiac disease	109	19	59	23	50	16
Cerebrovascular disease	30	5	15	6	15	5
Infection	126	22	43	17	83	27
Malignancy	133	23	61	24	72	23
Treatment withdrawal	21	4	7	3	14	5
Other	111	20	54	21	57	18
Uncertain	36	6	17	7	19	6
Total	**566**		**256**		**310**	
No cause of death data	311	35	140	35	171	36

aged ⩾65 years (34% versus 21%). Prevalent dialysis patients aged ⩾65 years were substantially more likely to withdraw from treatment than younger patients (22% and 10% respectively).

Table 5.21 shows the cause of death for prevalent transplant patients in the 2015 cohort, divided into subgroups according to age. It shows that cardiac disease was more common in the younger age group (similar to that seen for dialysis patients, table 5.20), whereas infection was much more common in older transplant patients. The proportions of other causes of death were relatively similar between older and younger patients.

Figure 5.27 shows cause of death for prevalent RRT patients over time (2000 to 2015). Cardiovascular mortality decreased from year 2000 to 2005 and has remained static since, whilst treatment withdrawal as a cause of death has increased since 2009 onwards. Infection and malignancy as cause of death have remained static over the period (figure 5.27).

Discussion

Survival of incident patients on RRT at 90 days (adjusted to age 60) was slightly lower compared to the preceding year. When analysed according to age group, 90 day survival declined for those ⩾65 years whilst it was similar for the younger patients. Incident one year after 90 days survival (adjusted to age 60) declined slightly in the 2015 cohort compared to 2014, due to decreased survival in patients aged <65 years of age. There was no difference in survival by gender. Long term survival of incident patients on RRT continued to improve gradually over time.

There were differences in short term incident survival (90 days and one year after 90 days) by combined age group and diagnosis of diabetes; 90 day survival was better for those with diabetes across all age groups. For survival one year after 90 days, in the younger age group (<65 years) survival was much better for those patients without diabetes, however, this association was

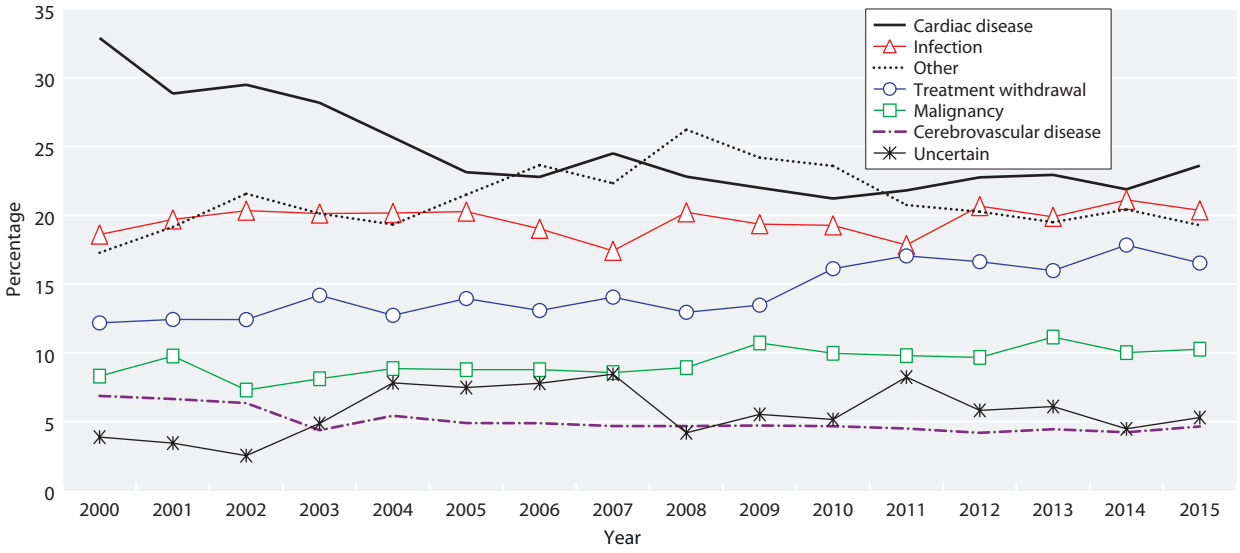

Fig. 5.27. Cause of death in prevalent RRT patients by cohort year (2000–2015)

not seen in the older age group (⩾65 years), where survival was more similar between patients with and without diabetes. Long-term survival showed a similar picture, where younger (<65 years) patients without diabetes survived much better than similar aged patients with diabetes. Survival was similar for older patients (⩾65 years) with and without diabetes.

One year age adjusted survival for prevalent dialysis patients was approximately the same in 2015 compared to 2014 (88.0% and 88.3% respectively). Prevalent dialysis patient survival in the UK seems to have peaked in 2011 and has been slightly lower in more recent years. The age adjusted one year survival for prevalent dialysis patients with diabetic primary renal disease in the UK has decreased slightly from 2011 onwards. The relative one year risk of death on RRT at age 20–24 years is 25 times that of the same age group in the general population, but has improved markedly over time (compared with a relative risk of 41 in the 1998–2001 cohort of the same age). For older patients (70–74 years) the relative risk is lower at 7.8 compared with the general population of a similar age, but this relative risk has not improved over time.

In the prevalent dialysis population for whom data regarding cause of death were available, cardiovascular disease was the most common cause of death accounting for 24% of deaths. Infection accounted for 20% of deaths and treatment withdrawal for 19% of deaths, with differences seen according to age group. In contrast, malignancy was the most common cause of death in prevalent transplant patients (23%), whilst infection accounted for 22% and cardiac disease 19% of all deaths. Trends in cause of death over time (2000–2015) show a decrease in cardiovascular disease, an increase in treatment withdrawal from 2009 onwards and a plateauing of deaths related to infection.

Variability in survival between centres was still evident, with some centres appearing as outliers in the data (below the lower 95% and above the upper 95% confidence limits) in 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. Differences in proportions of primary renal diagnosis, ethnicity and comorbidity have not been considered due to missing data from some renal centres. Although research has suggested that adjustment for comorbidity only explains a modest part of the variance in ERF patient outcomes [11], the prevalence of comorbidities could vary substantially between renal centres and it would be expected that adjustment for comorbidity may explain a proportion of the variance in survival. The UK Renal Registry regularly evaluates the effect of adjusting for primary renal diagnosis and comorbidity in addition to age in those centres returning ⩾85% of comorbidity data and repeatedly shows that, at centre level, there is clear benefit for some centres in adjusting for these case-mix factors. Research using comorbid conditions identified from Hospital Episode Statistics (HES) data for RRT patients in England during 2002–2006 showed that adjustment for HES-derived case-mix, including comorbid conditions, affected the position on the funnel plot and outlying status of some renal centres

for incident patients and reduced outlying centres from four to one [10].

Routine linkage of the UK Renal Registry data with hospital admissions information in the UK will allow the UKRR to report on survival adjusted for case-mix (age, ethnicity, primary renal diagnosis and comorbidity) in future UKRR reports. This will provide an improved comparison between centres and more accurate identification and location of outlying centres on funnel plots.

There was also considerable centre level variability in the early hazard of death (e.g. first six months) from start of RRT. The proportion of deaths in the first 90 days of starting RRT varied at centre level and in some centres the proportion was very low or even zero (data not shown). This may be due to unreported deaths in patients that die within the first 90 days of starting RRT for ERF. Alternatively, it may be due to those patients being described as having acute kidney injury (AKI) and therefore not included in the historical UKRR data collection. From January 2015, the UKRR began collecting data for patients receiving RRT for acute dialysis in renal centres in England and some Welsh centres, therefore future survival analyses will be able to take account of these discrepancies.

There is recognised variability in how conservative care is delivered and this is likely to contribute to centre differences in the population who start dialysis, particularly amongst older patients [12]. Historically, the UKRR has been unable to collect data on patients opting for conservative care rather than RRT for their chronic kidney disease. From January 2016 the UKRR began collecting data for patients with chronic kidney disease (CKD) stage 4 and 5 seen in renal centres in England, Wales and Northern Ireland. This will further improve understanding of case-mix differences between centres as well as understanding centre differences in the transition from CKD to RRT or conservative care and how this may impact on survival. In the future, patient frailty data, which has been shown to be independently associated with the timing of RRT start as well as outcomes may further augment the analysis [13].

Conflicts of interest: the authors declare no conflicts of interest

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Appendix 1: Survival tables

Table 5.22. One year after 90 day incident RRT survival percentage by centre, 2015 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	80.9	86.2	*80.6–92.2*
B QEH	88.2	90.9	*87.7–94.3*
Basldn	81.9	86.5	*78.8–95.0*
Bradfd	82.3	85.4	*78.6–92.7*
Brightn	82.8	87.2	*82.3–92.4*
Bristol	87.3	89.9	*85.5–94.4*
Carlis	95.9	97.1	*93.3–100.0*
Carsh	85.3	88.9	*85.4–92.6*
Chelms	96.3	97.2	*93.6–100.0*
Colchr	83.6	90.8	*82.8–99.6*
Covnt	82.7	86.4	*80.9–92.3*
Derby	80.2	82.0	*73.6–91.3*
Donc	82.4	86.6	*77.4–96.9*
Dorset	87.0	90.9	*85.4–96.7*
Dudley	88.9	90.6	*83.1–98.7*
Exeter	87.4	91.6	*87.9–95.6*
Glouc	92.6	95.1	*91.1–99.4*
Hull	89.2	92.1	*87.7–96.7*
Ipswi	86.7	92.0	*86.4–97.8*
Kent	83.9	88.3	*83.6–93.3*
L Barts	91.0	91.4	*88.2–94.6*
L Guys	86.3	87.9	*83.3–92.6*
L Kings	90.0	92.1	*88.5–95.8*
L Rfree	89.5	92.1	*89.0–95.2*
L St.G	90.8	92.6	*88.4–97.1*
L West	93.4	94.8	*92.7–96.9*
Leeds	91.2	91.9	*87.8–96.2*
Leic	88.7	90.6	*87.3–94.1*
Liv Ain	81.6	86.4	*78.5–95.0*
Liv Roy	86.7	88.5	*83.3–93.9*
M RI	88.5	90.5	*86.6–94.6*
Middlbr	84.8	86.9	*81.5–92.7*
Newc	78.0	81.9	*75.5–88.9*
Norwch	85.7	88.5	*82.8–94.5*
Nottm	86.5	90.3	*85.7–95.1*
Oxford	86.2	88.5	*84.4–92.7*
Plymth	92.2	93.7	*88.0–99.8*
Ports	87.8	90.5	*87.0–94.1*
Prestn	83.3	87.2	*82.8–91.9*
Redng	90.9	92.3	*87.4–97.5*
Salford	84.7	86.2	*81.3–91.4*
Sheff	92.5	94.0	*90.6–97.5*
Shrew	83.3	88.3	*82.1–95.0*
Stevng	94.4	95.4	*92.2–98.8*
Sthend	83.9	89.0	*80.4–98.4*
Stoke	81.9	87.2	*82.1–92.7*
Sund	88.4	91.5	*85.8–97.7*
Truro	89.8	92.5	*87.0–98.4*
Wirral	78.7	84.6	*76.9–93.0*
Wolve	81.7	85.4	*78.9–92.5*
York	78.0	84.2	*76.7–92.4*
N Ireland			
Antrim	88.9	92.2	*85.4–99.7*
Belfast	90.3	92.7	*88.0–97.7*
Newry	96.4	97.2	*91.9–100.0*
Ulster	92.6	94.8	*88.2–100.0*
West NI	94.4	96.4	*91.7–100.0*
Scotland			
Abrdn	90.9	92.2	*86.5–98.3*
Airdrie	86.0	87.9	*80.0–96.6*
D&Gall	92.9	92.3	*79.5–100.0*
Dundee	91.0	93.6	*87.8–99.8*
Edinb	85.7	86.5	*79.7–93.8*
Glasgw	85.7	86.0	*81.2–91.1*
Inverns	89.3	90.3	*80.7–100.0*
Klmarnk	81.8	86.8	*77.7–97.0*
Krkcldy	90.0	92.3	*84.6–100.0*
Wales			
Bangor	87.0	90.3	*80.8–100.0*
Cardff	86.8	89.9	*85.8–94.2*
Clwyd	77.8	86.1	*74.7–99.2*
Swanse	79.1	85.3	*80.1–90.9*
Wrexm	94.0	95.5	*90.6–100.0*
England	**87.3**	**90.0**	***91.5–96.9***
N Ireland	**91.9**	**94.1**	***86.1–91.3***
Scotland	**87.2**	**88.7**	***86.1–91.8***
Wales	**84.8**	**88.9**	***89.2–90.8***
UK	**87.3**	**90.0**	***89.2–90.8***

Cambridge excluded for 2015 as no patient level data was received

Table 5.23. Ninety day incident RRT survival percentage by centre, 2015 cohort, unadjusted and adjusted to age 60

Centre	Unadjusted 90 day survival	Adjusted 90 day survival	*Adjusted 90 day 95% CI*
England			
B Heart	98.0	98.8	*97.2–100.0*
B QEH	97.9	98.5	*97.2–99.8*
Basldn	92.6	95.3	*90.9–99.9*
Bradfd	92.2	94.1	*89.9–98.4*
Brightn	92.3	94.9	*92.0–97.9*
Bristol	92.4	94.6	*91.6–97.6*
Carsh	90.8	93.8	*91.4–96.3*
Colchr	86.7	93.2	*87.1–99.8*
Covnt	92.6	95.1	*91.9–98.3*
Derby	97.2	97.7	*94.5–100.0*
Dorset	98.6	99.1	*97.5–100.0*
Dudley	95.7	96.6	*92.2–100.0*
Exeter	95.8	97.6	*95.6–99.5*
Glouc	97.1	98.3	*96.0–100.0*
Hull	97.3	98.1	*96.1–100.0*
Ipswi	96.4	98.1	*95.6–100.0*
Kent	93.3	95.8	*93.1–98.5*
L Barts	93.9	94.6	*92.2–97.0*
L Guys	96.6	97.3	*95.2–99.5*
L Kings	98.3	98.8	*97.4–100.0*
L Rfree	95.8	97.3	*95.6–99.0*
L St.G	97.3	98.1	*96.0–100.0*
L West	96.2	97.3	*95.8–98.7*
Leeds	92.6	93.7	*90.3–97.2*
Leic	95.3	96.5	*94.5–98.5*
Liv Ain	90.7	93.9	*88.9–99.2*
Liv Roy	94.1	95.3	*92.1–98.5*
M RI	90.2	92.9	*89.8–96.1*
Middlbr	95.2	96.3	*93.4–99.3*
Newc	93.8	95.6	*92.4–98.8*
Norwch	93.8	95.6	*92.3–99.1*
Nottm	95.7	97.2	*94.9–99.7*
Oxford	97.9	98.4	*96.9–100.0*
Plymth	94.4	95.9	*91.4–100.0*
Ports	99.0	99.3	*98.4–100.0*
Prestn	94.3	96.1	*93.8–98.5*
Redng	93.8	95.2	*91.5–99.0*
Salford	93.3	94.7	*91.8–97.7*
Sheff	97.4	98.1	*96.3–100.0*
Shrew	95.7	97.4	*94.5–100.0*
Stevng	90.8	93.2	*89.6–96.9*
Sthend	88.6	93.2	*87.1–99.8*
Stoke	94.9	97.0	*94.6–99.4*
Truro	89.4	93.0	*88.2–98.2*
Wirral	81.4	88.3	*82.4–94.6*
Wolve	93.2	95.3	*91.7–99.0*
N Ireland			
Belfast	96.6	97.7	*95.2–100.0*
Newry	96.6	97.4	*92.7–100.0*
Ulster	96.4	97.8	*93.6–100.0*
West NI	97.3	98.5	*95.6–100.0*
Scotland			
Abrdn	97.1	97.7	*94.6–100.0*
Airdrie	96.2	97.0	*93.1–100.0*
D&Gall	93.3	93.3	*82.3–100.0*
Dundee	91.8	94.8	*90.0–99.9*
Edinb	97.7	98.0	*95.2–100.0*
Glasgw	96.8	97.1	*94.9–99.4*
Klmarnk	97.1	98.2	*94.8–100.0*
Krkcldy	96.8	97.8	*93.7–100.0*
Wales			
Bangor	95.8	97.3	*92.4–100.0*
Cardff	96.2	97.5	*95.5–99.5*
Clwyd	90.0	94.8	*88.1–100.0*
Swanse	93.2	95.8	*93.1–98.6*
Wrexm	92.6	94.8	*90.1–99.9*
England	**94.8**	**96.4**	***95.8–96.9***
N Ireland	**97.3**	**98.2**	***96.8–99.7***
Scotland	**96.6**	**97.2**	***96.0–98.5***
Wales	**94.3**	**96.3**	***94.8–97.9***
UK	**95.0**	**96.5**	***96.0–97.0***

Centres excluded: Carlisle, Chelmsford, Doncaster, Sunderland, York, Antrim and Inverness due to no deaths recorded in the first 90 days
Cambridge excluded for 2015 as no patient level data was received

Table 5.24. One year after 90 day incident RRT survival percentage by centre for incident RRT cohort years 2006–2015, adjusted to age 60

	Cohort year									
Centre	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
England										
B Heart	89.4	94.1	93.7	83.7	92.0	94.4	86.8	93.5	93.6	86.2
B QEH	86.4	92.7	90.2	91.5	89.0	94.1	92.1	92.0	89.9	90.9
Basldn	90.8	89.7	89.3	87.5	85.9	91.7	89.5	90.8	88.0	86.5
Bradfd	81.4	84.0	85.4	91.6	89.2	89.0	85.6	95.5	81.4	85.4
Brightn	87.1	94.7	90.4	84.9	88.5	91.1	91.0	86.8	91.2	87.2
Bristol	92.0	91.4	84.5	89.7	89.1	95.1	88.4	91.3	93.7	89.9
Camb	90.7	93.3	90.5	87.9	90.3	91.9	91.8	94.6	92.0	
Carlis	89.9	96.5	81.4	71.5	86.4	91.6	89.7	95.7	88.3	97.1
Carsh	88.2	87.2	85.9	88.0	88.9	94.1	89.1	94.6	91.3	88.9
Chelms	94.3	86.4	90.9	94.1	85.8	81.0	89.7	92.2	88.1	97.2
Colchr			85.0	86.4	93.9	84.3	82.4	97.9	90.0	90.8
Covnt	88.5	90.4	87.0	94.2	89.1	90.7	88.4	90.8	93.5	86.4
Derby	92.0	96.3	89.8	88.1	87.5	90.6	88.3	91.2	95.9	82.0
Donc			89.9	87.8	91.5	87.6	88.8	92.3	91.7	86.6
Dorset	86.2	91.3	92.6	92.4	87.6	88.3	88.6	93.3	90.7	90.9
Dudley	92.6	88.9	69.8	85.2	87.9	93.8	89.8	94.0	91.5	90.6
Exeter	89.4	86.2	86.6	88.6	95.8	89.2	92.9	94.9	92.4	91.6
Glouc	89.6	86.1	96.1	89.3	92.4	89.9	90.9	96.7	92.4	95.1
Hull	95.2	89.5	84.5	90.3	88.7	93.1	90.2	91.9	92.3	92.1
Ipswi	93.7	95.9	95.7	94.0	93.2	95.4	93.1	86.7	98.6	92.0
Kent		91.7	90.4	89.0	91.1	87.7	94.7	91.9	91.4	88.3
L Barts	93.9	86.3	92.5	91.2	91.8	94.1	91.0	91.3	87.4	91.4
L Guys	92.9	91.9	90.5	94.1	92.1	94.1	94.8	94.3	93.0	87.9
L Kings	84.5	87.4	90.2	84.8	89.8	90.4	89.7	90.6	93.3	92.1
L Rfree	89.7	94.3	94.8	90.1	90.8	91.0	93.5	91.6	92.3	92.1
L St.G		92.0	93.1	92.8	94.6	96.7	93.5	92.4	91.6	92.6
L West	93.0	92.4	93.9	92.5	88.6	90.7	92.4	94.2	90.5	94.8
Leeds	83.5	88.2	88.8	90.4	91.4	88.3	92.4	91.3	89.6	91.9
Leic	88.7	90.0	90.5	90.1	90.6	91.0	90.2	90.8	91.0	90.6
Liv Ain	91.2	82.6	83.6	82.8	89.0	87.6	95.0	85.9	89.3	86.4
Liv Roy	86.3	84.3	94.1	93.9	87.4	89.1	89.9	92.8	88.2	88.5
M RI		89.4	87.7	86.8	90.1	92.5	89.8	90.2	85.4	90.5
Middlbr	90.7	88.7	82.4	87.7	88.8	88.1	89.5	91.9	93.0	86.9
Newc	86.2	85.7	91.4	85.7	88.9	86.1	85.6	92.8	91.2	81.9
Norwch	85.8	90.9	88.2	88.7	92.4	89.9	88.2	88.9	88.5	88.5
Nottm	91.9	89.8	90.3	88.8	93.5	93.4	89.3	93.6	92.6	90.3
Oxford	89.3	88.6	87.2	91.6	90.6	89.0	92.7	94.1	86.6	88.5
Plymth	82.1	90.0	87.9	89.1	93.9	91.4	91.9	94.6	86.3	93.7
Ports	87.5	88.4	88.8	90.6	88.2	91.3	90.9	91.0	89.6	90.5
Prestn	83.0	91.3	82.2	87.6	87.6	91.2	93.3	94.4	93.5	87.2
Redng	91.3	90.0	93.5	89.0	92.1	93.1	96.7	93.2	95.0	92.3
Salford	90.6	86.3	85.7	88.6	86.5	92.0	88.9	88.6	90.5	86.2
Sheff	87.5	90.7	92.2	94.2	92.2	87.9	92.9	91.4	90.6	94.0
Shrew	87.7	91.7	93.0	84.8	87.0	91.8	85.9	88.0	83.5	88.3
Stevng	85.8	90.6	89.5	96.8	93.7	91.2	93.0	90.7	90.4	95.4
Sthend	94.8	91.7	88.8	91.5	82.2	94.4		91.5	89.2	89.0
Stoke		87.0	89.7	85.9	87.2	93.1	93.0	88.2	91.5	87.2
Sund	83.5	88.6	83.6	83.0	81.3	88.7	92.9	87.6	87.9	91.5
Truro	89.5	90.1	89.2	94.2	92.1	93.4	94.6	97.0	85.4	92.5
Wirral	85.9	88.8	90.4	84.8	94.5	86.1	86.2	93.4	87.9	84.6
Wolve	89.3	89.4	90.3	88.6	88.7	89.7	84.3	89.0	87.7	85.4
York	82.7	95.0	88.2	94.2	80.4	93.6	93.9	87.6	85.7	84.2

Table 5.24. Continued

	Cohort year									
Centre	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
N Ireland										
Antrim	93.9	85.0	88.7	97.5	85.9	89.1	86.5	92.5	81.8	92.2
Belfast	90.9	90.7	88.1	91.4	88.5	91.4	92.2	92.3	89.0	92.7
Newry	77.6	91.4	90.0	83.4	92.1	85.5	89.6	84.8	90.1	97.2
Ulster		89.1	66.8		93.7	86.5	93.8	89.9	92.8	94.8
West NI	90.1	97.3	93.1	97.6	89.1	97.8		94.1	88.3	96.4
Scotland										
Abrdn	85.1	85.9	87.0	88.8	85.4	94.4	91.4	97.2	94.1	92.2
Airdrie	80.7	79.7	90.3	94.2	83.3	84.0	91.9	95.0	88.1	87.9
D&Gall	88.2	87.4	84.9	84.1	90.3	92.7	90.6		97.1	92.3
Dundee	89.2	81.0	84.3	86.8	90.3	90.7	93.3	92.4	90.6	93.6
Edinb	88.5	90.1	83.1	85.0	86.5	89.7	92.9	82.0	89.9	86.5
Glasgw	83.6	87.7	83.1	87.2	86.9	89.2	90.5	89.8	86.3	86.0
Inverns	84.0	87.6	90.0	74.6	93.7	96.5	89.8	95.0	95.0	90.3
Klmarnk	79.2	86.5	90.1	84.1	88.5	85.6	90.8	85.1	87.6	86.8
Krkcldy	80.1	87.3	86.7	87.7	93.6	92.5	91.6	80.2		92.3
Wales										
Bangor	81.5	89.9	86.0	87.3	91.6	94.4	84.3	91.0	86.5	90.3
Cardff	87.0	84.5	82.9	89.7	90.0	88.5	86.1	89.1	87.2	89.9
Clwyd	96.9	85.4	75.3	92.4		87.1	81.8	89.6	89.8	86.1
Swanse	85.0	89.5	84.7	81.2	87.3	84.4	84.3	84.5	89.9	85.3
Wrexm	88.4	89.8	89.3	91.5	82.2	89.0	83.9	88.0	94.6	95.5
England	**88.9**	**90.0**	**89.4**	**89.7**	**89.9**	**91.2**	**91.0**	**92.0**	**90.5**	**90.0**
N Ireland	**90.3**	**90.0**	**87.9**	**92.5**	**89.3**	**90.3**	**92.3**	**91.3**	**87.5**	**94.1**
Scotland	**84.4**	**86.3**	**85.5**	**86.6**	**87.9**	**90.2**	**91.4**	**89.7**	**90.2**	**88.7**
Wales	**86.6**	**86.8**	**83.9**	**87.3**	**89.2**	**87.6**	**85.0**	**87.6**	**88.9**	**88.9**
UK	**88.4**	**89.5**	**88.8**	**89.5**	**89.7**	**90.9**	**90.8**	**91.6**	**90.3**	**90.0**

Blank cells: centres with either less than 10 patients, no deaths or no data contribution to the UKRR for that year

Table 5.25. Incident RRT survival percentage after 90 days from start of RRT by centre for incident RRT cohort years 2011–2015, adjusted to age 60

Centre	5 year survival 2011 cohort	4 year survival 2012 cohort	3 year survival 2013 cohort	2 year survival 2014 cohort	1 year survival 2015 cohort
England					
B Heart	61.5	63.9	79.7	84.3	86.2
B QEH	70.7	70.3	77.6	86.1	90.9
Basldn	66.4	65.7	73.0	79.3	86.5
Bradfd	48.4	71.0	72.0	77.8	85.4
Brightn	57.0	71.8	72.3	80.5	87.2
Bristol	69.9	64.6	77.2	84.8	89.9
Camb	65.6	67.3	80.2	81.5	
Carlis	66.7	79.7	80.8	81.5	97.1
Carsh	66.5	70.7	80.0	80.9	88.9
Chelms	63.6	64.0	79.1	84.4	97.2
Colchr	53.8	60.7	88.3	82.2	90.8
Covnt	57.9	65.2	66.6	83.4	86.4
Derby	61.0	62.7	73.8	89.7	82.0
Donc	67.2	66.5	85.3	76.1	86.6
Dorset	63.5	66.4	79.9	80.5	90.9
Dudley	69.0	65.0	72.7	78.6	90.6
Exeter	56.2	70.9	77.6	85.3	91.6
Glouc	61.9	67.1	86.1	83.5	95.1
Hull	66.9	70.6	79.7	86.1	92.1
Ipswi	69.1	70.4	66.1	93.8	92.0
Kent	56.1	67.8	75.8	80.8	88.3
L Barts	64.6	72.4	77.4	80.2	91.4
L Guys	71.2	74.6	78.6	84.5	87.9
L Kings	64.5	67.5	71.1	85.1	92.1
L Rfree	69.5	77.4	77.4	79.7	92.1
L St.G	67.0	74.9	82.8	80.8	92.6
L West	65.9	73.1	79.3	82.5	94.8
Leeds	61.3	70.0	74.6	82.1	91.9
Leic	62.1	68.7	72.7	83.2	90.6
Liv Ain	62.4	62.9	64.3	82.2	86.4
Liv Roy	46.0	62.7	79.8	81.8	88.5
M RI	63.2	61.6	75.3	77.2	90.5
Middlbr	59.8	66.4	77.1	83.9	86.9
Newc	58.5	66.7	74.0	80.0	81.9
Norwch	67.1	72.1	71.5	81.6	88.5
Nottm	68.7	63.7	79.4	85.6	90.3
Oxford	63.2	70.9	73.3	77.2	88.5
Plymth	65.8	68.4	72.5	79.6	93.7
Ports	60.0	67.2	74.5	77.8	90.5
Prestn	65.6	71.7	78.6	85.7	87.2
Redng	63.3	76.2	83.1	86.7	92.3
Salford	62.7	60.8	74.8	77.0	86.2
Sheff	62.7	67.9	75.6	82.8	94.0
Shrew	53.8	59.9	72.1	72.3	88.3
Stevng	64.2	80.4	79.6	85.5	95.4
Sthend	63.2	82.6	71.9	79.8	89.0
Stoke	57.7	57.0	73.6	84.4	87.2
Sund	42.1	72.1	76.1	75.9	91.5
Truro	72.0	67.1	79.5	75.8	92.5
Wirral	51.7	58.8	72.7	73.5	84.6
Wolve	55.9	69.9	67.9	77.8	85.4
York	70.9	69.8	70.5	81.1	84.2

Table 5.25. Continued

Centre	5 year survival 2011 cohort	4 year survival 2012 cohort	3 year survival 2013 cohort	2 year survival 2014 cohort	1 year survival 2015 cohort
N Ireland					
Antrim	73.1	60.7	78.0	73.2	92.2
Belfast	59.5	68.8	81.5	82.4	92.7
Newry	56.3	69.3	84.6	89.9	97.2
Ulster	58.3	66.3	77.1	88.9	94.8
West NI	72.3	76.4	77.8	81.6	96.4
Scotland					
Abrdn	52.8	76.4	76.9	85.7	92.2
Airdrie	47.0	64.1	69.3	81.6	87.9
D&Gall	42.1	75.0		87.2	92.3
Dundee	59.4	74.3	73.5	80.0	93.6
Edinb	65.7	68.4	66.7	79.8	86.5
Glasgw	52.9	67.6	76.1	75.6	86.0
Inverns	64.2	72.4	79.2	89.9	90.3
Klmarnk	39.8	63.6	61.6	76.3	86.8
Krkcldy	47.6	52.8	61.8	82.9	92.3
Wales					
Bangor	49.1	72.1	74.9	74.0	90.3
Cardff	60.0	62.7	70.1	79.3	89.9
Clwyd	52.6	47.3	64.0	78.0	86.1
Swanse	61.7	64.1	65.9	79.2	85.3
Wrexm	51.2	55.7	75.7	88.4	95.5
England	**63.2**	**69.1**	**76.4**	**81.8**	**90.0**
N Ireland	**62.8**	**68.6**	**80.0**	**81.7**	**94.1**
Scotland	**54.4**	**68.1**	**71.9**	**79.9**	**88.7**
Wales	**58.7**	**62.3**	**69.6**	**79.8**	**88.9**
UK	**62.3**	**68.7**	**75.8**	**81.6**	**90.0**

Blank cells: centres with either less than 10 patients, no deaths or no data contribution to the UKRR for that year

Table 5.26. One year prevalent dialysis patient survival percentage by centre for prevalent cohort years 2006–2015, adjusted to age 60

	Cohort year									
Centre	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
England										
B Heart	87.9	90.5	91.0	87.5	89.6	88.6	89.2	87.6	89.6	87.9
B QEH	88.0	88.4	90.0	89.4	91.1	91.6	91.9	89.7	91.4	88.0
Basldn	90.3	92.7	91.6	88.7	91.0	88.2	92.8	86.8	88.7	90.3
Bradfd	84.3	87.7	84.6	89.3	88.1	87.7	85.2	87.6	87.6	84.3
Brightn	87.3	88.8	87.5	90.0	88.4	89.6	88.3	87.4	87.7	87.3
Bristol	89.2	87.4	85.1	85.9	89.7	90.7	89.9	89.3	88.1	89.2
Camb	88.0	92.6	90.0	91.4	93.1	89.2	92.8	87.8	89.6	
Carlis	85.9	87.1	80.6	80.8	93.3	89.0	83.1	88.4	91.0	85.9
Carsh	88.3	89.7	88.7	89.2	89.6	91.0	90.4	89.6	87.9	88.3
Chelms	87.6	85.2	86.2	89.7	84.4	91.3	90.3	90.1	90.6	87.6
Colchr			91.2	86.7	89.1	89.3	86.1	88.4	90.5	
Covnt	86.9	87.2	90.9	90.2	91.0	91.9	90.6	86.2	85.8	86.9
Derby	87.0	90.3	90.5	90.0	89.5	89.4	88.1	89.5	90.9	87.0
Donc		88.8	84.1	88.9	91.9	91.2	83.1	90.5	89.6	
Dorset	87.6	90.0	90.2	93.1	90.1	90.6	91.9	92.2	89.8	87.6
Dudley	86.9	88.9	88.9	90.8	87.8	91.5	86.9	87.7	90.9	86.9
Exeter	87.2	85.4	85.4	86.6	88.4	88.2	91.6	90.0	89.1	87.2
Glouc	88.3	86.4	91.7	92.2	89.7	90.8	89.8	92.1	89.1	88.3
Hull	90.0	86.8	87.9	87.6	89.9	91.0	88.5	87.7	88.8	90.0
Ipswi	86.1	93.0	84.4	87.5	91.8	90.3	88.0	89.6	89.2	86.1
Kent		86.4	88.0	90.5	89.9	89.3	87.7	87.9	86.5	
L Barts	89.3	88.7	90.8	92.9	91.7	89.9	91.2	90.2	88.2	89.3
L Guys	90.7	90.3	91.4	91.0	94.0	91.2	90.9	90.6	89.9	90.7
L Kings	84.6	87.6	87.7	88.7	89.7	89.5	89.0	90.5	90.6	84.6
L Rfree	90.4	91.3	89.7	90.2	91.5	90.3	90.8	90.0	90.1	90.4
L St.G		94.3	89.3	90.8	92.0	88.5	91.7	92.2	88.4	
L West	91.5	90.1	91.8	90.5	90.5	91.7	90.1	89.9	91.1	91.5
Leeds	88.3	87.3	88.9	90.8	88.8	86.8	88.4	88.8	87.5	88.3
Leic	89.7	89.4	88.6	90.4	89.8	90.4	89.0	89.4	86.4	89.7
Liv Ain	90.5	88.4	92.0	89.8	89.8	84.0	84.4	87.7	86.8	90.5
Liv Roy	84.5	86.5	89.1	89.0	90.5	88.6	87.9	87.0	88.0	84.5
M RI		86.5	87.6	87.0	88.6	90.8	86.2	86.5	85.2	
Middlbr	87.2	86.9	86.5	83.6	93.0	88.6	88.8	85.3	88.6	87.2
Newc	86.1	86.4	87.2	86.3	85.3	89.3	84.6	86.5	89.0	86.1
Norwch	87.7	90.7	89.5	90.1	91.4	91.4	88.7	88.9	91.0	87.7
Nottm	89.6	88.4	88.0	89.6	90.0	89.0	90.7	88.8	90.4	89.6
Oxford	86.8	88.0	88.4	87.2	88.0	88.3	89.6	87.5	83.5	86.8
Plymth	82.9	88.0	86.0	85.3	90.0	84.8	89.9	87.1	85.5	82.9
Ports	89.9	88.5	89.3	88.5	88.2	90.0	90.2	85.7	89.6	89.9
Prestn	90.8	90.2	89.8	90.2	88.3	90.9	89.2	88.8	87.8	90.8
Redng	90.4	89.0	92.5	89.1	89.6	91.0	91.0	89.6	90.9	90.4
Salford	87.5	86.1	87.5	84.7	87.1	88.5	87.6	88.6	85.5	87.5
Sheff	88.9	88.9	89.8	89.7	88.9	89.1	91.5	88.3	89.2	88.9
Shrew	89.1	89.0	87.9	85.8	87.5	90.0	84.0	86.6	88.5	89.1
Stevng	88.0	91.5	89.0	88.5	91.2	90.7	87.2	90.7	89.7	88.0
Sthend	86.5	90.3	91.1	92.0	90.4	87.9	91.9	90.4	87.1	86.5
Stoke		87.5	88.6	87.0	90.7	90.6	91.9	88.9	87.1	
Sund	83.9	87.7	85.4	85.0	84.0	86.7	85.1	88.2	85.6	83.9
Truro	89.4	89.6	89.1	90.8	89.3	89.8	89.0	90.3	85.5	89.4
Wirral	88.2	89.3	90.3	88.6	90.8	90.1	90.8	84.5	83.5	88.2
Wolve	88.0	92.6	89.6	87.5	89.5	89.0	89.4	90.1	88.3	88.0
York	88.6	87.9	88.9	90.1	84.5	88.9	91.6	88.3	88.6	88.6

Table 5.26. Continued

	Cohort year									
Centre	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
N Ireland										
Antrim	85.4	87.9	89.6	88.2	91.7	90.1	90.7	85.7	88.4	85.4
Belfast	89.5	87.8	87.0	87.1	87.6	87.7	85.3	89.2	88.5	89.5
Newry	87.4	89.1	91.7	86.8	91.2	81.8	90.2	90.7	92.9	87.4
Ulster	89.5	89.7	87.5	90.0	89.1	91.1	90.9	91.3	86.5	89.5
West NI	90.3	93.2	89.4	91.1	90.9	91.6	91.9	86.1	93.9	90.3
Scotland										
Abrdn	87.3	90.0	89.6	89.5	89.2	91.5	88.1	83.9	86.3	87.3
Airdrie	79.1	86.2	85.6	89.5	88.1	86.5	86.0	85.9	88.6	79.1
D&Gall	90.0	83.8	86.5	87.7	91.0	87.0	90.0	86.7	87.3	90.0
Dundee	82.0	82.0	93.3	86.4	86.8	90.9	88.3	91.5	89.2	82.0
Edinb	87.0	87.7	85.8	88.2	81.4	89.4	89.1	87.9	85.4	87.0
Glasgw	87.4	87.4	88.1	88.0	87.1	87.6	87.1	87.5	85.4	87.4
Inverns	93.5	88.0	91.8	88.5	86.1	87.2	86.5	88.9	90.5	93.5
Klmarnk	86.9	88.5	88.0	88.6	88.9	89.6	87.1	91.8	85.7	86.9
Krkcldy	87.0	90.3	84.8	86.1	88.9	86.8	90.4	84.1	85.3	87.0
Wales										
Bangor	81.7	88.8	85.2	85.7	87.0	90.0	84.7	85.7	86.4	81.7
Cardff	88.7	82.5	86.4	85.8	88.2	86.4	87.6	86.6	85.6	88.7
Clwyd	90.6	87.3	88.9	78.6	93.1	90.1	86.4	88.9	84.3	90.6
Swanse	88.1	89.4	87.4	87.5	89.1	86.3	88.3	87.2	87.2	88.1
Wrexm	88.2	85.2	89.1	86.8	85.9	87.4	89.3	87.4	85.1	88.2
England	**88.5**	**88.9**	**89.0**	**89.2**	**89.9**	**89.9**	**89.5**	**88.9**	**88.6**	**88.5**
N Ireland	**88.4**	**89.2**	**88.6**	**88.5**	**89.8**	**88.8**	**89.2**	**88.4**	**89.7**	**88.4**
Scotland	**86.5**	**87.2**	**88.2**	**88.0**	**87.0**	**88.6**	**87.8**	**87.5**	**86.5**	**86.5**
Wales	**87.9**	**85.6**	**87.0**	**85.9**	**88.5**	**87.0**	**87.6**	**86.9**	**86.0**	**87.9**
UK	**88.3**	**88.6**	**88.8**	**88.9**	**89.6**	**89.6**	**89.3**	**88.6**	**88.3**	**88.3**

Blank cells: centres with either less than 10 patients or no data contribution to the UKRR for that year

Table 5.27. Percentage completeness of EDTA cause of death for prevalent patients by centre and year of death, 2007 to 2016

	Year of death									
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
England										
B Heart	84.5	93.9	100.0	96.6	96.1	96.6	95.0	65.6	93.8	93.3
B QEH	7.0	5.8	0.7	1.7	2.0	2.1	61.9	91.0	53.4	4.2
Basldn	45.5	47.6	76.2	66.7	84.6	88.9	90.9	90.0	86.7	91.4
Bradfd	86.5	92.5	82.2	97.0	97.5	97.7	97.9	98.0	92.2	95.8
Brightn	11.9	0.0	1.1	2.4	1.1	1.1	0.0	0.9	7.0	91.9
Bristol	60.3	66.4	70.7	89.4	96.1	82.2	82.0	94.5	61.2	65.3
Camb	1.1	1.6	5.1	10.4	62.0	94.1	80.5	42.3		
Carlis	73.9	47.6	80.6	100.0	92.9	94.7	92.3	92.0	82.4	85.3
Carsh	0.8	1.5	0.8	6.7	25.0	40.8	17.4	16.3	25.0	10.8
Chelms	76.5	71.4	86.7	86.7	87.0	100.0	92.3	85.7	96.2	92.7
Colchr		33.3	66.7	85.2	82.6	100.0	91.7	77.3	90.0	78.3
Covnt	0.0	1.2	1.8	0.0	1.4	33.3	70.5	6.7	4.7	1.9
Derby	83.3	97.8	73.5	91.2	88.5	86.9	88.7	78.9	86.7	93.4
Donc		100.0	94.3	90.9	91.7	92.6	100.0	96.8	91.7	81.8
Dorset	87.2	88.9	85.2	95.7	95.0	89.1	98.3	90.6	90.2	93.2
Dudley	6.1	5.3	0.0	94.4	88.1	91.2	94.0	97.7	94.3	90.5
Exeter	4.7	3.1	3.0	89.5	84.6	95.1	98.6	96.5	85.3	89.1
Glouc	77.8	70.8	68.4	97.2	93.6	91.5	100.0	88.1	94.2	78.6
Hull	76.5	52.7	18.7	92.0	93.5	96.9	86.8	91.7	97.3	60.0
Ipswi	35.5	13.6	18.8	73.3	77.8	77.4	78.8	83.3	25.0	5.9
Kent		61.7	92.8	89.0	96.2	94.9	81.4	86.6	95.3	100.0
L Barts	74.6	77.0	69.5	73.9	82.6	79.9	82.9	83.3	49.5	42.4
L Guys	3.5	0.0	0.0	67.6	84.2	58.2	1.1	0.0	93.2	90.1
L Kings	75.6	86.2	67.1	94.8	97.6	100.0	98.9	98.7	96.7	98.1
L Rfree	0.0	0.0	0.9	1.7	0.0	7.1	5.7	16.1	16.1	16.0
L St.G	16.7	17.9	19.6	77.6	49.0	42.4	62.5	57.1	32.8	26.8
L West	18.9	6.3	2.2	2.2	95.0	97.3	96.4	94.6	96.7	98.9
Leeds	29.6	30.1	33.9	100.0	99.1	97.7	98.3	99.2	97.3	88.8
Leic	65.5	69.5	69.8	74.5	61.7	94.1	79.6	55.7	57.7	50.0
Liv Ain	73.3	66.7	100.0	89.5	95.7	0.0	0.0	0.0	12.5	10.0
Liv Roy	76.8	75.8	81.8	71.6	76.4	2.8	33.7	19.0	11.1	4.5
M RI	4.0	0.9	1.0	4.7	3.1	10.0	0.8	1.4	2.0	1.4
Middlbr	57.5	26.0	52.0	89.2	97.5	94.9	81.3	95.1	93.4	83.0
Newc	48.7	35.7	40.8	14.0	45.0	16.9	23.6	51.8	74.1	92.5
Norwch	18.2	20.9	44.4	75.8	70.3	76.5	91.0	74.0	48.6	61.2
Nottm	87.0	98.8	97.1	98.8	100.0	100.0	97.6	98.9	95.7	96.1
Oxford	0.0	1.0	0.0	84.6	97.4	93.5	96.5	98.3	97.5	75.4
Plymth	56.7	70.7	47.5	80.9	43.6	41.2	100.0	32.7	74.0	92.0
Ports	21.4	6.9	44.5	68.7	23.3	19.8	40.7	38.8	34.1	24.0
Prestn	47.8	38.1	17.9	95.7	98.9	97.6	99.0	96.2	80.3	83.2
Redng	97.8	89.6	83.0	100.0	96.7	91.2	91.9	79.7	76.7	95.9
Salford	1.3	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Sheff	12.9	0.9	1.9	3.0	0.8	0.8	1.9	0.9	0.8	0.0
Shrew	89.3	62.5	20.5	46.0	0.0	7.9	17.7	0.0	34.9	8.3
Stevng	54.3	66.1	74.3	86.3	85.2	67.7	69.8	9.3	62.1	7.9
Sthend	3.2	57.7	75.0	92.3	90.0	100.0	100.0	95.7	97.0	86.0
Stoke	16.1	21.0	28.6	54.7	57.9	89.6	55.9	53.5	75.0	91.8
Sund	60.5	50.0	78.9	93.5	95.1	97.4	82.6	97.4	98.0	91.5
Truro	0.0	18.4	28.9	93.3	94.9	78.8	100.0	97.1	98.0	100.0
Wirral	84.6	96.9	84.8	86.5	0.0	2.6	25.8	68.5	69.0	59.5
Wolve	51.5	65.8	76.4	98.4	94.1	92.2	85.1	85.2	62.5	62.0
York	38.5	62.1	67.9	96.7	97.3	100.0	100.0	97.4	94.6	95.2

Table 5.27. Continued

	Year of death									
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
N Ireland										
Antrim	8.6	3.4	26.9	96.8	95.2	100.0	93.1	100.0	93.9	100.0
Belfast	36.0	20.0	25.4	80.3	77.2	77.0	41.7	51.1	50.0	43.2
Newry	15.0	11.8	68.4	95.2	94.4	96.7	100.0	93.3	100.0	80.0
Ulster	92.9	69.2	75.0	95.0	90.9	100.0	95.7	90.0	96.0	100.0
West NI	35.0	22.2	45.8	92.3	80.0	96.6	96.2	93.9	100.0	100.0
Scotland										
Abrdn	2.1	100.0	100.0	100.0	100.0	97.1	91.1	68.3	46.7	81.8
Airdrie	100.0	100.0	100.0	100.0	97.1	93.9	100.0	97.6	97.5	92.2
D&Gall	100.0	93.3	94.4	100.0	100.0	87.5	100.0	100.0	69.2	69.2
Dundee	8.9	100.0	100.0	100.0	100.0	100.0	100.0	57.6	66.7	98.0
Edinb	48.3	100.0	97.5	100.0	98.8	100.0	96.4	96.2	92.9	100.0
Glasgw	59.1	100.0	98.5	97.8	99.3	100.0	99.3	100.0	91.4	92.2
Inverns	0.0	100.0	94.7	100.0	100.0	100.0	100.0	100.0	100.0	85.7
Klmarnk	15.6	100.0	96.7	100.0	100.0	100.0	100.0	100.0	97.4	100.0
Krkcldy	61.5	100.0	96.6	96.6	100.0	96.9	100.0	94.7	54.8	80.5
Wales										
Bangor	86.2	52.4	76.9	73.9	90.0	100.0	95.8	95.0	90.0	100.0
Cardff	4.9	0.0	2.4	6.7	7.9	0.6	73.5	96.7	80.9	93.5
Clwyd	45.5	84.2	83.3	100.0	85.7	89.5	83.3	90.0	100.0	92.3
Swanse	97.3	94.8	89.8	98.0	87.5	98.1	95.7	82.6	94.9	93.9
Wrexm	22.7	69.2	100.0	95.7	92.6	100.0	95.7	87.0	97.4	100.0
England	**37.8**	**36.9**	**38.9**	**58.8**	**63.4**	**64.5**	**64.7**	**60.5**	**59.6**	**57.9**
N Ireland	**31.7**	**20.4**	**40.8**	**89.3**	**84.6**	**90.7**	**75.2**	**81.5**	**80.0**	**79.2**
Scotland	**44.8**	**99.8**	**98.1**	**99.0**	**99.3**	**98.5**	**98.4**	**90.6**	**82.4**	**91.9**
Wales	**43.8**	**36.3**	**47.6**	**53.3**	**48.6**	**50.6**	**84.8**	**91.2**	**89.2**	**94.5**
UK	**38.6**	**42.2**	**44.9**	**62.9**	**66.6**	**67.1**	**69.1**	**65.3**	**63.6**	**63.2**

Blank cells: centres with either less than 10 patients or no data contribution to the UKRR for that year

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UK Renal Registry 20th Annual Report: Chapter 6 Adequacy of Haemodialysis in UK Adult Patients in 2016: National and Centre-specific Analyses

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Adequacy · Haemodialysis · Urea reduction ratio

Summary

- Data regarding the urea reduction ratio (URR) were available for analysis from 63 renal centres and 74% of the prevalent haemodialysis (HD) population in the UK.
- Fifty-one centres provided URR data on more than 90% of prevalent HD patients.
- The proportion of patients in the UK who met the Renal Association (RA) clinical practice guideline for URR (>65%) has been stable between 88–89% since 2011.
- The median URR has been stable over the same period (75%).
- There was persistent variation observed between centres, 15 centres attaining the RA clinical practice guideline in >90% of patients and 42 centres attaining the guideline in 70–90% of patients.
- Over 95% of the prevalent HD population received dialysis three times a week but 26% did less than four hours per session.
- Median URR was similar between patients irrespective of dialysis session duration.

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Introduction

Measures of dialyser urea clearance have been the basis for assessing dialysis adequacy since the National Co-operative Dialysis Study (NCDS) [1]. Observational studies have shown that the minimum amount of dialysis a patient receives affects mortality although higher urea clearance targets in randomised clinical trials have not been shown to improve survival [2–4]. Of the two commonly used measures of dialyser urea clearance, the UK Renal Registry (UKRR) has historically reported the urea reduction ratio (URR), the percentage fall in serum urea following a mid-week dialysis session. Whilst the alternative Kt/V is a better method for measuring dialysis dose because it takes account of the size of a patient and urea removal by ultrafiltration, it requires data items not routinely collected by all UK renal centres [5–6]. URR is the most commonly used measure of urea clearance in dialysis centres in Europe in daily practice [7] and predicts minimum dialysis dose in the majority of patients consistently with Kt/V [8]. Both measures can be influenced by failure to adhere to standardised sampling techniques and by urea rebound at the end of dialysis [9, 10].

The direct toxicity of urea and the extent to which dialyser urea clearance reflects the removal of other azotaemic toxins which may have greater impact on patient outcomes remains under debate. Increasing use of alternative dialysis regimens to the paradigm of thrice weekly short dialysis sessions upon which urea clearance models were developed may further challenge their validity as measures of dialysis adequacy in the future [11]. Despite such uncertainties, measures of urea clearance currently remain the basis for assessing dialysis adequacy in international guidelines which remain remarkably uniform in the minimum recommended amounts of dialyser urea clearance [12–14].

The UK Renal Registry (UKRR) collects data on patients with established renal failure (ERF) receiving haemodialysis (HD) from renal centres in England, Wales and Northern Ireland as well as from Scotland via the Scottish Renal Registry. This enables UK renal centres to compare performance to each other, to the national average and to the attainment of the minimum dose of HD, as defined by URR, in the Renal Association (RA) guidelines on dialysis adequacy.

Table 6.1 lists the current Renal Association audit measures relevant to haemodialysis patients and whether the audit measure is currently reported in the UKRR annual report [12]. Updated RA haemodialysis guidelines are due to be published in 2018.

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 [12].

Table 6.1. Summary of recommended Renal Association audit measures relevant to haemodialysis adequacy

Haemodialysis adequacy RA audit measure	Included in UKRR annual report?	Reason for non-inclusion
The proportion of patients in the main renal centre and its satellite units who are on twice weekly haemodialysis	Partly	Varying levels of reporting between centres
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	
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
The proportion of thrice weekly haemodialysis sessions which have prescribed treatment times less than four hours	Yes	
The proportion of hospital (main and satellite unit) and home haemodialysis patients who are prescribed more frequent than thrice weekly haemodialysis	Partly	Not for home haemodialysis patients

Methods

Seventy renal centres in the UK submitted data electronically to the UKRR on a quarterly basis. Cambridge renal centre (Addenbrooke's) was unable to submit 2015 and 2016 data at patient level prior to the UKRR closing date for data submission but provided summary numbers of patients starting RRT by treatment modality. This centre is therefore excluded from most analyses in this chapter. The majority of UK 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 30 September 2016. The UKRR electronically receive quarterly data extracts with the latest available result for each quarter, from renal centres in England, Wales and Northern Ireland (E,W&NI). Data from Scotland were provided by the Scottish Renal Registry (SRR). For this analysis, data for URR were taken from the 3rd quarter of 2016 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 September 30 2016. 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 2015. 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 for one year and the last recorded URR in the quarter after one-year follow-up was used for this analysis.

From 2015, quarterly HD sessional data as specified in version 4.2 of the UKRR renal dataset were increasingly being returned by many renal centres. It is hoped that in future, the number of dialysis sessions per week and time per dialysis session data can be augmented using these data items. Two centres, London Guys and Stevenage only returned these data items within the HD sessional data; hence data for these items were fully retrieved from the HD sessional data. However, the quality of the sessional data varied across centres and therefore was not used to augment quarterly data for the remaining centres at this time.

Data from patients known to be receiving more than or less than thrice weekly HD were omitted from the analysis for both the incident and prevalent population. Patients who had missing data for the number of dialysis sessions per week 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 the 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, the UK countries as well as for the UK 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 ten 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 [12] 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 [12].

The data were analysed using SAS 9.3.

Results

Data completeness

Sixty three of the 71 UK renal centres submitted HD dose (URR) data to the UKRR (table 6.2). Data were available for 73.7% ($N = 15{,}501$) of the total prevalent population ($N = 21{,}041$) treated with HD who met the inclusion criteria for these analyses.

Fifty-one centres reported URR data on more than 90% of their patients. Six centres reported URR data on less than 50% of prevalent patients (Carshalton,

Table 6.2. Percentage completeness of URR data returns for prevalent patients on HD by centre, on 30/9/2016

Centre	*N*	% completeness	Centre	*N*	% completeness
England					
B Heart	333	99.7	Sheff	497	94.2
B QEH	884	99.7	Shrew	165	1.2
Basldn	134	96.3	Stevng	399	98.5
Bradfd	214	99.5	Sthend	87	98.9
Brightn	374	99.5	Stoke	279	93.9
Bristol	441	100.0	Sund	199	1.5
Camb	0	0.0	Truro	132	89.4
Carlis	86	100.0	Wirral	146	96.6
Carsh	745	0.3	Wolve	270	88.2
Chelms	110	94.6	York	151	100.0
Colchr	113	92.9			
Covnt	338	96.2	**N Ireland**		
Derby	181	99.5	Antrim	111	96.4
Donc	171	95.9	Belfast	161	98.8
Dorset	254	91.7	Newry	69	79.7
Dudley	162	95.7	Ulster	94	100.0
Exeter	396	100.0	West NI	100	100.0
Glouc	222	100.0			
Hull	302	99.3	**Scotland**		
Ipswi	122	0.0	Abrdn	186	99.5
Kent	358	98.9	Airdrie	181	97.8
L Barts	952	0.0	D & Gall	39	97.4
L Guys	571	98.1	Dundee	167	98.8
L Kings	521	0.0	Edinb	256	99.2
L Rfree	636	0.0	Glasgw	528	100.0
L St.G	312	0.0	Inverns	76	98.7
L West	1,348	88.4	Klmarnk	111	100.0
Leeds	422	100.0	Krkcldy	131	100.0
Leic	788	99.5			
Liv Ain	152	0.0	**Wales**		
Liv Roy	262	0.0	Bangor	59	100.0
M RI	431	2.6	Cardff	429	99.8
Middlbr	293	100.0	Clwyd	66	98.5
Newc	264	23.1	Swanse	310	99.4
Norwch	291	99.0	Wrexm	103	96.1
Nottm	323	91.6			
Oxford	379	98.9	**England**	**17,864**	**69.2**
Plymth	121	96.7	**N Ireland**	**535**	**96.3**
Ports	479	99.4	**Scotland**	**1,675**	**99.3**
Prestn	500	81.4	**Wales**	**967**	**99.2**
Redng	280	15.4	**UK**	**21,041**	**73.7**
Salford	274	66.4			

Manchester RI, Newcastle, Reading, Shrewsbury, Sunderland). URR data were not received from eight centres (Cambridge, Ipswich, London St Bartholomew's, London Kings, London Royal Free, London St Georges, Liverpool Aintree, Liverpool Royal Infirmary).

There was little change in the overall completeness of URR data submitted to the UKRR from most centres in 2016 compared with 2015, with an average change of 1.2% (range: −5.4% to 88.4%). Any centre change may have occurred due to changes in computerised data bases and data extraction, or by centres moving to online Kt/V, or total Kt/Vurea including residual renal urea clearance rather than URR as the preferred measure of haemodialysis dose.

Eleven centres did not provide data on frequency of dialysis sessions, and 49 centres provided data on

>90% of patients (table 6.3). Eleven centres did not provide data on dialysis session times, and 45 centres provided data on >90% of patients (table 6.4). In those centres not returning data, there appeared to be a common IT provider and locally collected data was not received by the UKRR. Ways of overcoming this problem in the future are being sought.

Of the total incident patient population ($N = 4,879$) who started HD during 2015 and meeting the inclusion criteria for URR analyses, 47.0% ($N = 2,298$) had URR data available during the first quarter of treatment (data not shown). This was an increase from 43% in the 2014 incident population. Eight centres did not provide data for the first quarter of treatment, and 41 centres provided data on >90% of incident patients during the first year.

Achieved URR

The median URR for prevalent HD patients was 75% but ranged between centres from 69–82% (figure 6.1a). There was evidence that the median URR for female HD patients at 78% (centre range 73–85%) (figure 6.1b) was greater than that of male HD patients, with a median URR at 74% (centre range 68–80%) (figure 6.1c).

There was evidence that the median sessional URR was lower for patients aged <70 years (median 75%) compared to older patients ⩾70 years (median 76%). Similarly, the median sessional URR was lower for both genders in the younger age group (<70 years) compared to the older age group (⩾70 years of age): median URR of 77% for females <70 years of age compared to a median URR of 78% for female patients aged ⩾70 years. Similarly, for male patients aged <70 years of age the median URR of 73% was lower than for male patients aged ⩾70 years (median URR 74%).

The current UK RA clinical guideline target is to achieve a minimum sessional URR of 65%, and this was achieved in 87.5% of HD prevalent patients (centre range 70.8–95.7%) (figure 6.2). A higher number of female patients achieved this minimum target (92.1%,

Table 6.3. Number of dialysis sessions for prevalent patients on HD by centre, on 30/9/2016

Centre	*N*	% completeness	%		
			<3 sessions	3 sessions	>3 sessions
England					
B Heart	362	79.0	9.4	89.9	0.7
B QEH	884	0.0			
Basldn	149	95.3	1.4	89.4	9.2
Bradfd	222	100.0	3.2	96.4	0.5
Brightn	378	99.5	0.5	98.9	0.5
Bristol	460	100.0	3.5	95.9	0.7
Carlis	88	97.7	2.3	97.7	0.0
Carsh	755	99.7	1.1	98.7	0.3
Chelms	124	100.0	8.9	88.7	2.4
Colchr	113	98.2	0.0	100.0	0.0
Covnt	338	2.1			
Derby	181	43.1			
Donc	173	98.3	0.6	98.8	0.6
Dorset	259	99.6	1.9	98.1	0.0
Dudley	166	89.2	2.7	97.3	0.0
Exeter	415	99.8	3.9	95.4	0.7
Glouc	222	0.0			
Hull	302	0.3			
Ipswi	133	100.0	8.3	91.7	0.0
Kent	371	98.9	1.4	96.5	2.2
L Barts	952	0.0			
L Guys	600	99.2	3.9	95.1	1.0
L Kings	521	100.0	0.0	100.0	0.0
L Rfree	636	0.0			
L St.G	315	97.1	1.0	99.0	0.0
L West	1,365	63.5	1.0	98.0	0.9
Leeds	458	99.6	7.9	92.1	0.0
Leic	796	99.5	1.0	99.0	0.0

Table 6.3. Continued

Centre	*N*	% completeness	% <3 sessions	% 3 sessions	% >3 sessions
Liv Ain	155	99.4	0.6	98.1	1.3
Liv Roy	306	97.4	0.3	85.2	14.4
M RI	436	35.3			
Middlbr	294	23.5			
Newc	271	100.0	1.1	97.4	1.5
Norwch	298	99.7	1.0	97.6	1.3
Nottm	344	99.7	0.6	93.9	5.5
Oxford	379	100.0	0.0	100.0	0.0
Plymth	121	0.0			
Ports	523	99.0	5.0	91.5	3.5
Prestn	500	0.0			
Redng	280	97.9	0.0	100.0	0.0
Salford	329	99.7	1.5	83.2	15.2
Sheff	514	99.8	3.3	96.7	0.0
Shrew	174	100.0	3.4	94.8	1.7
Stevng	466	99.2	13.0	85.5	1.5
Sthend	107	99.1	18.9	81.1	0.0
Stoke	290	98.3	2.1	96.1	1.8
Sund	216	100.0	0.9	92.1	6.9
Truro	145	91.0	6.8	90.2	3.0
Wirral	165	97.0	0.6	88.1	11.3
Wolve	270	7.0			
York	161	85.7	0.0	92.8	7.2
N Ireland					
Antrim	111	96.4	0.0	100.0	0.0
Belfast	164	98.2	0.6	98.1	1.2
Newry	76	100.0	9.2	90.8	0.0
Ulster	99	100.0	3.0	94.9	2.0
West NI	111	99.1	1.8	90.0	8.2
Scotland					
Abrdn	204	98.0	1.5	91.0	7.5
Airdrie	182	91.2	0.6	99.4	0.0
D & Gall	45	95.6	2.3	86.0	11.6
Dundee	172	97.7	0.0	97.0	3.0
Edinb	261	92.7	0.8	97.9	1.2
Glasgw	534	93.6	0.4	98.8	0.8
Inverns	80	98.8	1.3	94.9	3.8
Klmarnk	113	94.7	0.0	98.1	1.9
Krkcldy	135	96.3	1.5	96.9	1.5
Wales					
Bangor	59	0.0			
Cardff	429	0.0			
Clwyd	66	0.0			
Swanse	310	0.0			
Wrexm	103	0.0			
England	**18,482**	**70.2**	**2.8**	**95.2**	**2.0**
N Ireland	**561**	**98.6**	**2.4**	**95.3**	**2.4**
Scotland	**1,726**	**94.7**	**0.7**	**96.9**	**2.4**
Wales	**967**	**0.0**	**0.0**	**0.0**	**0.0**
UK	**21,736**	**69.7**	**2.6**	**95.4**	**2.0**

Blank cells denote no data returned by the centre or <10 patients in the renal centre or data completeness was <50%

Table 6.4. Time per dialysis session for prevalent patients on HD by centre, on 30/9/2016

Centre	*N*	% completeness	% per dialysis session		
			<4 hours	4–5 hours	>5 hours
England					
B Heart	333	77.8	14.3	85.7	0.0
B QEH	884	0.0			
Basldn	134	94.8	37.0	63.0	0.0
Bradfd	214	99.1	25.9	74.1	0.0
Brightn	374	97.9	7.1	92.9	0.0
Bristol	441	100.0	24.0	76.0	0.0
Carlis	86	97.7	8.3	91.7	0.0
Carsh	745	98.5	11.2	88.4	0.4
Chelms	110	100.0	40.0	60.0	0.0
Colchr	113	98.2	0.9	99.1	0.0
Covnt	338	3.6			
Derby	181	43.1			
Donc	171	98.3	24.4	75.6	0.0
Dorset	254	100.0	8.7	91.3	0.0
Dudley	162	88.9	14.6	85.4	0.0
Exeter	396	100.0	51.0	49.0	0.0
Glouc	222	0.0			
Hull	302	1.3			
Ipswi	122	100.0	10.7	89.3	0.0
Kent	358	99.7	56.6	43.4	0.0
L Barts	952	0.0			
L Guys	571	99.1	30.9	68.9	0.2
L Kings	521	100.0	39.0	61.0	0.0
L Rfree	636	0.0			
L St.G	312	87.5	4.4	95.6	0.0
L West	1,348	63.5	18.5	79.6	2.0
Leeds	422	100.0	20.9	79.1	0.0
Leic	788	78.3	9.9	86.7	3.4
Liv Ain	152	100.0	21.7	78.3	0.0
Liv Roy	262	99.2	8.5	91.2	0.4
M RI	431	34.6			
Middlbr	293	100.0	38.6	61.4	0.0
Newc	264	100.0	18.6	79.9	1.5
Norwch	291	99.7	58.3	41.7	0.0
Nottm	323	99.7	6.2	93.8	0.0
Oxford	379	100.0	29.6	70.4	0.0
Plymth	121	0.0			
Ports	479	0.0			
Prestn	500	0.2			
Redng	280	96.8	19.9	80.1	0.0
Salford	274	95.3	13.4	86.6	0.0
Sheff	497	88.7	84.8	15.0	0.2
Shrew	165	100.0	44.8	55.2	0.0
Stevng	399	99.5	81.4	18.6	0.0
Sthend	87	98.9	48.8	51.2	0.0
Stoke	279	100.0	11.8	88.2	0.0
Sund	199	83.9	21.6	78.4	0.0
Truro	132	97.0	65.6	33.6	0.8
Wirral	146	100.0	25.3	74.0	0.7
Wolve	270	7.0			
York	151	85.4	10.9	89.1	0.0

Table 6.4. Continued

Centre	*N*	% completeness	% per dialysis session		
			<4 hours	4–5 hours	>5 hours
N Ireland					
Antrim	111	97.3	14.8	85.2	0.0
Belfast	161	100.0	16.8	83.2	0.0
Newry	69	100.0	52.2	47.8	0.0
Ulster	94	100.0	12.8	87.2	0.0
West NI	100	99.0	58.6	41.4	0.0
Scotland					
Abrdn	186	98.4	5.5	92.3	2.2
Airdrie	181	98.9	13.4	83.8	2.8
D & Gall	39	100.0	20.5	79.5	0.0
Dundee	167	97.6	7.4	92.0	0.6
Edinb	256	92.6	38.4	61.6	0.0
Glasgw	528	99.4	6.5	89.1	4.4
Inverns	76	98.7	17.3	82.7	0.0
Klmarnk	111	92.8	0.0	93.2	6.8
Krkcldy	131	96.2	27.0	73.0	0.0
Wales					
Bangor	59	0.0			
Cardff	429	0.0			
Clwyd	66	0.0			
Swanse	310	0.0			
Wrexm	103	0.0			
England	**17,864**	**66.2**	**27.5**	**72.1**	**0.4**
N Ireland	**535**	**99.3**	**28.1**	**71.9**	**0.0**
Scotland	**1,675**	**97.3**	**13.9**	**83.7**	**2.5**
Wales	**967**	**0.0**			
UK	**21,041**	**66.5**	**25.9**	**73.4**	**0.7**

Blank cells denote no data returned by the centre or <10 patients in the renal centre or data completeness was <50%

centre range 76.0–100.0%) compared to male patients (84.6%, centre range 67.5–95.3%).

Changes in URR over time

From 2002 there was an initial progressive increase in the percentage of patients achieving the current RA clinical practice guidelines (URR >65%) until 2011, after which it has plateaued around 88% (figure 6.3). Similarly, the median URR in UK haemodialysis patients rose from 71% to stabilise at 75% since 2011.

Variation of achieved URR with time on dialysis

The proportion of patients who attained the UK RA clinical guideline for URR was greater for those who had been treated by haemodialysis for two years or longer compared to those who had been dialysing for <6 months (figure 6.4). For all strata of dialysis vintage, marked improvement in the proportion of patients receiving the sessional target dose of haemodialysis has plateaued in recent years.

Changes in URR for incident patients

The median sessional URR during the first quarter after starting haemodialysis treatment in the UK was 67.0% (centre range 58.5–76.0%) (figure 6.5a) for incident HD patients in 2015. At the end of one-year follow-up, the median URR had increased to 73.0% (centre range 68.0–83.0%) (figure 6.5b). More centres are included in the analysis this year due to the threshold for centre inclusion being relaxed to include centres returning data for at least ten patients rather than a minimum of 20 patients.

There was evidence that the median sessional URR during the first three months after starting haemodialysis

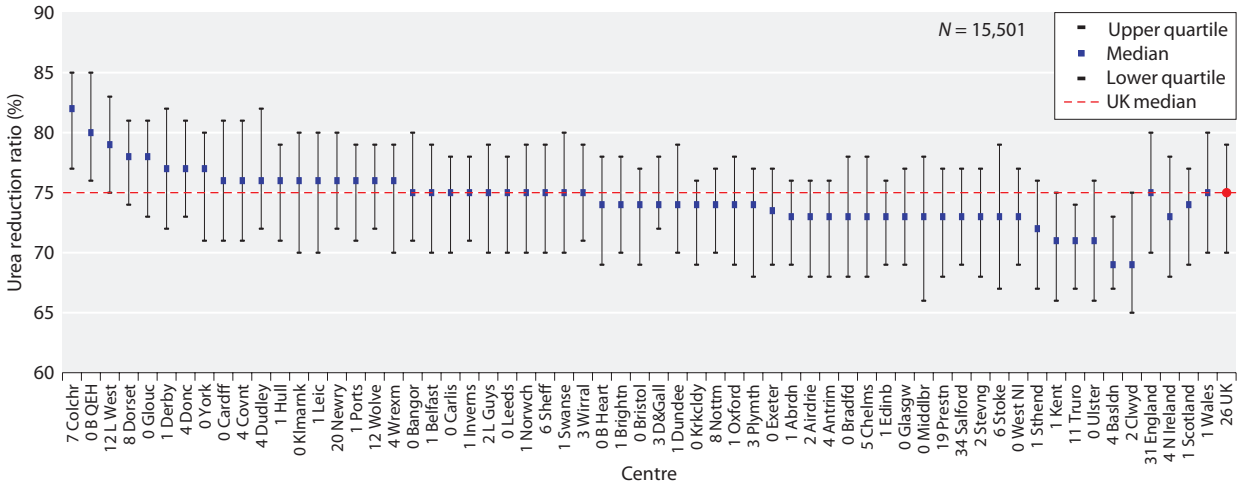

Fig. 6.1a. Median URR achieved in prevalent patients on HD by centre, 30/9/2016

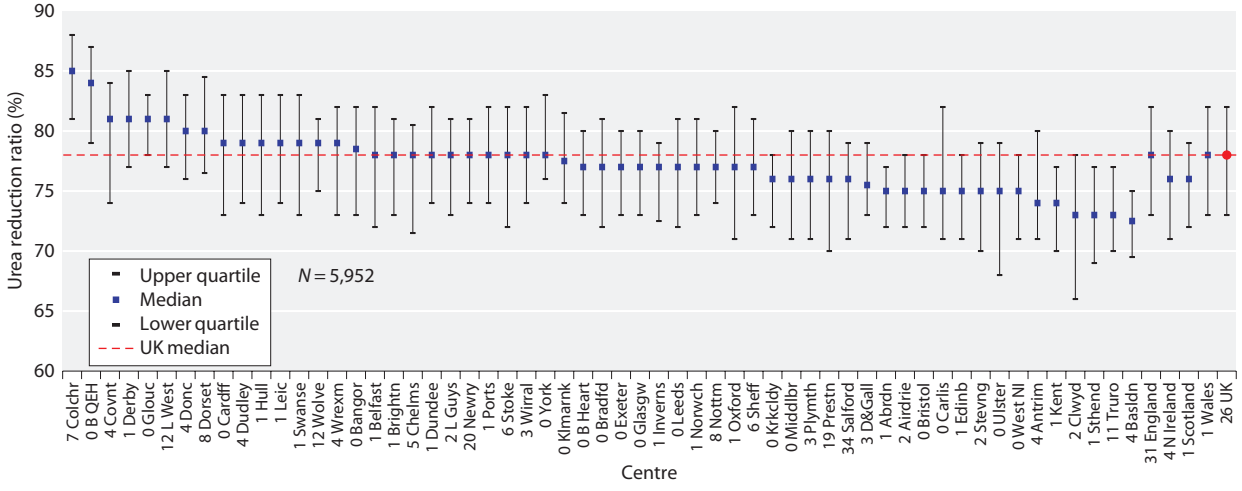

Fig. 6.1b. Median URR achieved in female prevalent patients on HD by centre, 30/9/2016

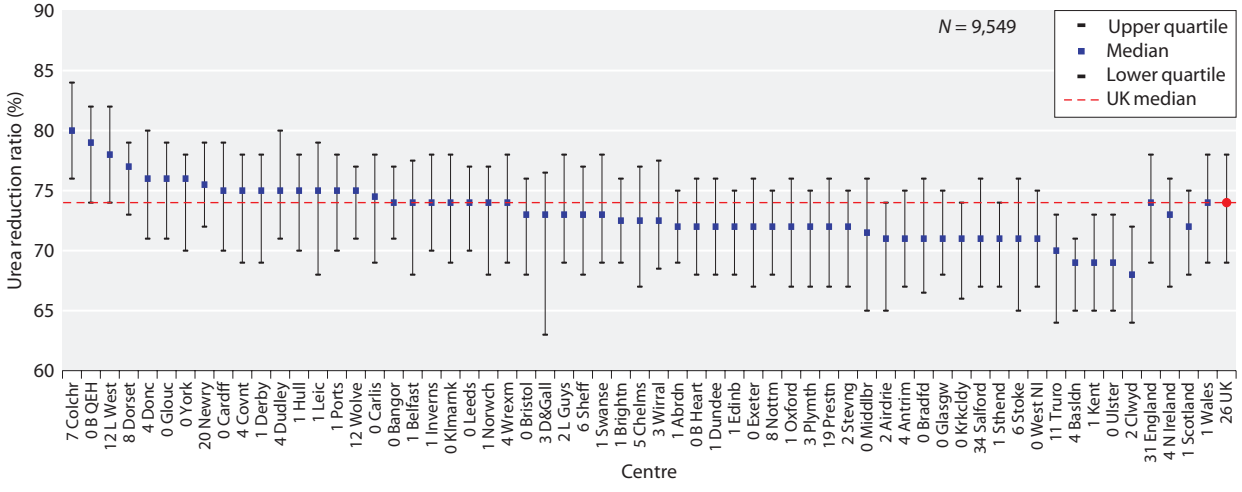

Fig. 6.1c. Median URR achieved in male prevalent patients on HD by centre, 30/9/2016

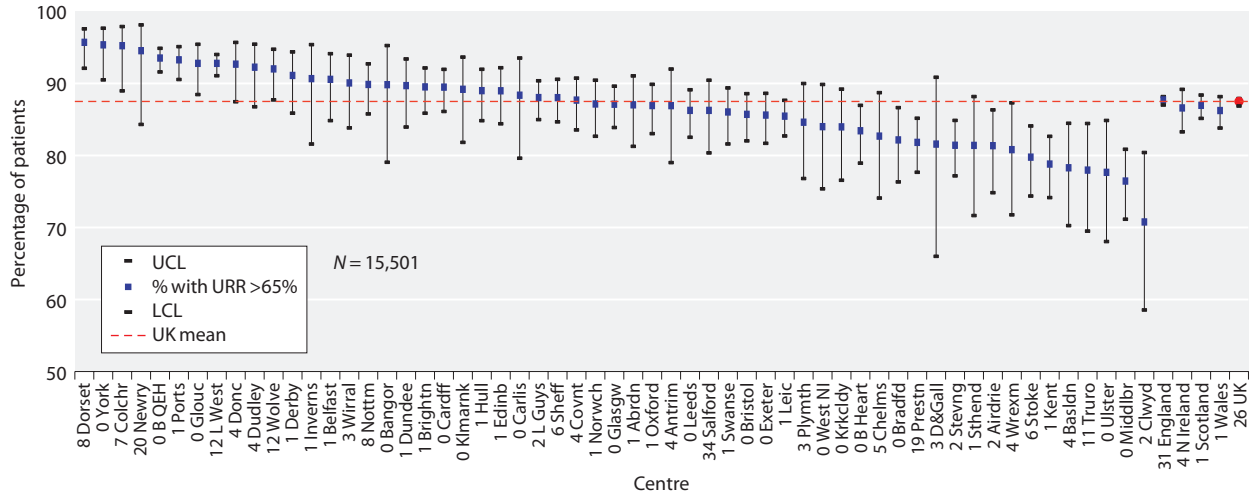

Fig. 6.2. Percentage of prevalent patients on HD with URR >65% by centre, 30/9/2016

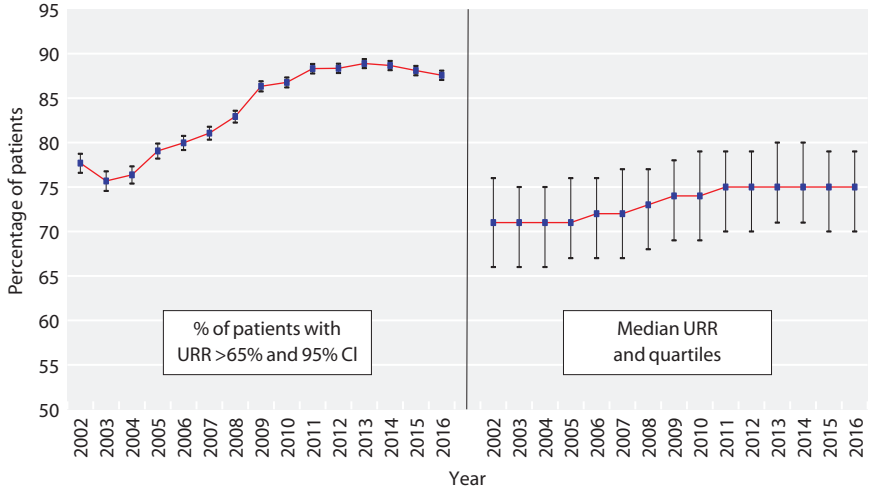

Fig. 6.3. Change in the percentage of prevalent patients on HD with URR >65% and the median URR between 2002 and 2016

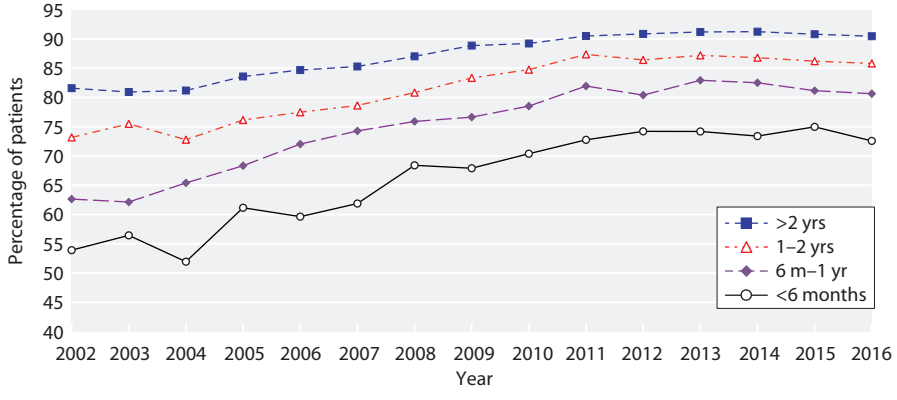

Fig. 6.4. Percentage of prevalent patients on HD achieving URR >65% by time on RRT between 2002 and 2016

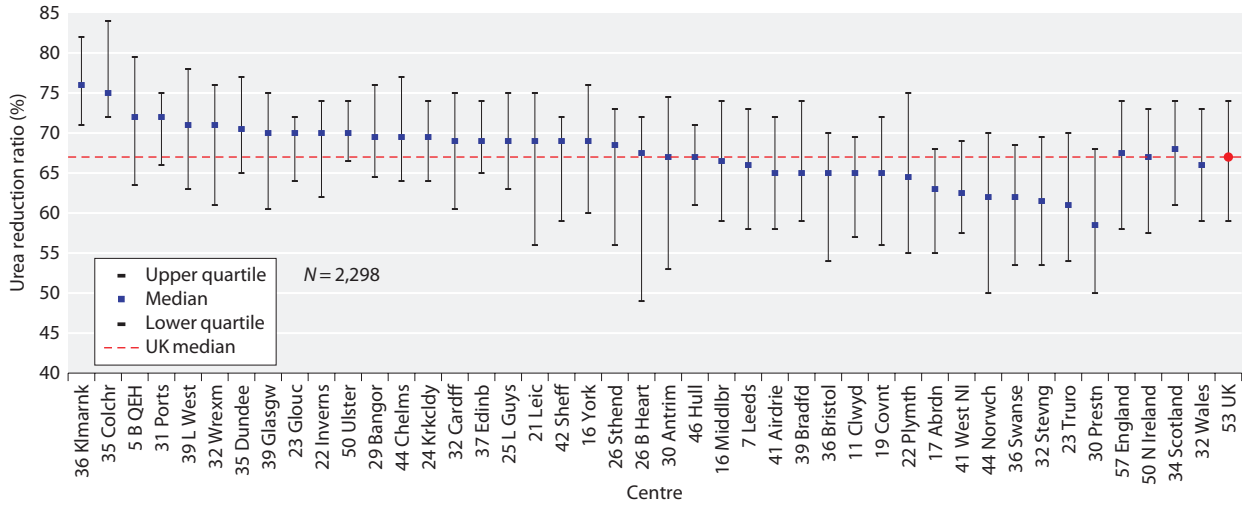

Fig. 6.5a. Median URR in the first quarter of starting RRT in incident patients who started HD in 2015

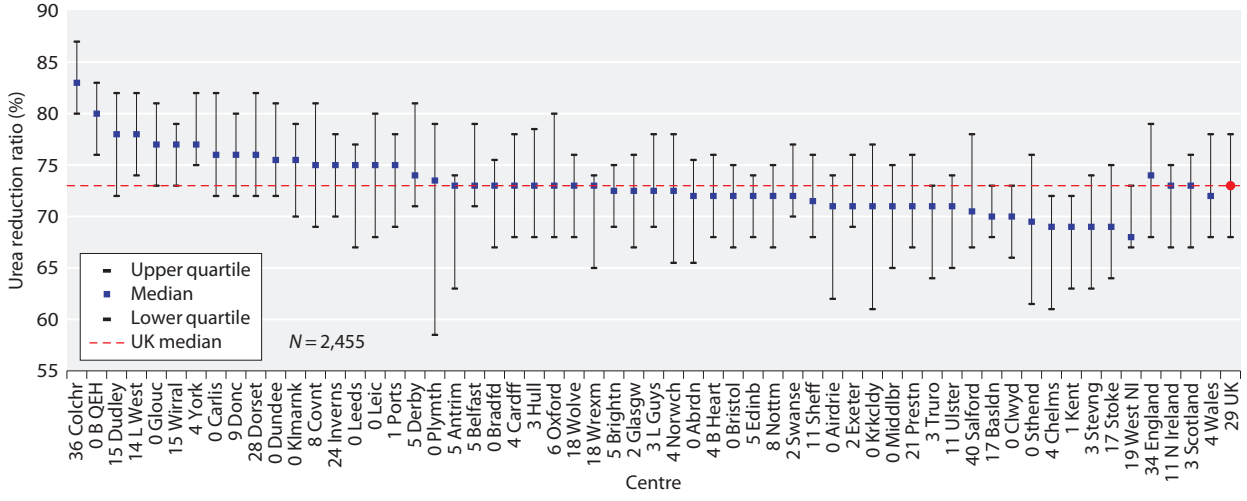

Fig. 6.5b. Median URR one year after starting RRT for incident patients who started HD in 2015

was lower for patients aged <70 years (median URR 66.0%) compared to patients older than ⩾70 years (median URR 69.0%). Similarly, at the end of the first year of haemodialysis the median sessional URR was again lower for patients aged <70 years (median URR 73.0%) versus ⩾70 years of age (median URR 74.0%).

Haemodialysis session duration for prevalent HD patients

For those centres which returned data, the majority of prevalent patients (73.4%) dialysed between 4–5 hours, with 25.9% dialysing less than four hours per session, and only 0.7% dialysing for more than five hours (table 6.4). However, there were marked differences between centres, with between 1–85% of patients reported to be dialysing less than four hours. Median URR was similar for patients dialysing longer (⩾4 hours) versus shorter dialysis sessions (<4 hours).

Haemodialysis session frequency for prevalent HD patients

Dialysis frequency data were available for 69.7% of patients (table 6.3) in 2016 compared with 68.7% in 2015. Although 95.4% of all prevalent haemodialysis patients dialysed thrice weekly, there were marked differences in centre practices. Centres reported dialysing between 0.0–18.9% of patients twice weekly or less, and between 0.0–15.2% more than thrice weekly. Two centres

reported dialysing >10% of patients less than thrice weekly and four centres more often than thrice weekly. The sessional URR was lower with lower dialysis frequency (median URR 71.6% for prevalent HD patients dialysing <3 times per week versus a median URR of 75.0% for patients dialysing ⩾3 times per week).

Discussion

Haemodialysis is a life-sustaining treatment for patients with end stage kidney disease. In addition to the clearance of azotaemic toxins, the dialysis prescription encompasses volume control, maintenance of acid-base status and mono- and di-valent ion homeostasis. Dialysis adequacy is defined in the current RA and international clinical guidelines by dialyser urea clearance. Target dialyser urea clearance of 70% is recommended to consistently achieve the minimum URR of >65% in as many patients as possible [12–14]. A minimum dialysis adequacy appears to be necessary for patient well-being [1], but the benefits of higher clearance and the optimal dialysis dose have not been well defined [2–5]. The older, more comorbid demographic of the current dialysis cohort may differ from previously studied populations although UKRR data has consistently, somewhat paradoxically, shown higher sessional urea clearance amongst older patients [15–17]. Muscle mass declines with age [15], and dialysis patients with less muscle mass are less physically active [16] and have lower energy expenditure [17]. So, one may have expected higher dialyser urea clearances delivered to the younger rather than older patients [18]. This apparent greater dialyser urea clearance in the older patient may be due to a mathematical confounder, in that it is easier to achieve a higher percentage urea clearance in a smaller patient with a lower pre-dialysis serum urea concentration compared to that in a heavier patient with a higher starting urea [19], and this confounder not only affects urea reduction ratio, but also Kt/Vurea [20, 21]. As there is an association between muscle mass and body surface area, then as Kt/Vurea underestimates clearance in patients with increased body mass index, and overestimates clearance in those with smaller body mass index [22], an adjustment for body surface area or energy expenditure may be more appropriate [18, 23].

Men and women differ in size, body composition and in their rates of resting energy expenditure all of which can contribute to lower dialyser urea clearance being needed in women to achieve a higher URR [16, 18]. Observational studies and post hoc analyses of the HEMO study have suggested that women may benefit from a greater dialyser urea clearance than men [24, 25], and for the same urea dialyser clearance women would receive a lower effective clearance [20]. However, neither UK RA nor other clinical guidelines advocate different targets based on gender [12]. It is therefore reassuring that in the UK, the median sessional URR remained higher for women than men to prevent lower dialysis dosing [20].

Following increases in the proportion of UK haemodialysis patients achieving target URR from 2002 until 2010, this has since stabilized around 88% for the prevalent population. Standardised sampling technique and improved haemodialysis technology may have contributed to the earlier improvement [26]. The subsequent plateau in target attainment likely reflects the reality that not all established dialysis patients will consistently achieve the target URR, for example due to poorly functioning vascular access, cardiovascular intolerance on the day of urea sampling, or patients receiving palliative dialysis [21]. However, the marked inter-centre variability in the proportion of patients achieving the URR minimum of >65%, ranging from 70.7–95.7% of patients suggests a centre practice effect. Our current analysis makes no adjustment for centre differences in terms of patient case-mix, patient non-adherence to dialysis session length or practice differences such as high flux dialysis or haemodiafiltration. Residual renal function is not accounted for in the URR calculation and centre practice differences around early versus delayed start dialysis as well as whether centres practice an incremental approach to initiating dialysis may account for some of the differences observed [27]. The effect of residual renal function most likely accounts for the increase in URR observed in the incident haemodialysis patients from the first quarter to the final quarter URR returns, as shown by one centre increasing from <60% to >70%.

In the UK, centres receive sessional payments, initially introduced to encourage more frequent dialysis. However, only some 2% of patients dialysing in England were reported to dialyse more than thrice weekly although there was variation between centres, as four centres reported dialysing over 10% of their patients more frequently. The UK Renal Association clinical guidelines recommend that patients should have thrice weekly dialysis [12], and although on average only around 3% of patients dialysed twice or less frequently, again practice varied markedly with centres reporting a range of 0% to 19%. The UKRR were unable to determine

whether this was due to patient-case mix, centres taking into account residual renal function, or resource limitations; although on enquiry to individual centres it would appear to be a combination of patient-case mix [21], centres measuring residual renal function and practicing incremental dialysis [27].

The UK Renal Association clinical guidelines recommend that patients without residual renal function should dialyse for four hours [12]. Most prevalent patients dialysed between 4–5 hours, however over a quarter (25.9%) dialysed for shorter times (<4 hours) and less than 1% dialysing for longer (>5 hours). Further marked inter-centre variability was noted in session duration with a wide range (0.0–84.8%) of patients dialysing for less than four hours. Twenty six of the 53 centres that provided data on time dialysed (49%), dialysed more than 20% of patients for <4 hours. The guidelines date from a time when low-flux dialysers were the standard, and prior to the improvements in dialyser technology and introduction of other modalities such as haemodiafiltration [26]. However, although greater urea clearance can potentially be achieved with shorter session times, this does not imply that other azotaemic toxins [28–31], as well as sodium would be equally cleared [32]. Once again, the UKRR were unable to determine whether centres with higher proportions of patients having shorter dialysis sessions was due to patient case-mix, patient wishes, intolerance of dialysis, or clinician factors, including considering residual renal function.

The pros and cons of using URR as a measure of dialysis adequacy continue to be debated [11, 21, 30, 31]. It does not account for the clearance of other larger molecules, nor does it reflect other important aspects of dialysis such as session length, volume control, sodium balance and the correction of metabolic acidosis all of which can potentially impact patient outcomes [29, 32]. However, no consensus has yet emerged on alternative markers of HD adequacy [33]. Practically, URR has been relatively simple to collect and the resulting data completeness has made it the easier to analyse for the UKRR.

It is planned to work with centres to ensure dialysis session data can be used to augment the overall data completeness. As data collection expands, Kt/V and dialysis prescription practice will be used to improve the analysis.

Conflicts of interest: the authors declare no conflicts of interest

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UK Renal Registry 20th Annual Report: Chapter 7 Haemoglobin, Ferritin and Erythropoietin in UK Adult Dialysis Patients in 2016: National and Centre-specific Analyses

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Keywords

Anaemia · Chronic kidney disease · Dialysis · End stage renal disease · Epidemiology · Erythropoietin · Erythropoiesis stimulating agent · European Best Practice Guidelines · Ferritin · Haemodialysis · Haemoglobin · NICE · Peritoneal dialysis · Renal Association

Summary

In the UK in 2016:

- The median haemoglobin (Hb) of patients at the time of starting dialysis was 99 g/L with 47% of patients having a Hb ⩾100 g/L.
- The median Hb in patients starting haemodialysis (HD) was 96 g/L (IQR 87–105) and in patients starting peritoneal dialysis (PD) was 108 g/L (IQR 98–116).
- At the start of dialysis, 50% of patients presenting early had Hb ⩾100 g/L compared with only 34% of patients presenting late.
- The median Hb of prevalent patients on HD was 111 g/L (IQR 102–119).
- The median Hb of prevalent patients on PD was 111 g/L (IQR 102–120).
- 80% of prevalent HD patients and 79% of PD patients had Hb ⩾100 g/L.
- 59% of prevalent HD patients and 55% of PD patients had Hb ⩾100 and ⩽120 g/L.
- The median serum ferritin in HD patients was 410 μg/L and 94% of HD patients had a ferritin ⩾100 μg/L.
- The median serum ferritin in PD patients was 306 μg/L and 88% of PD patients had a ferritin ⩾100 μg/L.

In England, Wales and Northern Ireland in 2016:

- The median erythropoiesis stimulating agent (ESA) dose in HD patients was 7,750 IU/week.
- The median ESA dose in PD patients was 4,500 IU/week.

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Introduction

Anaemia is a common complication of chronic kidney disease (CKD). It is associated with morbidity and mortality as well as reduced exercise tolerance and quality of life. Iron therapies and erythropoiesis stimulating agents (ESAs) remain the mainstay of the management of patients with renal anaemia, minimising the need for blood transfusions. This chapter describes analyses of the management of anaemia in dialysis patients in the UK in 2016. The attainment of parameters is compared at a renal centre and national level as well as against national performance measures as set out in the Renal Association (RA) practice guidelines which are published online.

The audit measures applied to the care of dialysis patients in 2016 and recommended in this chapter are taken from the Renal Association Clinical Practice Guideline for Anaemia of CKD (5th edition) published online in 2010 [1]. Table 7.1 lists the audit measures recommended in these guidelines alongside those parameters measured in this chapter and where applicable reasons for exclusion.

In mid-2017, an updated 6th edition of the Renal Association guideline was published [2] which endorses the National Institute for Health and Care Excellence (NICE) guideline for anaemia management in chronic kidney disease 2015 [3]. The recommended haemoglobin targets remain the same although the indices for assessing patient iron status have changed. Specifically, percentage hypochromic red blood cells (HRC) or reticulocyte haemoglobin content (CHr) are recommended as preferable markers of iron deficiency to serum ferritin or transferrin saturation. The impact this will have on both clinical

Table 7.1. Summary of recommended Renal Association audit measures

RA audit measure	Included in UKRR annual report?	Reason for exclusion
1. Proportion of CKD patients with eGFR <30 ml/min by 4 variable MDRD method with an annual Hb level	No	Data not available for the period covered by this report
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	Partly	UKRR reports the completeness of these data items
5. The proportion of CKD stage 4–5 patients with Hb 10–12 g/dl	No	Data not available for the period covered by this report
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	Data not available for the period covered by this report/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

practice and centre reporting through the UKRR remains to be seen. The guidelines acknowledge the practical challenges of measuring HRC due to the need for timely testing on specialist analysers. CHr does not currently form part of the UKRR renal dataset and further work will be undertaken by the UKRR in collaboration with renal centres to explore the ability to report this variable. Internationally, The Kidney Disease Improving Global Outcomes (KDIGO) Clinical Practice Guideline for Anemia in Chronic Kidney Disease was published in August 2012 [4] and is yet to be updated.

Methods

Most of the analyses in this chapter use the incident or prevalent renal replacement therapy (RRT) cohorts for 2016. Some analyses use data from earlier years. 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.

The UKRR extracted quarterly data electronically from renal centres in England, Wales and Northern Ireland (E,W & NI) taking the latest available result from each quarter. Data from Scotland were provided by the Scottish Renal Registry (SRR).

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. Due to possible deficiencies with extract routines it is possible that a small number of the values extracted electronically may actually be from before the person started dialysis. This problem will not occur for Scottish data. 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 these analyses only centres with at least 75% completeness of presentation time data were included.

For the analyses of prevalent dialysis patients those patients receiving dialysis on 31 December 2016 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 measurement for each patient from the last two quarters was used for Hb and from the last three quarters for ferritin.

The completeness of data items were analysed at both centre and country level. 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 ten 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 and 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 were significantly different from the average. Longitudinal analyses were performed to show overall changes in achievement of standards over time.

Erythropoietin data from the last quarter of 2016 were used to define which patients were receiving erythropoietin stimulating agents (ESAs). Scotland was excluded from this analysis due to incomplete data. 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 40% 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 (assumed to be darbepoietin or methoxy polyethylene glycol–epoetin beta) were harmonised with erythropoietin data by calculating a weekly dose and 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). Many centres provided data on ESA dose but not on ESA frequency. The ESA dose field is defined as the weekly dose and the dose is presumed to have been converted accordingly on submission to the UKRR. This may be an incorrect assumption for a number of patients and this needs to be considered when interpreting the ESA information.

Starting with the cohort of patients receiving ESAs in the final quarter of the year 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 was indirect. The three centres in North Wales, namely Wrexham, Bangor and Clwyd used several databases including their renal IT system for ESA data in HD patients and were therefore excluded from the HD ESA analysis.

Cambridge renal centre (Addenbrooke's) was unable to submit their 2016 (and 2015) data at patient level prior to the UKRR closing the database and only provided summary numbers of patients starting RRT by treatment modality. This centre is therefore excluded from most analyses in this chapter.

The data were analysed using SAS 9.3.

Table 7.2. Haemoglobin data for incident patients starting RRT on haemodialysis or peritoneal dialysis during 2016, both overall and by presentation time

	All incident dialysis patients				Early presenters (⩾90 days)		Late presenters (<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	119	96	40	96	42		
B QEH	98	190	99	48	100	51	93	41
Basldn	100	35	95	31	97	37		
Bradfd	88	64	99	48	99	48		
Brightn	100	135	101	51	102	54	97	43
Bristol	100	134	103	72				
Camb	n/a	n/a						
Carlis	100	33	101	55	103	64		
Carsh	100	225	100	51				
Chelms	98	49	102	53	107	64		
Colchr	54	15	95	40				
Covnt	98	101	97	42	96	39	100	50
Derby	99	76	104	57	106	59	97	40
Donc	97	57	97	46	100	53		
Dorset	98	61	100	54	103	61	87	30
Dudley	98	49	94	39	96	41		
Exeter	100	124	103	72	103	75	101	55
Glouc	98	58	101	53	102	58		
Hull	87	74	98	43	99	48		
Ipswi	97	35	95	40				
Kent	100	121	98	45	98	44	101	55
L Barts	100	257	96	38				
L Guys	99	142	91	30	92	32	88	19
L Kings	96	133	97	46	99	49	89	28
L Rfree	98	191	97	46	98	48	91	38
L St.G	77	58	98	47				
L West	89	306	100	50	100	50	100	50
Leeds	90	115	94	32				
Leic	100	254	96	39	98	44	91	24
Liv Ain	96	47	97	47	101	51		
Liv Roy	100	94	102	56	103	61	95	43
M RI	99	167	95	40	97	45	90	24
Middlbr	99	89	96	43	98	44	87	38
Newc	99	109	96	37	96	39	93	21
Norwch	100	86	94	37				
Nottm	96	92	94	40	96	44	85	26
Oxford	99	169	97	44	98	46	92	33
Plymth	98	45	101	56	101	58		
Ports	100	161	102	60				
Prestn	99	115	99	49	100	51	95	40
Redng	100	76	99	46	100	50		
Salford	98	132	99	48				
Sheff	100	137	97	42	98	46	93	29
Shrew	100	54	106	63	107	65	103	55
Stevng	99	144	97	42	98	47	90	25
Sthend	100	43	105	63	105	64		
Stoke	97	87	103	59	103	60		
Sund	99	88	99	49	103	53		
Truro	100	45	103	56	104	59		
Wirral	97	59	101	56	101	54	101	55
Wolve	93	55	102	55	102	53		
York	94	60	95	42	97	45	85	31

Table 7.2. Continued

Centre	All incident dialysis patients				Early presenters (⩾90 days)		Late presenters (<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	95	36	97	39	98	45		
Belfast	99	68	102	62	107	68		
Newry	95	21	99	48	99	44		
Ulster	100	27	102	63	102	68		
West NI	100	34	105	65	104	66		
Scotland								
Abrdn	90	44	98	41				
Airdrie	60	36	93	33				
D&Gall	64	7						
Dundee	76	34	102	56				
Edinb	65	47	107	72				
Glasgw	75	126	98	44				
Inverns	31	5						
Klmarnk	68	34	100	50				
Krkcldy	75	24	97	46				
Wales								
Bangor	100	23	105	74	106	77		
Cardff	99	140	99	49	100	52	90	25
Clwyd	100	12	95	25				
Swanse	100	114	96	39	98	44	88	21
Wrexm	98	46	102	52	102	52		
England	**97**	**5,365**	**98**	**47**	**99**	**49**	**93**	**35**
N Ireland	**98**	**186**	**102**	**56**	**103**	**61**	**91**	**35**
Scotland	**71**	**357**	**99**	**49**				
Wales	**99**	**335**	**99**	**47**	**100**	**51**	**90**	**24**
UK	**95**	**6,243**	**99**	**47**	**100**	**50**	**92**	**34**

n/a – not available
Blank cells – centres excluded from the analysis due to poor data completeness or low patient numbers

Results

Anaemia management in incident dialysis patients

Haemoglobin in incident dialysis patients

As the UKRR does not collect comprehensive data on patients who are not yet receiving RRT, Hb at the time of starting RRT is the only indication of concordance with anaemia clinical practice guidelines in the pre-dialysis (CKD not (yet) on dialysis) group. The percentage data returned and outcome Hb are listed in table 7.2.

The median Hb of patients at the time of starting dialysis in the UK in 2016 was 99 g/L. The median Hb for patients at the time of starting dialysis by renal centre is shown in figure 7.1. The percentage of patients starting dialysis with Hb ⩾100 g/L is shown in figure 7.2. Using data from centres with adequate completeness for date of first presentation the difference in median Hb between early (100 g/L) and late (92 g/L) presenters is shown in table 7.2. These figures are unchanged from the analysis of 2015 incident patients. Of the early presenters, 50% had a Hb ⩾100 g/L compared with 34% of late presenters.

Again, there was a substantial difference between Hb at the time of starting dialysis by modality. Patients starting on HD had a median Hb of 96 g/L (IQR 87–105) whilst those starting on PD had a median Hb of 108 g/L (IQR 98–116). Of HD patients, 40% started dialysis with a Hb ⩾100 g/L compared with 72% of PD patients.

Incident dialysis patients from 2015 were followed for one year and the median haemoglobin and percentage with ⩾100 g/L in survivors on the same treatment at the same centre were calculated for each quarter. Only patients with Hb data for each of the four time points were included in this analysis. Results by modality and length of pre-dialysis care are shown in figures 7.3 and 7.4. The 'PD-late' group consisted of only 38 patients, so care should be taken in interpreting the results.

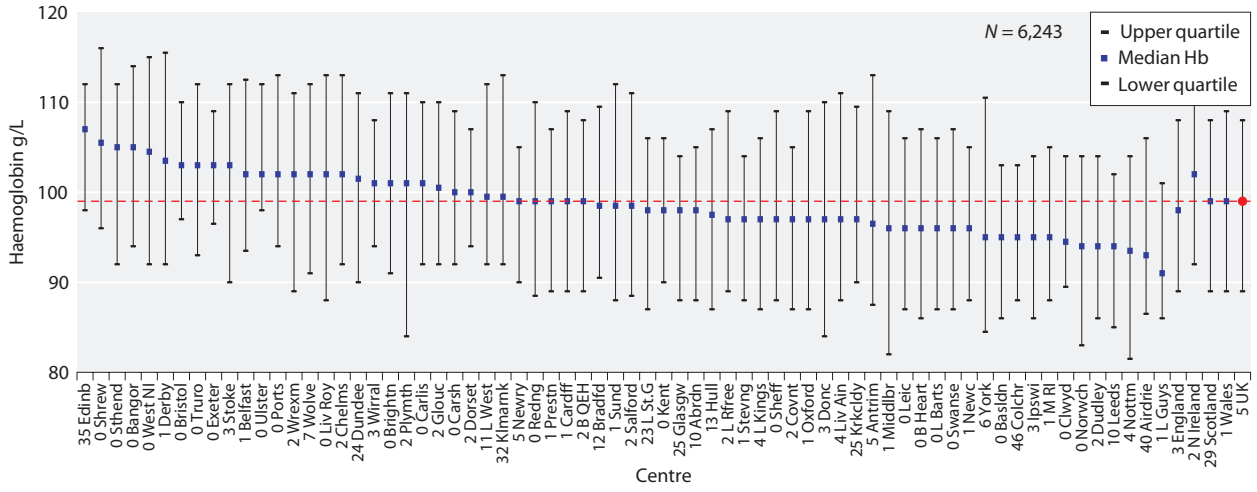

Fig. 7.1. Median haemoglobin for incident dialysis patients at start of dialysis treatment in 2016

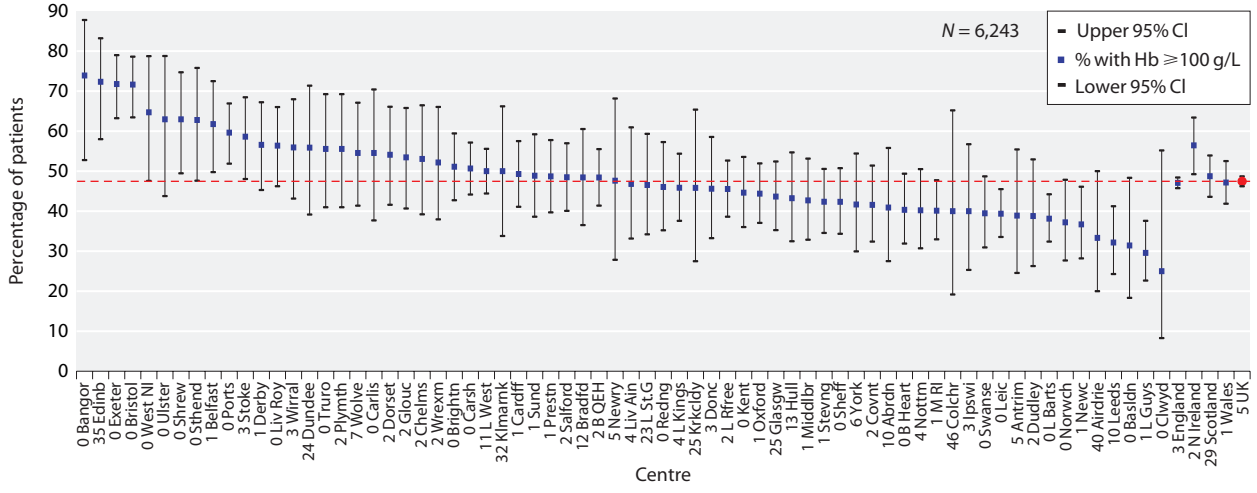

Fig. 7.2. Percentage of incident dialysis patients with Hb ⩾100 g/L at start of dialysis treatment in 2016

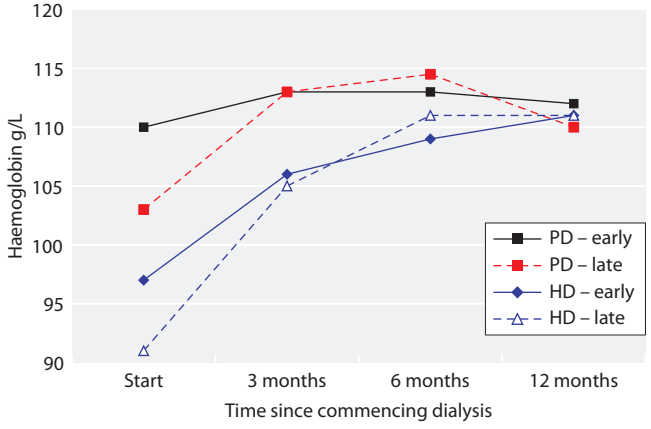

Fig. 7.3. Median haemoglobin, by time on dialysis and length of pre-RRT care, for incident dialysis patients in 2015

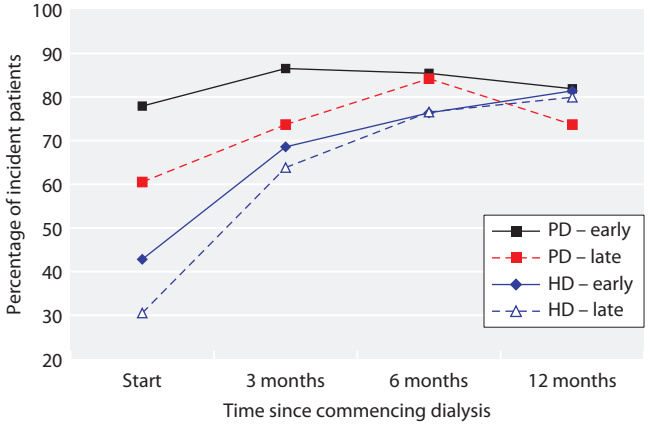

Fig. 7.4. Percentage of incident dialysis patients in 2015 with Hb ⩾100 g/L by time on dialysis and by length of pre-RRT care

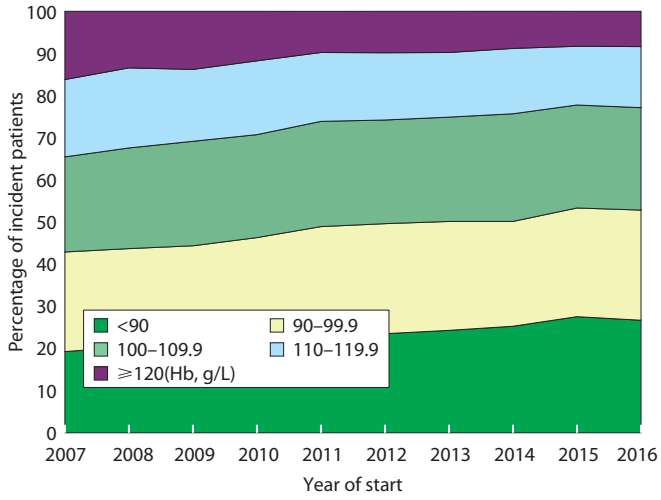

Fig. 7.5. Distribution of haemoglobin in incident dialysis patients by year of start

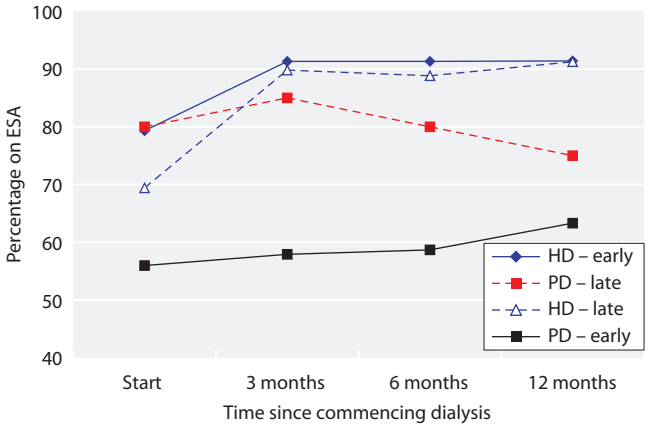

Fig. 7.6. Percentage of incident dialysis patients in 2015 on ESA, by time on dialysis and by length of pre-RRT care

The distribution of Hb ranges in incident dialysis patients by year of start is shown in figure 7.5. The proportion of incident dialysis patients with Hb ⩾120 g/L has fallen from 16.2% in 2007 to 8.4% in 2016. In contrast, the proportion of patients starting dialysis with Hb <100 g/L has increased from 42.9% in 2007 to 52.8% in 2016.

The proportion of patients receiving an ESA by length of time on dialysis for patients starting dialysis in 2015 is shown in figure 7.6. The difference in ESA use between early and late starters was reduced substantially after six months of treatment. Only 20 patients presenting late to dialysis and starting on PD had ESA data, so care should be taken in interpreting this result.

Anaemia management in prevalent dialysis patients

Compliance with data returns for Hb and serum ferritin are shown in table 7.3. Data completeness was generally good for Hb and ferritin. Salford did not submit any ferritin data. Percentages of patients reportedly receiving ESAs are shown in table 7.3. These are as received by the UKRR.

Summary statistics for haemoglobin, serum ferritin and ESA are shown in table 7.4 for HD and 7.5 for PD.

Table 7.3. Percentage completeness of data returns for haemoglobin and serum ferritin and percentages on ESA for prevalent HD and PD patients in 2016

	HD				PD			
Centre	*N*	Hb	Ferritin	% on ESA	*N*	Hb	Ferritin	% on ESA
England								
B Heart	373	100	98	82	72	100	94	68
B QEH	938	100	100	92	125	100	100	67
Basldn	150	98	98	92	30	100	100	87
Bradfd	228	100	100	94	22	100	100	95
Brightn	419	100	99	88	56	98	93	4
Bristol	470	100	100	93	42	100	95	79
Carlis	88	100	100	76	31	100	100	65
Carsh	774	100	99	3	101	94	87	0
Chelms	118	100	100	94	27	89	89	63
Colchr	110	83	85	0				
Covnt	346	100	100	81	59	98	97	68
Derby	227	100	100	0	71	100	99	0
Donc	177	100	100	90	25	100	100	60
Dorset	263	100	100	91	33	100	85	70
Dudley	185	100	100	3	48	100	81	2

Table 7.3. Continued

	HD				PD			
Centre	*N*	Hb	Ferritin	% on ESA	*N*	Hb	Ferritin	% on ESA
Exeter	423	100	100	92	73	100	100	73
Glouc	228	100	98	87	33	100	91	45
Hull	302	100	100	56	61	100	100	66
Ipswi	136	99	99	60	33	100	100	0
Kent	387	100	99	93	43	98	95	53
L Barts	955	100	100	0	179	98	89	0
L Guys	644	100	99	0	32	100	94	0
L Kings	545	100	99	91	75	100	100	79
L Rfree	653	100	99	0	138	99	97	0
L St.G	324	97	95	0	37	97	97	0
L West	1,378	92	91	0	85	93	92	0
Leeds	485	100	100	94	36	100	100	75
Leic	882	100	100	97	70	99	96	76
Liv Ain	175	97	97	0	23	100	100	0
Liv Roy	343	98	99	0	64	98	98	0
M RI	487	94	85	0	49	98	96	0
Middlbr	310	100	99	69	22	100	91	55
Newc	287	100	100	81	46	100	100	0
Norwch	302	99	100	93	41	100	100	78
Nottm	365	100	100	88	67	99	100	78
Oxford	401	100	100	92	80	100	99	79
Plymth	128	99	98	0	31	100	97	0
Ports	583	100	99	6	67	99	99	3
Prestn	531	100	96	94	35	100	94	80
Redng	288	100	99	87	44	100	98	5
Salford	362	100	0	29	90	99	0	72
Sheff	578	100	100	90	47	100	100	62
Shrew	189	100	100	1	29	100	100	0
Stevng	491	100	97	93	16	100	94	56
Sthend	109	100	100	95	24	100	100	58
Stoke	322	99	98	0	71	100	99	0
Sund	223	100	83	90	17	100	94	59
Truro	156	100	100	0	17	100	82	0
Wirral	179	99	99	87	15	100	100	87
Wolve	294	99	99	83	64	95	91	64
York	181	100	100	87	27	100	100	67
N Ireland								
Antrim	115	100	99	90	14	100	100	79
Belfast	185	99	100	95	22	100	100	86
Newry	80	96	100	90	19	100	100	68
Ulster	96	100	100	93	5	100	100	80
West NI	118	100	100	93	9	100	100	89
Scotland								
Abrdn	218	100	97		19	100	95	
Airdrie	173	100	100		21	100	95	
D&Gall	47	100	100		10	100	80	
Dundee	166	98	98		13	100	92	
Edinb	269	100	100		31	100	100	
Glasgw	537	100	99		43	100	100	
Inverns	85	82	74		9	44	56	
Klmarnk	128	100	99		28	100	96	
Krkcldy	135	100	99		15	100	93	

Table 7.3. Continued

	HD				PD			
Centre	*N*	Hb	Ferritin	% on ESA	*N*	Hb	Ferritin	% on ESA
Wales								
Bangor*	68	100	100		15	100	100	33
Cardff	481	100	100	40	67	100	84	34
Clwyd*	68	100	100		14	100	100	57
Swanse	343	100	100	89	58	100	98	60
Wrexm*	113	100	100		28	100	100	39
England	**19,492**	**99**	**96**		**2,623**	**99**	**92**	
N Ireland	**594**	**99**	**100**		**69**	**100**	**100**	
Scotland	**1,758**	**99**	**98**		**189**	**97**	**94**	
Wales	**1,073**	**100**	**100**		**182**	**100**	**93**	
UK	**22,917**	**99**	**97**		**3,063**	**99**	**93**	

Blank cells – centres with no PD patients or because data were not available
*These three centres in North Wales did not only hold HD ESA data on their renal IT systems so have not been included in the analysis of ESA. Percentages of patients receiving ESA are shown but centres with less than 60% HD patients or 40% PD patients on ESA have been excluded from further analysis. Therefore, country averages are not shown – these can be found in tables 7.4 and 7.5

Table 7.4. Summary statistics for haemoglobin, serum ferritin and ESA for prevalent HD patients in 2016

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
England										
B Heart	373	109	74	58	271	86	43	82	6,500	15
B QEH	936	110	79	62	370	95	64	92	6,000	6
Basldn	147	107	67	56	168	77	32	92	7,500	5
Bradfd	228	114	77	47	508	98	39	94	8,000	4
Brightn	417	110	80	58	475	97	44	88	5,000	10
Bristol	470	113	95	66	610	98	22	93	8,000	7
Carlis	88	116	86	55	731	95	15	76	4,500	24
Carsh	772	111	83	65	307	92	65			
Chelms	118	117	88	51	536	98	38	94	11,000	6
Colchr	91	114	86	63	592	99	31			
Covnt	345	107	72	60	359	95	64	81	9,000	15
Derby	227	116	88	56	457	97	44			
Donc	177	111	80	63	380	97	54	90	6,667	8
Dorset	262	113	86	61	519	97	40	91	6,375	8
Dudley	185	114	89	58	300	88	65			
Exeter	423	112	94	74	301	94	62	92	6,500	8
Glouc	228	114	84	64	330	93	49	87		12
Hull	302	111	81	63	390	94	52			
Ipswi	135	108	76	67	576	96	30			
Kent	387	111	81	57	490	95	33	93	9,000	6
L Barts	953	110	78	61	624	95	21			
L Guys	643	107	72	56	506	94	33			
L Kings	544	111	82	64	440	94	36	91	8,250	8
L Rfree	652	110	75	58	536	97	33			
L St.G	314	108	75	60	390	94	52			
L West	1,271	112	83	63	307	94	60			
Leeds	485	109	77	56	466	95	40	94	6,000	6
Leic	882	112	79	54	311	91	58	97	7,500	2
Liv Ain	170	113	81	56	476	92	29			

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 Roy	336	113	77	45	390	91	36			
M RI	458	112	78	53	480	97	40			
Middlbr	310	110	79	61	865	98	17	69	5,000	25
Newc	287	110	77	55	373	92	41	81	9,250	18
Norwch	299	113	88	61	542	95	33	93	9,625	6
Nottm	364	109	76	62	447	97	54	88	7,500	11
Oxford	401	110	76	56	285	87	48	92	12,000	8
Plymth	127	111	76	47	665	95	24			
Ports	583	113	82	55	397	94	56			
Prestn	531	110	77	56	621	95	25	94		6
Redng	288	115	83	50	481	98	45	87	13,039	9
Salford	361	109	71	51						
Sheff	577	110	75	49	462	96	50	90	7,500	8
Shrew	189	114	85	65	343	97	62			
Stevng	491	106	72	61	602	97	29	93	9,000	5
Sthend	109	111	83	70	273	99	73	95	10,000	5
Stoke	319	113	83	57	280	89	46			
Sund	222	109	71	52	252	86	41	90	8,609	9
Truro	156	106	76	68	390	97	60			
Wirral	178	109	79	65	417	94	54	87	8,000	13
Wolve	291	115	83	49	488	92	34	83	8,000	15
York	181	109	81	65	376	96	68	87	5,000	12
N Ireland										
Antrim	115	108	77	62	397	95	41	90	7,000	8
Belfast	183	115	87	54	433	97	43	95	6,750	5
Newry	77	111	75	60	386	94	40	90	6,375	10
Ulster	96	114	84	66	716	96	18	93	4,250	7
West NI	118	112	79	55	554	97	27	93	7,000	7
Scotland										
Abrdn	218	106	72	62	545	98	36			
Airdrie	173	113	84	63	636	95	29			
D&Gall	47	115	91	55	578	100	28			
Dundee	163	112	87	69	257	80	47			
Edinb	269	117	88	48	419	92	38			
Glasgw	537	110	76	55	489	92	32			
Inverns	70	112	79	64	353	89	48			
Klmarnk	128	110	71	51	248	86	50			
Krkcldy	135	115	90	65	432	84	25			
Wales										
Bangor	68	112	72	54	366	93	51			
Cardff	480	111	79	58	295	91	57			
Clwyd	68	111	82	63	344	96	62			
Swanse	343	110	80	62	265	85	36	89	10,000	10
Wrexm	113	113	87	57	429	99	48			
England	**19,283**	**111**	**80**	**59**	**412**	**94**	**45**	**90**	**7,750**	**9**
N Ireland	**589**	**112**	**82**	**58**	**488**	**96**	**35**	**93**	**6,000**	**7**
Scotland	**1,740**	**112**	**80**	**58**	**436**	**91**	**36**			
Wales	**1,072**	**111**	**80**	**59**	**306**	**91**	**49**	**89**	**10,000**	**10**
UK	**22,684**	**111**	**80**	**59**	**410**	**94**	**44**	**90***	**7,750***	**9***

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 where the percentage on ESA was 60% or more

*ESA summary results are for E, W & NI (not UK)

Table 7.5. Summary statistics for haemoglobin, serum ferritin and ESA for prevalent PD patients in 2016

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	72	105	61	43	221	81	66	68	6,000	22
B QEH	125	108	74	54	293	90	70	67	4,275	29
Basldn	30	103	63	57	145	70	67	87	4,750	13
Bradfd	22	110	73	41	273	73	45	95	8,000	5
Brightn	55	107	78	69	522	87	35			
Bristol	42	116	95	64	325	93	60	79	4,846	21
Carlis	31	117	97	61	350	90	52	65	2,250	35
Carsh	95	111	79	56	197	76	70			
Chelms	24	116	88	54	168	71	58	63	4,000	38
Colchr	n/a									
Covnt	58	105	64	48	216	81	61	68	8,000	28
Derby	71	117	85	46	471	96	50			
Donc	25	112	80	60	339	96	76	60	3,000	40
Dorset	33	110	82	58	299	96	75	70	4,000	30
Dudley	48	111	73	52	132	69	64			
Exeter	73	112	92	70	280	92	81	73	4,615	27
Glouc	33	116	88	58	183	80	70	45		55
Hull	61	110	77	61	343	97	72	66	4,000	31
Ipswi	33	108	79	55	477	100	52			
Kent	42	117	90	60	332	88	61	53	4,000	
L Barts	176	110	74	54	282	85	58			
L Guys	32	99	47	44	209	93	87			
L Kings	75	110	81	59	220	85	75	79	4,500	21
L Rfree	136	109	74	59	568	93	34			
L St.G	36	112	83	64	270	92	78			
L West	79	108	68	43	428	91	47			
Leeds	36	108	78	64	337	97	78	75	4,000	25
Leic	69	110	80	55	345	90	64	76	4,000	22
Liv Ain	23	111	87	65	309	100	83			
Liv Roy	63	118	89	48	242	86	68			
M RI	48	109	63	38	294	96	74			
Middlbr	22	112	100	82	361	95	55	55	4,000	45
Newc	46	106	74	54	410	91	63			
Norwch	41	114	80	59	434	95	66	78	3,483	20
Nottm	66	102	65	52	495	96	49	78	2,550	18
Oxford	80	111	85	61	246	95	86	79	5,750	21
Plymth	31	111	81	52	443	93	50			
Ports	66	114	86	50	401	97	64			
Prestn	35	112	77	46	577	94	33	80		20
Redng	44	114	93	59	384	88	63			
Salford	89	114	84	56				72	8,000	25
Sheff	47	108	77	57	494	96	47	62	8,000	34
Shrew	29	113	93	76	256	86	72			
Stevng	16	115	88	56	281	100	73	56		44
Sthend	24	114	88	63	171	71	67	58	2,833	42
Stoke	71	110	75	45	302	91	70			
Sund	17	120	82	35	275	75	31	59	2,307	41
Truro	17	111	82	59	240	86	86			
Wirral	15	107	80	67	426	100	67	87	8,000	13
Wolve	61	111	79	51	147	55	43	64	6,000	30
York	27	112	85	74	248	85	63	67	3,000	30

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	14	115	93	71	356	100	79	79	3,333	21
Belfast	22	116	95	68	341	95	68	86	3,000	14
Newry	19	111	79	53	325	95	79	68	3,500	32
Ulster	5									
West NI	9									
Scotland							57			
Abrdn	19	104	63	37	374	100	67			
Airdrie	21	110	90	71	304	95	65			
D&Gall	10	112	80	60						
Dundee	13	119	92	46	212	67	50			
Edinb	31	108	74	65	429	97	61			
Glasgw	43	115	91	56	197	77	51			
Inverns	4									
Klmarnk	28	107	75	54	327	93	59			
Krkcldy	15	112	93	60	322	71	36			
Wales										
Bangor	15	113	87	53	144	60	53			
Cardff	67	110	72	48	165	82	77			
Clwyd	14	112	86	64	414	100	71	57		43
Swanse	58	112	86	59	280	93	68	60	5,000	38
Wrexm	28	118	89	50	258	96	75			
England	**2,590**	**111**	**78**	**55**	**309**	**88**	**62**	**70**	**4,608**	**27**
N Ireland	**69**	**115**	**88**	**61**	**375**	**97**	**65**	**80**	**3,000**	**20**
Scotland	**184**	**111**	**83**	**57**	**291**	**87**	**57**			
Wales	**182**	**112**	**81**	**53**	**232**	**88**	**71**	**60**	**5,000**	**39**
UK	**3,025**	**111**	**79**	**55**	**306**	**88**	**62**	**70***	**4,500***	**28***

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 – not applicable
ESA data only shown for those centres where the percentage on ESA was 40% or more
*ESA summary results are for E, W & NI (not UK)

Haemoglobin in prevalent haemodialysis patients

The median Hb of patients on HD in the UK in 2016 was 111 g/L (IQR 102–119) and is shown in table 7.4. For HD patients, 80% had a Hb ⩾100 g/L. Figure 7.7 shows the median Hb in HD patients by renal centre. Figure 7.8 shows the proportion of patients by centre with Hb within the Renal Association guideline range (100–120 g/L) and figure 7.9 shows the distribution of Hb within, above and below this range.

Funnel plots for the percentage of patients with Hb ⩾100 g/L (figure 7.10) and between 100–120 (figure 7.11) are shown with 95% and 99.9% confidence limits. Table 7.4 can be used to identify centres in these funnel plots.

Haemoglobin in prevalent peritoneal dialysis patients

The median Hb of patients on PD in the UK in 2016 was 111 g/L (IQR 102–120, table 7.5). For PD patients, 79% had a Hb ⩾100 g/L. Figure 7.12 shows the median Hb in PD patients by centre. Figure 7.13 shows the proportion of patients by centre with Hb within the Renal Association guideline range (100–120 g/L) and figure 7.14 shows the distribution of Hb within, above and below this range.

Figures 7.15 and 7.16 are funnel plots showing the percentage of PD patients by centre in 2016 with Hb ⩾100 g/L and Hb ⩾100 g/L and ⩽ 120 g/L respectively.

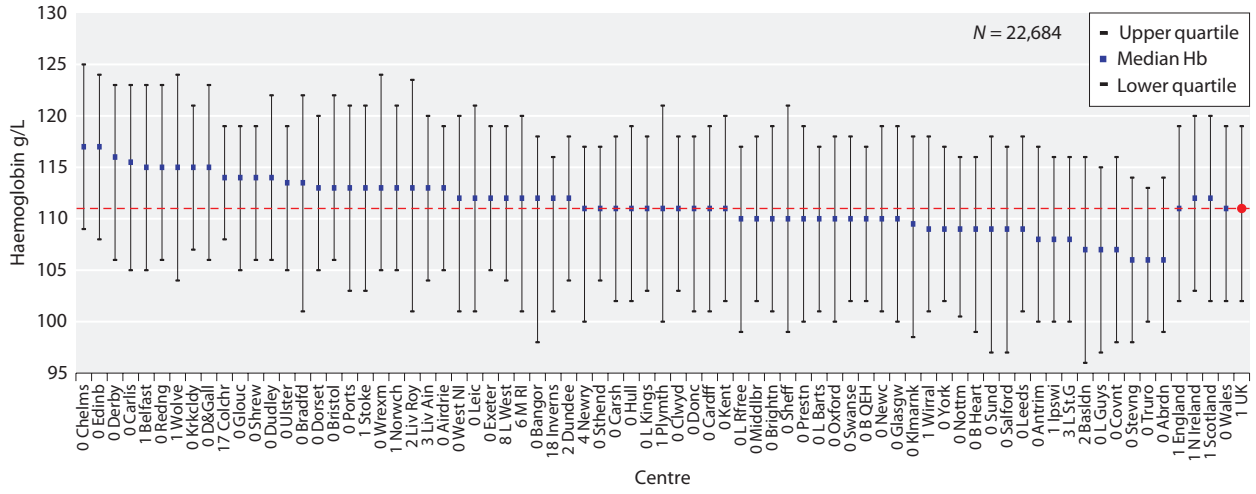

Fig. 7.7. Median haemoglobin in prevalent patients treated with HD by centre in 2016

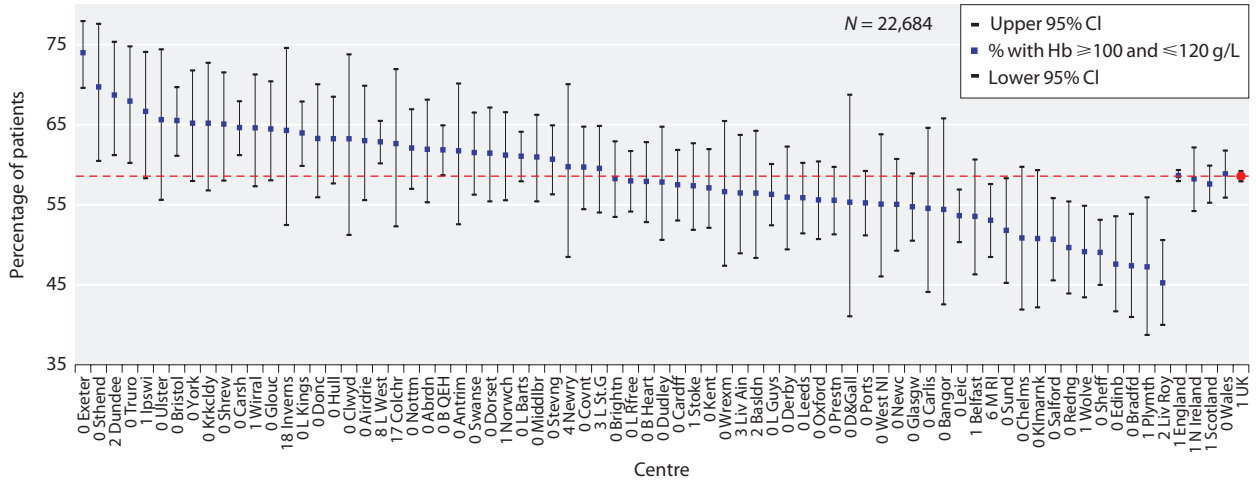

Fig. 7.8. Percentage of prevalent HD patients with Hb ⩾100 g/L and ⩽120 g/L by centre in 2016

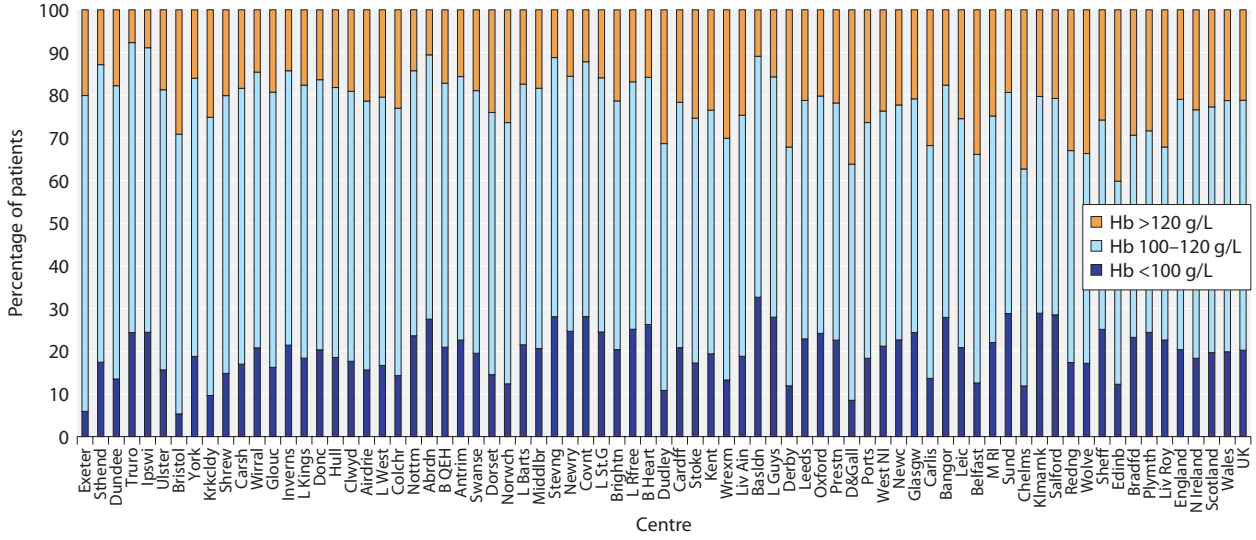

Fig. 7.9. Distribution of haemoglobin in prevalent patients treated with HD by centre in 2016

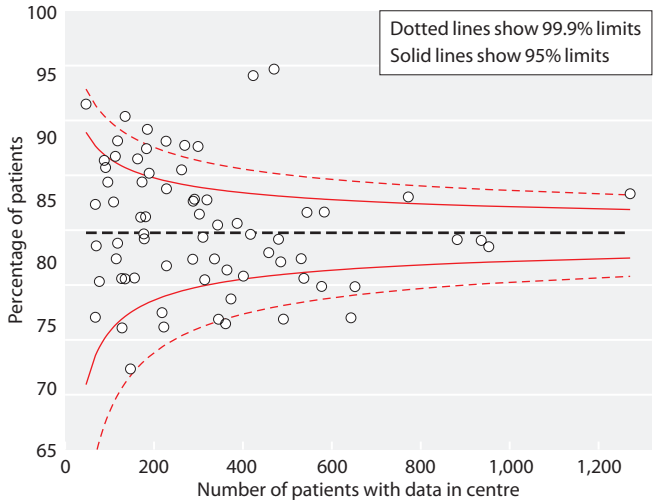

Fig. 7.10. Funnel plot of percentage of prevalent HD patients with Hb ⩾100 g/L by centre in 2016

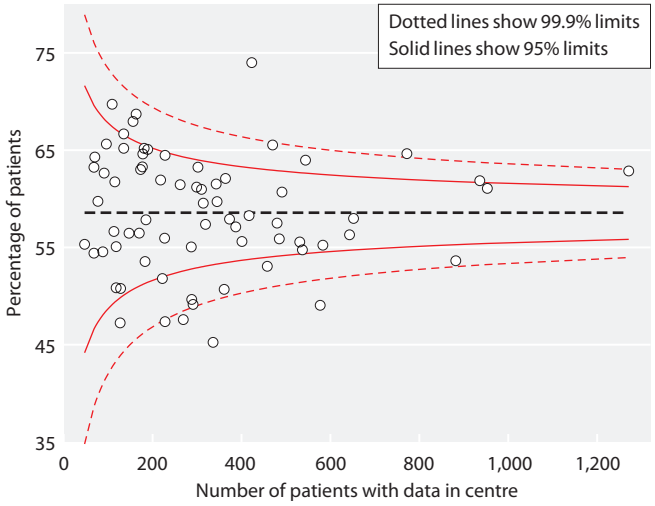

Fig. 7.11. Funnel plot of percentage of prevalent HD patients with Hb ⩾100 g/L and ⩽120 g/L by centre in 2016

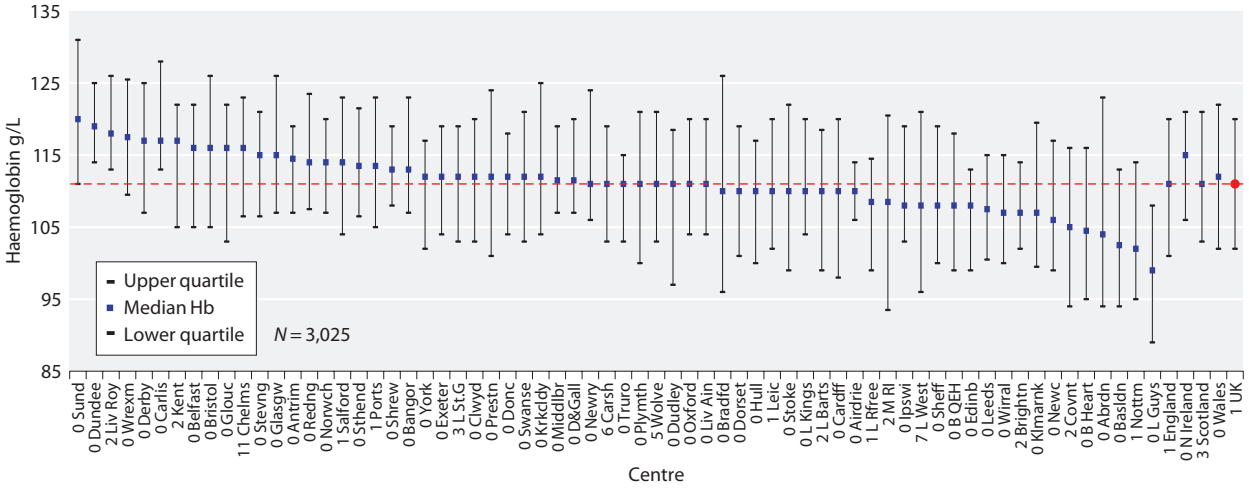

Fig. 7.12. Median haemoglobin in prevalent patients treated with PD by centre in 2016

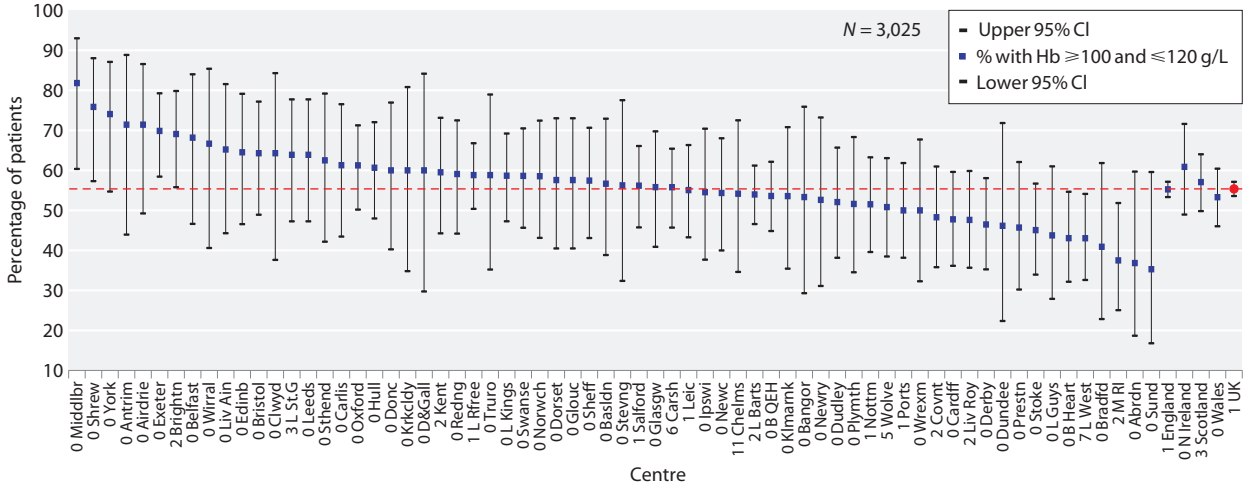

Fig. 7.13. Percentage of prevalent PD patients with Hb ⩾100 g/L and ⩽120 g/L by centre in 2016

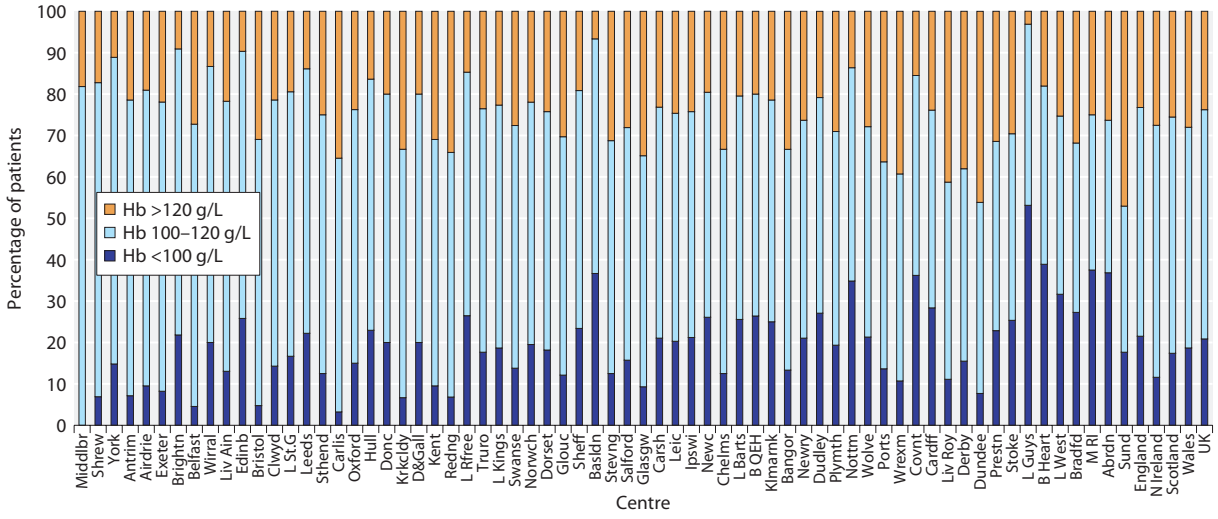

Fig. 7.14. Distribution of haemoglobin in prevalent patients treated with PD by centre in 2016

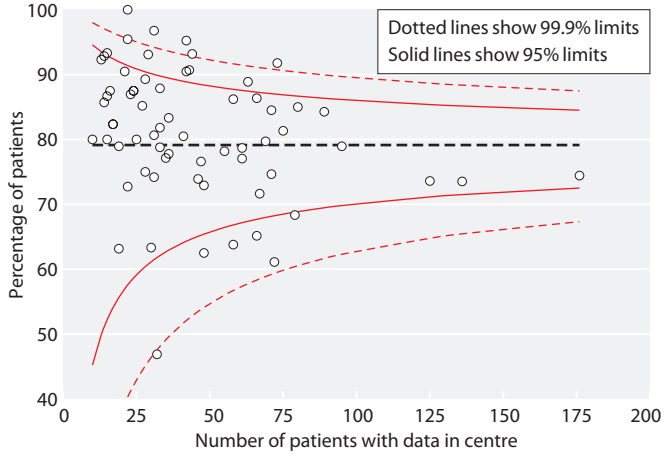

Fig. 7.15. Funnel plot of percentage of prevalent PD patients with Hb $\geqslant$100 g/L by centre in 2016

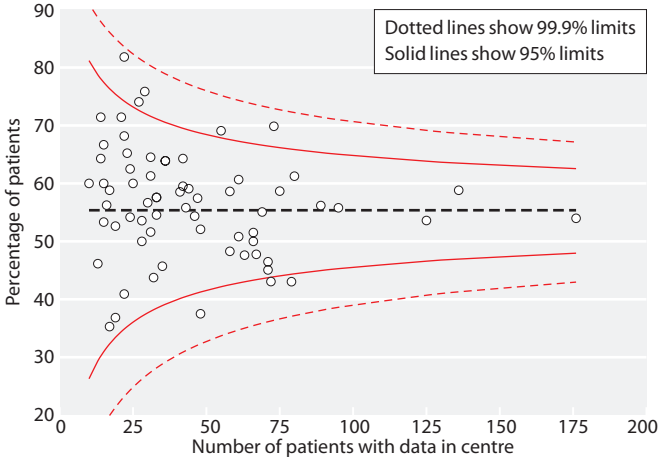

Fig. 7.16. Funnel plot of percentage of prevalent PD patients with Hb $\geqslant$100 g/L and $\leqslant$120 g/L by centre in 2016

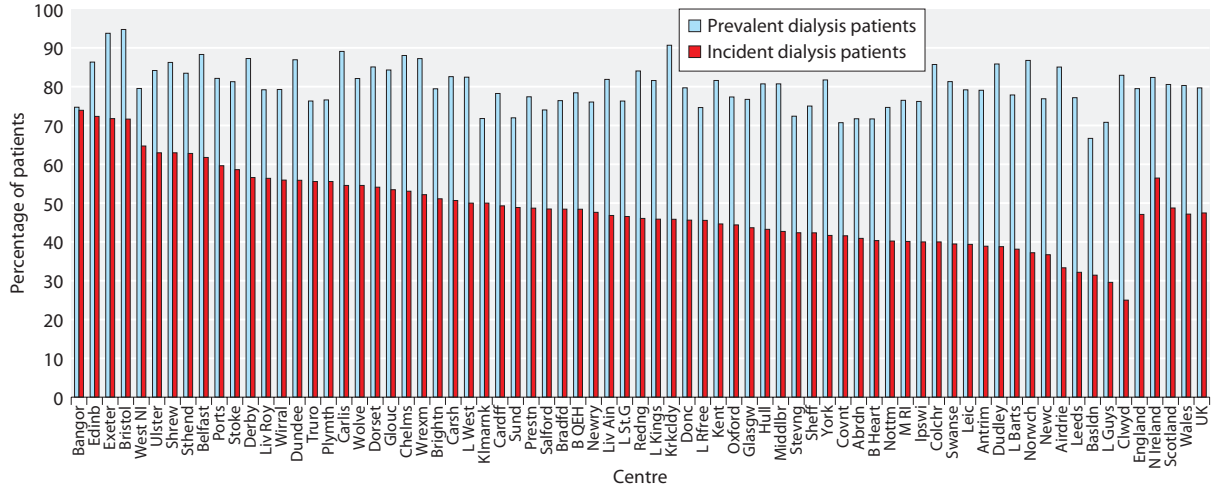

Fig. 7.17. Percentage of incident and prevalent dialysis patients with Hb $\geqslant$100 g/L by centre in 2016

Relationship between Hb in incident and prevalent dialysis patients

The relationship between the percentage of incident and prevalent patients with 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 of incident patients.

Changes in achievement of Hb ⩾100 g/L by year of start in both incident and prevalent patients is shown in figure 7.18. This shows a falling trend in the proportion of patients achieving a Hb ⩾100 g/L over the last decade.

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 ⩽500 μg/L, and ⩾800 μg/L are shown in figures 7.20, 7.21 and 7.22 respectively. The median serum ferritin in HD patients was 410 μg/L with 94% of HD patients achieving a serum ferritin ⩾100 μg/L.

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 to ⩽500 μg/L, and ⩾800 μg/L are shown in figures 7.24, 7.25 and 7.26 respectively. The median serum ferritin in PD patients was 306 μg/L with 88% of PD patients achieving a serum ferritin ⩾100 μg/L.

Erythropoiesis stimulating agents in prevalent haemodialysis patients

The median dose of ESA for prevalent HD patients in England, Wales and Northern Ireland was 7,750 IU/week

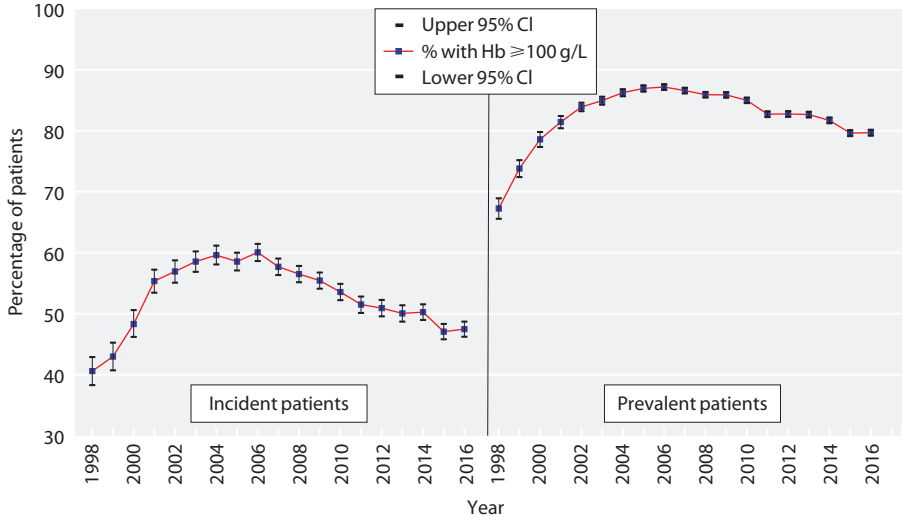

Fig. 7.18. Percentage of incident and prevalent dialysis patients (1998–2016) with Hb ⩾100 g/L

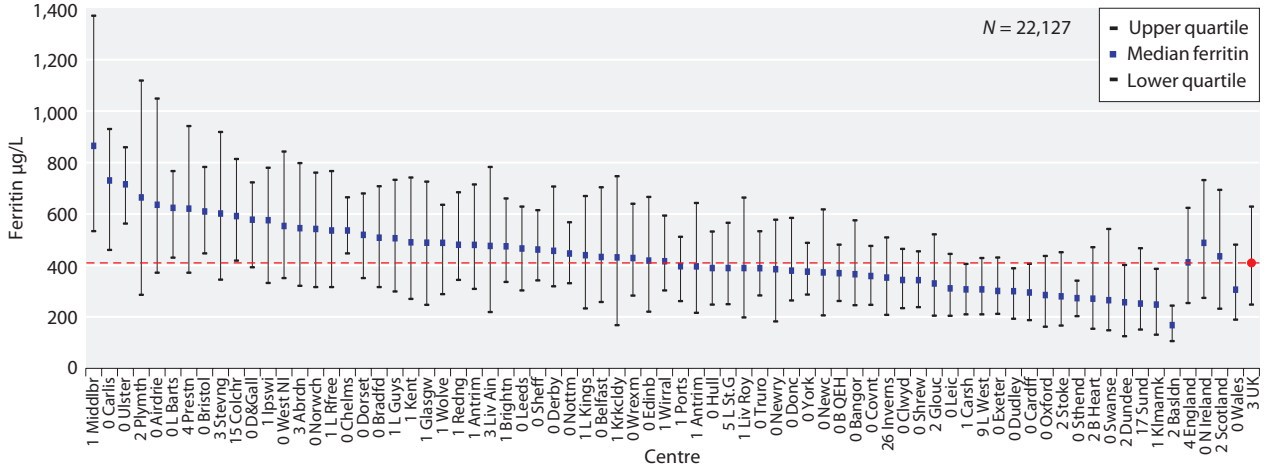

Fig. 7.19. Median ferritin in prevalent patients treated with HD by centre in 2016

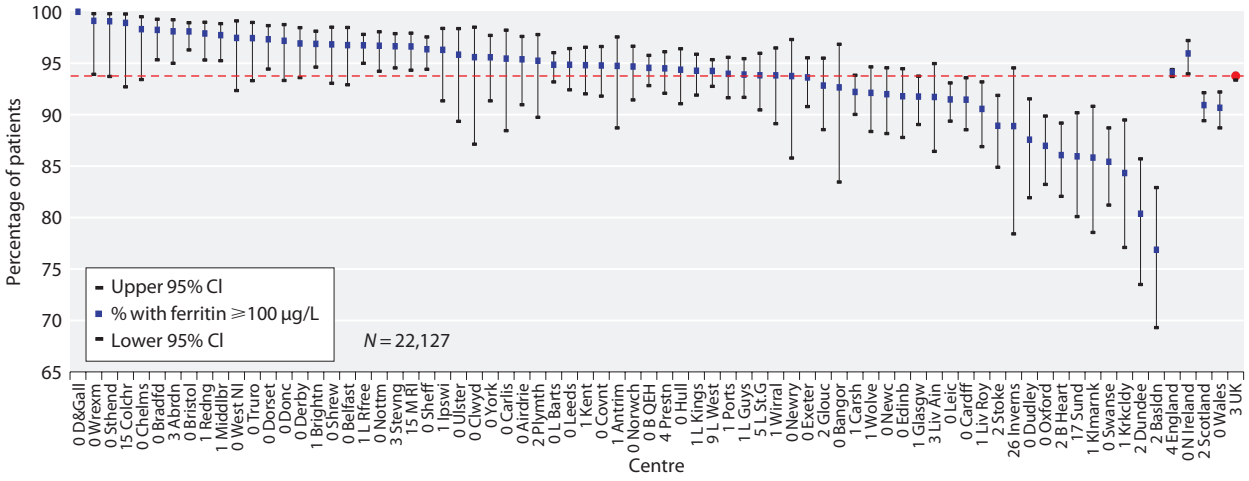

Fig. 7.20. Percentage of prevalent HD patients with ferritin ⩾100 µg/L by centre in 2016

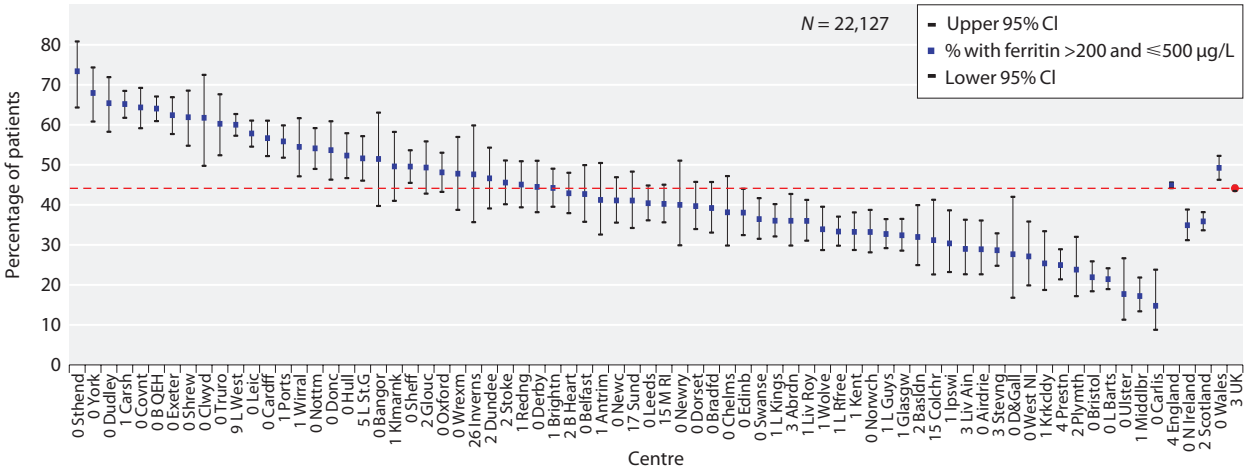

Fig. 7.21. Percentage of prevalent HD patients with ferritin > 200 and ⩽500 µg/L by centre in 2016

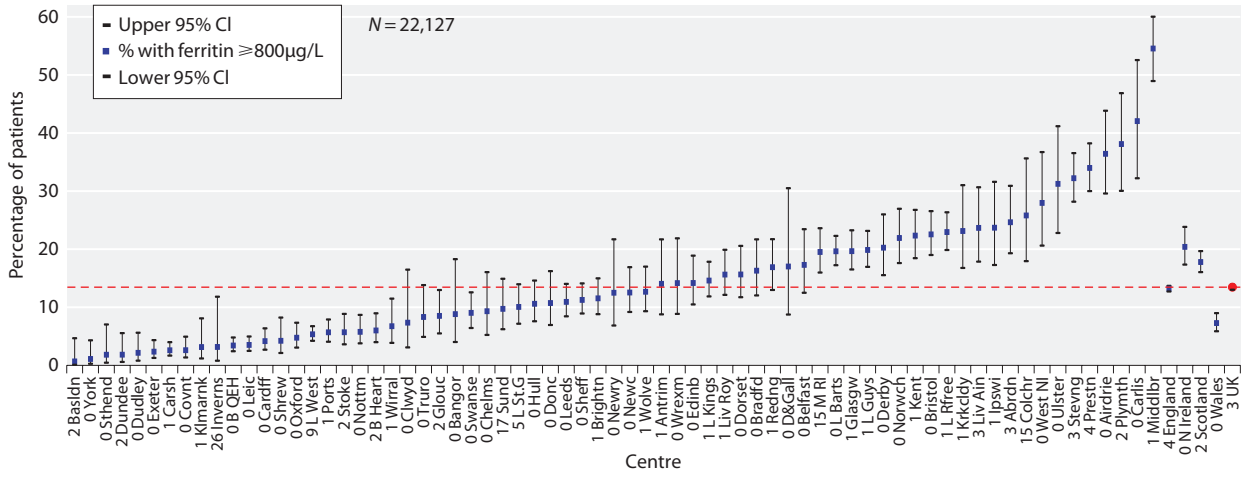

Fig. 7.22. Percentage of prevalent HD patients with ferritin ⩾800 µg/L by centre in 2016

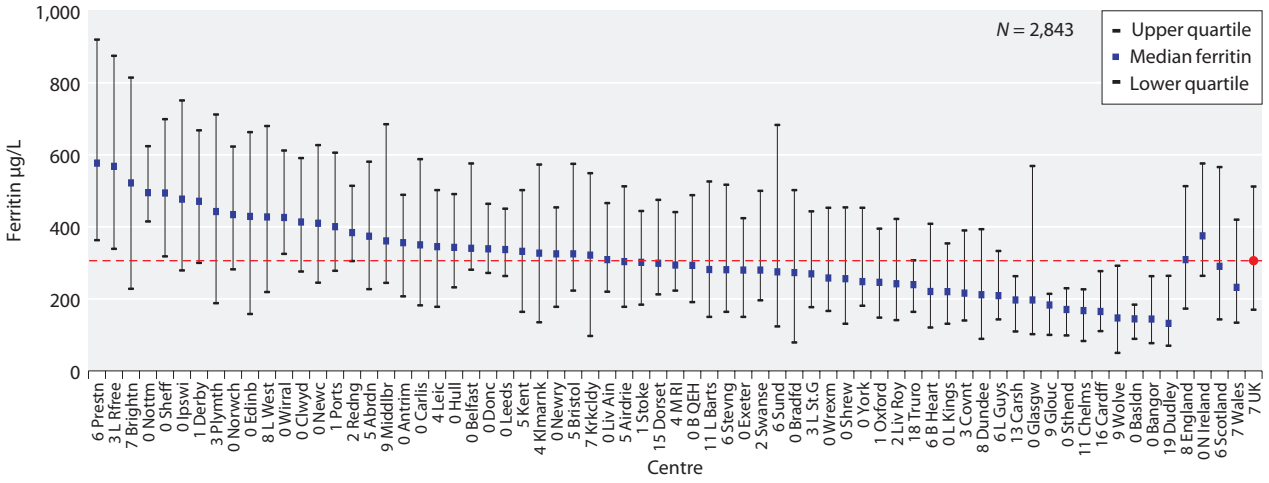

Fig. 7.23. Median ferritin in prevalent patients treated with PD by centre in 2016

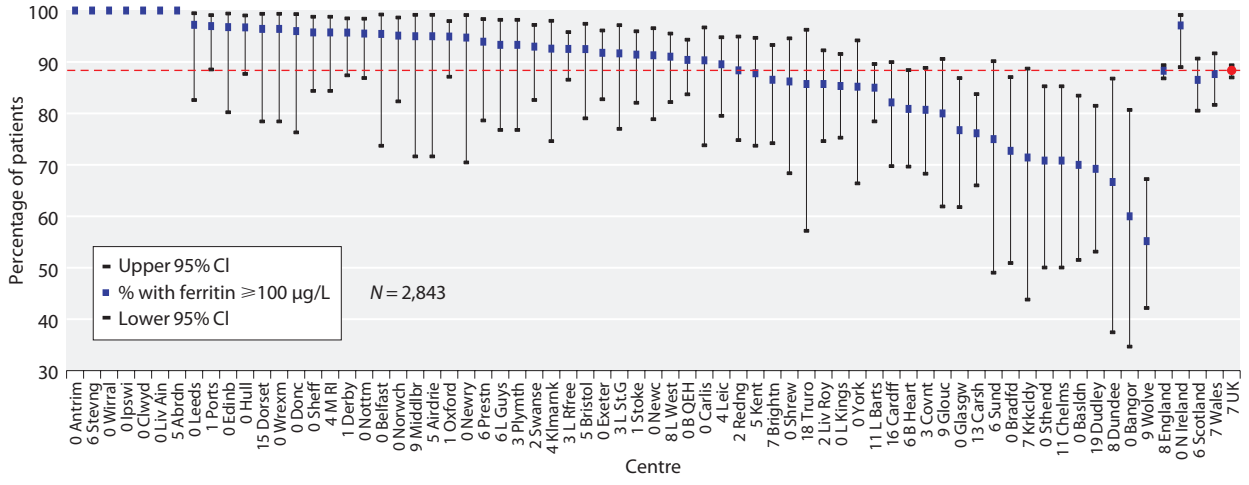

Fig. 7.24. Percentage of prevalent PD patients with ferritin ⩾100 µg/L by centre in 2016

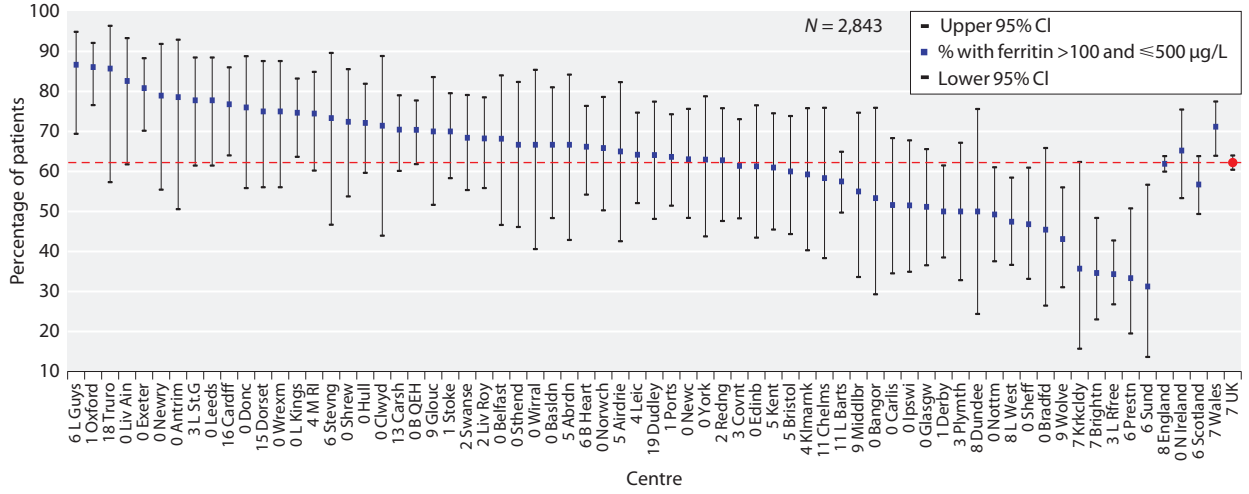

Fig. 7.25. Percentage of prevalent PD patients with ferritin > 100 and ⩽500 µg/L by centre in 2016

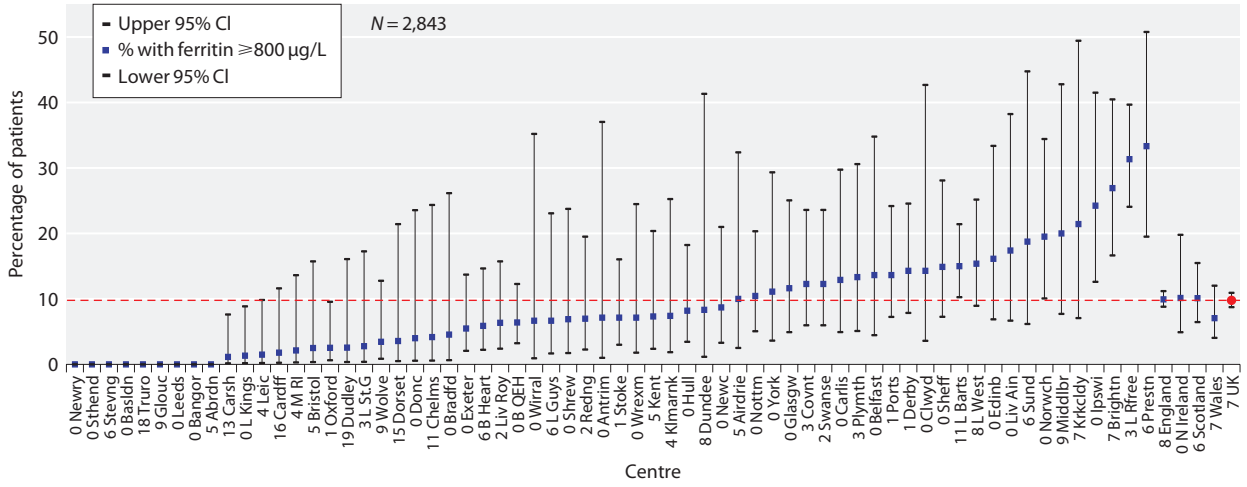

Fig. 7.26. Percentage of prevalent PD patients with ferritin ⩾800 µg/L by centre in 2016

with wide variation between centres from 4,250 IU/week (Ulster) to 13,039 IU/week (Reading) (table 7.4). There was very little correlation between median ESA dose and either median Hb (figure 7.27) or compliance with Hb 100–120 g/L (figure 7.28). For these analyses only patients with both Hb and ESA data were included.

Erythropoiesis stimulating agents in prevalent peritoneal dialysis patients

The median dose of ESA for prevalent PD patients in England, Wales and Northern Ireland was 4,500 IU/week (table 7.5).

ESA prescription and association with achieved haemoglobin

Figures 7.9 and 7.14 show the distribution of Hb concordance with the Renal Association guideline (100–120 g/L). Not all patients with Hb >120 g/L were receiving ESA. The consensus was that these patients should not be included in the group of patients not meeting this target. There are two reasons: first, the high Hb remains largely outside the control of the clinician; secondly, the trials suggesting it may be detrimental to achieve a high Hb in renal patients were based upon patients treated with ESAs [5–7]. Figures 7.29 and 7.30 therefore show the percentages of HD and PD patients in each centre whose Hb lies below, within or above the Renal Association guideline range. For those patients with Hb >120 g/L it also differentiates between those receiving, or not, ESAs. In centres with useable ESA data, 21.2% of HD patients had a Hb >120 g/L and 4.1% had a Hb >120 g/L and were not receiving ESAs. For PD patients 23.1% had a Hb >120 g/L and 12.4% had a Hb >120 g/L and were not receiving ESAs.

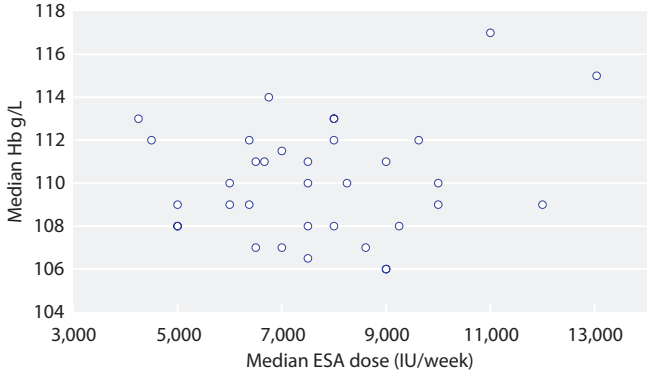

Fig. 7.27. Median Hb versus median ESA dose in prevalent HD patients on ESA, by centre in 2016

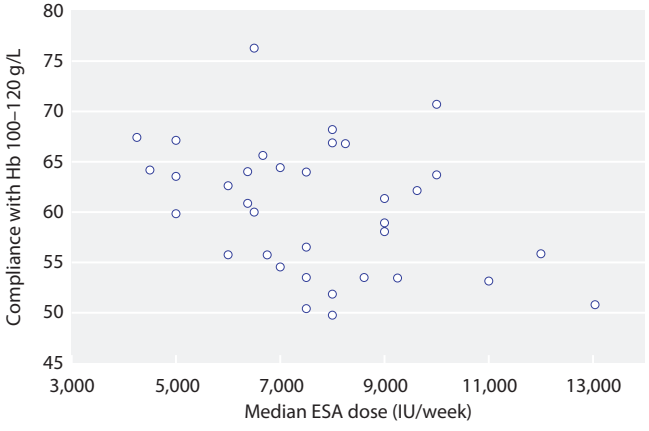

Fig. 7.28. Compliance with Hb 100–120 g/L versus median ESA dose in prevalent HD patients on ESA, by centre in 2016

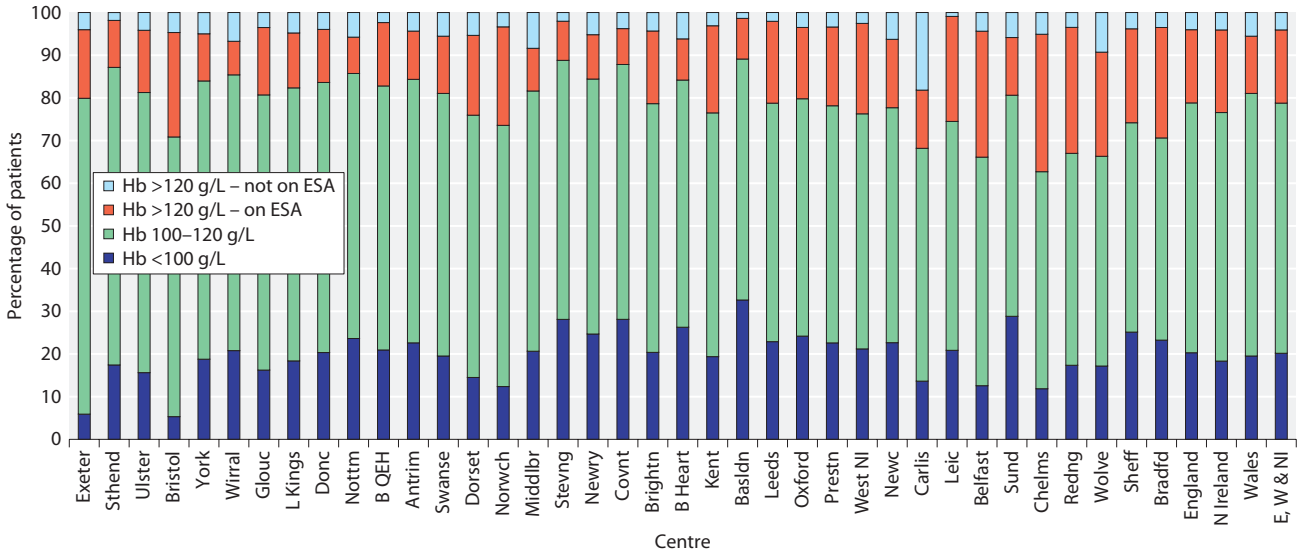

Fig. 7.29. Distribution of haemoglobin in prevalent patients treated with HD and the proportion of patients with Hb >120 g/L receiving ESA by centre in 2016

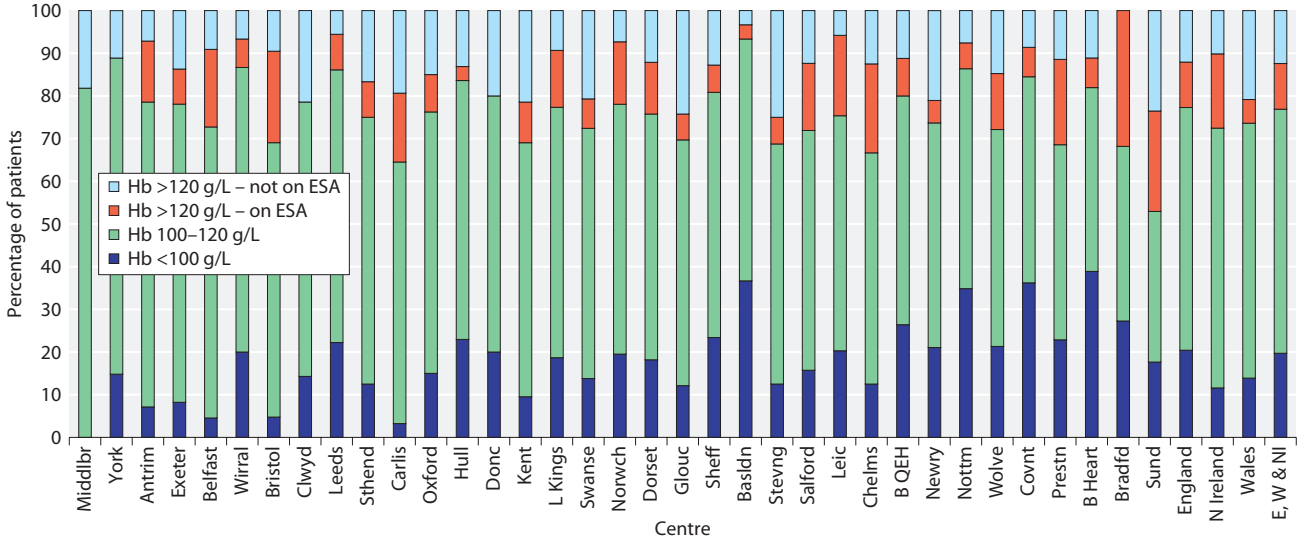

Fig. 7.30. Distribution of haemoglobin in prevalent patients treated with PD and the proportion of patients with Hb >120 g/L receiving ESA by centre in 2016

ESA prescription: age and modality associations

The proportion of patients on ESA was higher for HD (90%) than for PD (70%). This difference was maintained across all age groups (figure 7.31). The proportion of patients with Hb ⩾100 g/L without requiring an ESA is shown (by age group and modality) 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 of patients at the end of 2016. Patients who had previously changed RRT modality were included in the analysis. The proportion of PD patients receiving ESA rises with duration of RRT from 70% after 3–12 months to 78% after ten or more years.

Resistance to ESA therapy

The Renal Association 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 >1.5 mcg/kg/week***' [1]. Figure 7.34 shows the frequency distribution

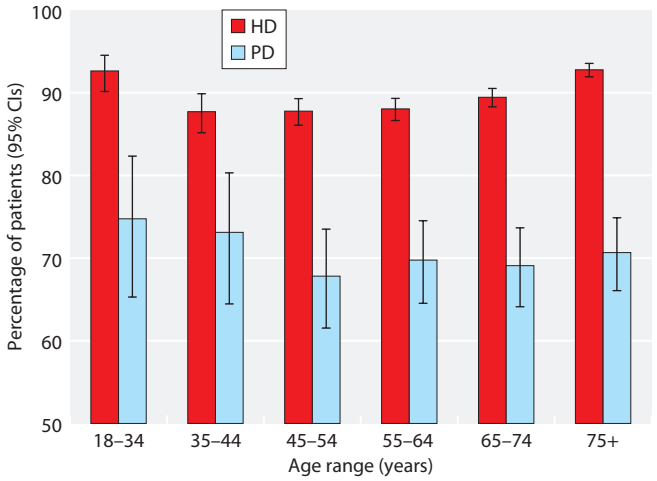

Fig. 7.31. Percentage of dialysis patients on ESA, by age group and treatment modality in 2016

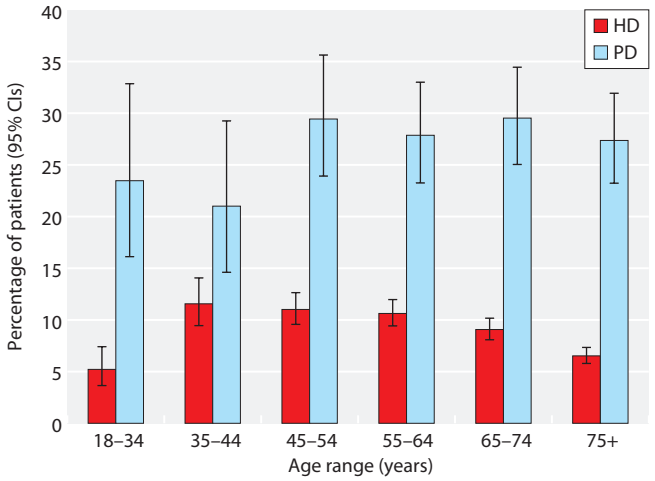

Fig. 7.32. Percentage of whole cohort (2016) who were not on ESA and had Hb ⩾100 g/L, by age group and treatment modality

of weekly ESA dose adjusted for weight by treatment modality. Centres included in this analysis were restricted to those with good completeness for weight (>75%) and ESA data. Thirty two centres were included for HD data and 16 centres for PD. The prevalence of PD patients receiving over 300 IU/kg/week was 3.0% with 5.7% of HD patients receiving more than 300 IU/kg/week and 1.2% more than 450 IU/kg/week.

Success with guideline compliance

The percentage of prevalent dialysis patients achieving a Hb ⩾100 g/L by year (1998–2016) is shown in figure 7.35. This has shown a gradual fall in achievement of this guideline over the last decade.

Table 7.6 shows that the percentage of all patients treated with an ESA and having Hb >120 g/L ranged between 8–32% for HD and between 0–32% for PD.

Table 7.7 shows the percentage completeness for ESA type, dose, route and frequency for centres reporting ESA data. Even for this group of centres which is already restricted to those with useable ESA data, completeness of frequency and administration route averaged below 50%. Roughly half of the centres had very good completeness for these items and the other half did not submit at all.

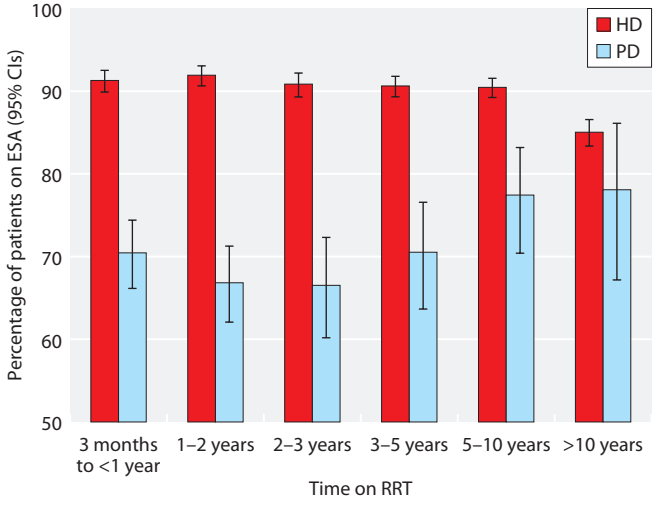

Fig. 7.33. Percentage of patients on ESA by time on RRT in 2016

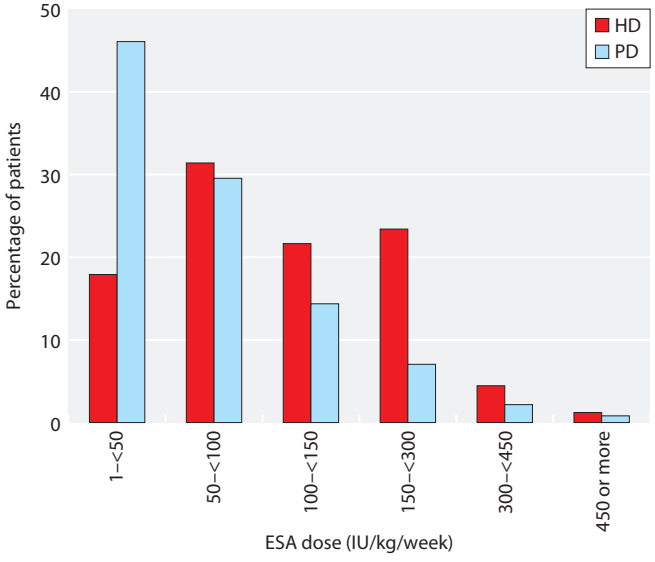

Fig. 7.34. Frequency distribution of mean weekly ESA dose corrected for weight in 2016

Table 7.6. Percentage of prevalent patients with Hb >120 g/L and on ESA and percentage of patients with serum ferritin <100 μg/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	10	10	7	10
B QEH	15	4	9	2
Basldn	10	21	3	27
Bradfd	26	1	32	16
Brightn	17	2		
Bristol	24	2	21	3
Carlis	14	2	16	9
Chelms	32	0	21	10
Covnt	8	2	7	14
Donc	12	3	0	0
Dorset	19	2	12	0
Exeter	16	5	8	0
Glouc	16	5	6	9
Hull			3	2
Kent	20	4	10	3
L Kings	13	5	13	7
Leeds	19	3	8	0
Leic	25	8	19	3
Middlbr	10	1	0	0
Newc	16	4		
Norwch	23	3	15	3
Nottm	9	1	6	0
Oxford	17	11	9	4
Prestn	18	4	20	3
Redng	30	1		
Salford			16	0
Sheff	22	2	6	0
Stevng	9	2	6	0
Sthend	11	1	8	8
Sund	14	10	24	20
Wirral	8	1	7	0
Wolve	24	5	13	29
York	11	1	0	4
N Ireland				
Antrim	11	4	14	0
Belfast	30	2	18	0
Newry	10	6	5	0
Ulster	15	1		
West NI	21	2		
Wales				
Clwyd			0	0
Swanse	13	10	7	0
England	**17**	**4**	**11**	**5**
N Ireland	**19**	**3**	**17**	**0**
Wales	**13**	**10**	**6**	**0**
E, W & NI	**17**	**4**	**11**	**5**

Blank cells – centres excluded from analyses due to poor data completeness, small numbers with data or incomplete ESA 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	307	100	98	0	0	49	100	100	0	0
B QEH	866	100	100	100	0	84	100	100	100	0
Basldn	138	100	100	100	100	26	100	100	100	100
Bradfd	214	100	99	100	100	21	100	95	100	95
Brightn	367	100	100	0	0					
Bristol	435	100	100	0	0	33	100	100	0	0
Carlis	67	100	100	0	0	20	100	100	0	0
Chelms	111	100	100	99	100	17	100	100	100	100
Covnt	281	100	100	0	0	40	100	100	0	0
Donc	160	100	100	100	100	15	100	100	93	100
Dorset	240	100	100	95	100	23	100	100	74	100
Exeter	389	100	100	0	0	53	100	100	0	0
Glouc	199	100	0	0	0	15	100	0	0	0
Hull						40	100	85	93	98
Kent	360	100	100	99	100	23	100	100	96	100
L Kings	498	100	100	0	0	59	100	100	0	0
Leeds	457	100	95	100	100	27	100	81	100	100
Leic	858	100	100	0	0	53	100	100	0	0
Middlbr	214	100	100	0	0	12	100	100	0	0
Newc	232	100	100	0	0					
Norwch	282	100	100	99	100	32	100	100	66	100
Nottm	322	100	100	97	100	52	100	100	98	100
Oxford	367	100	100	0	0	63	100	100	0	0
Prestn	499	100	18	0	0	28	100	4	0	0
Redng	250	100	100	0	0					
Salford						65	100	100	100	0
Sheff	519	100	93	0	0	29	100	100	0	0
Stevng	458	100	100	100	100	9	100	100	100	100
Sthend	104	100	95	0	0	14	100	86	0	0
Sund	200	100	100	0	0	10	100	100	0	0
Wirral	155	100	100	100	100	13	100	100	100	100
Wolve	243	100	100	97	100	41	100	100	100	100
York	158	100	91	100	99	18	100	89	94	100
N Ireland										
Antrim	104	100	100	100	100	11	100	100	100	100
Belfast	176	100	100	99	100	19	100	100	95	100
Newry	72	100	100	99	100	13	100	100	92	100
Ulster	89	100	100	100	100					
West NI	110	100	100	97	100					
Wales										
Clwyd						8	100	0	0	0
Swanse	304	100	100	100	100	35	100	100	100	100

Blank cells – data not useable or not available

Discussion

Anaemia is one of the major comorbidities associated with CKD. It can lead to a debilitating reduction in exercise capacity and quality of life as well as left ventricular dysfunction and heart failure. While the degree of renal impairment affects the likelihood of any patient developing anaemia [8], all patients should be carefully

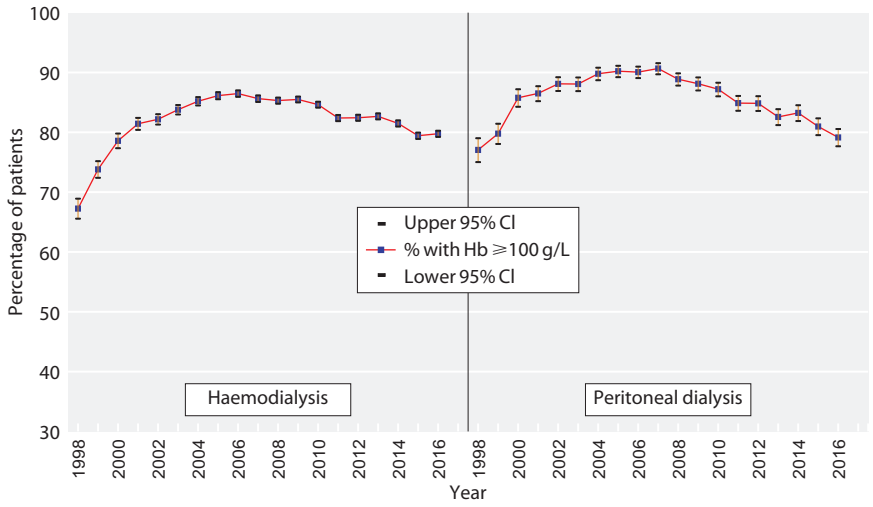

Fig. 7.35. Percentage of prevalent HD and PD patients (1998–2016) with Hb ⩾100 g/L

investigated for an underlying cause particularly prior to the initiation of any therapy. The anaemia of chronic kidney disease, often an isolated normocytic anaemia, is multifactorial but primarily due to a reduction (absolute or relative) in erythropoietin production often with an associated (absolute or relative) iron deficiency. Inflammatory processes related to underlying kidney disease or other comorbidities, inflammatory processes related to dialysis, blood loss (CKD-associated platelet dysfunction, frequent phlebotomy, dialysis-associated blood loss), hyperparathyroidism and dialysis inadequacy may all further contribute to the anaemia and may do so variably over time, resulting in a need for regular monitoring.

The goal of anaemia management in CKD is the maintenance of acceptable Hb concentrations. Prior to the development of ESAs, severe anaemia with intermittent blood transfusions were the norm. Unexpectedly, several studies subsequently showed adverse outcomes with physiological correction of Hb with ESAs [5–7], resulting in clinical guidelines advocating a target Hb of 100–120 g/L for patients receiving ESA therapy. This evolution in understanding of optimal Hb targets is reflected in historic analyses in figures 7.18 and 7.35. Guidelines continue to underline the importance of individualising therapy taking into account the time it takes for ESA therapy to work and the small but significant risk associated with ESA therapy.

Haemoglobin outcomes were similar for both HD and PD patients with proportions of prevalent patients compliant with Hb 100–120 g/L of 59% and 55% respectively. Prevalent HD patients had a higher median serum ferritin (410 μg/L vs 306 μg/L), a higher proportion of patients requiring ESAs (90% vs 70%) and a higher median ESA dose in those receiving ESAs (7,750 IU/week vs 4,500 IU/week) compared with prevalent PD patients.

As expected, a greater proportion of prevalent dialysis patients than incident patients attained a Hb ⩾100 g/L (80% vs 47%). Only 34% of late presenters achieved a Hb ⩾100 g/L suggesting that part of this difference was because there was less opportunity for anaemia to be treated with iron or ESAs. The fact that even in the early presenting incident group of patients only 50% achieved Hb ⩾100 g/L suggests that opportunity is only part of the explanation for incident patients. Alternative explanations include the fact that a number of patients commenced dialysis at the time of an acute illness when acute anaemia is common.

The proportion of patients achieving a serum ferritin of ⩾100 μg/L was 94% of HD patients and 88% of PD patients. It is recommended that patients be iron replete to achieve and maintain optimal target Hb, while avoiding iron overload and potential toxicity as reflected in the guideline audit measures. Iron repletion helps to minimise both the need to initiate ESA therapy and the dose of ESA subsequently required. The revised Renal Association anaemia guideline published midway through the 2017 data collection period [2] recommends that percentage hypochromic red blood cells or reticulocyte haemoglobin are preferable markers of iron deficiency than serum ferritin or transferrin saturation. Renal centres will need to consider the incorporation of these changes into local guidelines. The UKRR will continue to work in collaboration with renal centres to report these new data items as well as improve data completeness for ESA and iron therapy. As of 2016, the analysis of ESA usage continued to be limited by incomplete

data returns. From the available data, 90% of HD patients and 70% of PD patients were receiving ESAs. The attainment of Hb targets correlated poorly with median ferritin and ESA usage.

There continued to be variation in concordance with anaemia guidelines between UK renal centres.

Conflicts of interest: the authors declare no conflicts of interest

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UK Renal Registry 20th Annual Report: Chapter 8 Biochemical Variables in UK Adult Dialysis Patients in 2016: National and Centre-specific Analyses

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Keywords
Bicarbonate · Biochemical variables · Calcium · Dialysis · Haemodialysis · Parathyroid hormone · Peritoneal dialysis · Phosphate · Potassium · Quality improvement

Summary

In 2016

- 59.9% of haemodialysis (HD) patients and 58.7% of peritoneal dialysis (PD) patients achieved the Renal Association (RA) audit measure for phosphate (<1.7 mmol/L).
- 40.1% of HD and 41.3% of PD patients had a serum phosphate above the RA audit standard (⩾1.7 mmol/L).
- Simultaneous control of all three parameters (calcium, phosphate and parathyroid hormone (PTH)) within current target ranges was achieved by 27.3% of HD and 33.2% of PD patients.
- 78.7% of HD and 79.7% of PD patients had adjusted calcium in the recommended target range of 2.2–2.5 mmol/L.
- 55.2% of HD and 60.3% of PD patients had phosphate between 1.1–1.7 mmol/L.
- 58.3% of HD and 65.7% of PD patients had a serum PTH between 16–72 pmol/L.
- 17.9% of HD and 13.4% of PD patients had a serum PTH >72 pmol/L.
- 62.2% of HD and 80.7% of PD patients achieved the audit measure for bicarbonate (18–24 mmol/L for HD patients and 22–30 mmol/L for PD patients).
- 84.1% of HD patients (for whom data were available) had pre-dialysis potassium between 4.0–6.0 mmol/L.

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Introduction

This chapter analyses the routine biochemistry data of patients on established haemodialysis (HD) and peritoneal dialysis (PD) from all renal centres in the UK in 2016. The UK Renal Registry (UKRR) collects data from all renal centres in England, Wales and Northern Ireland and receives Scottish data via the Scottish Renal Registry. The attainment of biochemistry parameters is compared at a renal centre and national level as well as against national performance measures as set out in the Renal Association (RA) guidelines.

The audit measures listed in table 8.1 applied in 2016 and are obtained from several different RA guidelines [1] which are updated over time:

- CKD-mineral bone disease 2015 guideline [2]
- Haemodialysis 2009 guideline [3] – update due in 2018
- Peritoneal dialysis 2010 guideline [4]
- Cardiovascular disease 2010 guideline [5]

No new guidelines were published during the 2016 calendar year and therefore the same audit standards apply as were used for the 2015 analyses. In 2017, updated KDIGO international chronic kidney disease – mineral bone disorder (CKD-MBD) guidelines were published which have not advocated changes in target biochemical parameters in relation to dialysis patients citing the ongoing lack of strong evidence [6]. They highlight the importance in identifying trends in parameters rather than reacting to isolated measurements and to understand the complex interplay of the variables involved. They advise that clinicians individualise treatment and suggest that changes aimed at improving biochemical parameters could have inadvertent detrimental effects which are more difficult to measure such as in relation to bone mineral density or arterial calcification. In this context, out of range observations (e.g. hyperphosphataemia or PTH below target range) need to be interpreted cautiously as they may relate to different clinical problems or population characteristics.

The most recent RA renal bone disease guidelines offer two audit measures, firstly the proportion of patients with

Table 8.1. Summary of Renal Association audit measures for biochemical variables [1]

RA audit measure or guideline	Included in UKRR annual report	Reason
CKD-MBD in CKD stage 5D audit measures		
Percentage of patients CKD5D with serum PO_4 <1.7 mmol/L	Yes	
Percentage of patients with all bone parameters within target range (Ca/P/PTH)	Yes	Target ranges used for this analysis: adjusted calcium 2.2–2.5 mmol/L, phosphate 1.1–1.7 mmol/L (please note this is different from audit measure of <1.7 mmol/L) and PTH 16–72 pmol/L (2–9 × upper end of reference range)
Peritoneal dialysis guidelines		
Cumulative frequency curves of plasma bicarbonate	Partly	Summary measures at centre and country level are presented in various formats but not as cumulative frequency curves
Haemodialysis guidelines		
Cumulative frequency curves of pre-dialysis potassium concentration	Partly	Summary measures at centre and country level are presented in various formats but not as cumulative frequency curves.
Cumulative frequency curves of pre-dialysis serum calcium (adjusted for albumin) and phosphate concentrations	Partly	Summary measures at centre and country level are presented in various formats but not as cumulative frequency curves
Cardiovascular disease in CKD guidance		
Record of HbA1c concentrations in IFCC (mmol/mol) and/or DCCT (%) units	No	Poor data completeness
Cholesterol concentrations in patients prescribed HMG CoA reductase inhibitors	No	The UKRR has previously reported summary statistics for total cholesterol and aims to improve data completeness. Reliable information is not currently available within the UKRR data on statin prescription

CKD-MBD – chronic kidney disease mineral bone disease; PO_4 – phosphate; Ca – calcium; P – phosphorous; PTH – parathyroid hormone; HbA1c – glycated haemoglobin; IFCC – International Federation of Clinical Chemistry and Laboratory Medicine; DCCT – Diabetes Control and Complications Trial

serum phosphate <1.7 mmol/L and secondly the proportion of patients with all bone parameters within target range [2]. The target range for phosphate recommended in the guideline is 1.1–1.7 mmol/L (not <1.7 mmol/L as for the phosphate audit measure). Therefore the authors have interpreted the latter audit measure to include this recommended target range for phosphate of 1.1–1.7 mmol/L which results in different measures of phosphate being used at different points in the chapter and readers should be aware of this when interpreting these results.

For the first time, a sufficient number of centres have returned data in relation to pre-dialysis potassium. The most recent RA haemodialysis guideline recommends an audit measure of cumulative frequency curves of pre-dialysis potassium and includes a target range for pre-dialysis potassium of 4.0–6.0 mmol/L [3]. There is no recommendation on serum potassium levels in the most recent peritoneal dialysis guidelines [4].

All parameters from haemodialysis patients audited in this report have used data collected mid-week before a 'short-gap' dialysis session in line with recommendations from the bone mineral guidelines as well as the haemodialysis guidelines [2, 3].

Methods

The analyses presented in this chapter relate to biochemical variables in the prevalent dialysis cohort in the UK. The cohort studied were patients prevalent on dialysis treatment on 31 December 2016. Patients receiving dialysis for less than 90 days and those who had changed modality or renal centre in the last 90 days were excluded. HD and PD cohorts were analysed separately. A full definition of the cohort including inclusion and exclusion criteria is available in appendix B (www.renalreg.org/publications-reports/).

The biochemical variables analysed in this chapter were serum phosphate, calcium (adjusted for albumin), parathyroid hormone, bicarbonate and potassium. The method of data collection and validation by the UKRR has been previously described [7]. In brief, for each quarter of 2016 the UKRR extracted biochemical data electronically from clinical information systems in renal centres in England, Wales and Northern Ireland (E,W & NI). Cambridge renal centre (Addenbrooke's) was unable to submit 2016 data at patient level prior to the UKRR closing the database and only provided summary numbers of patients starting RRT by treatment modality. This centre is therefore excluded from most analyses in this chapter. Scottish centres have only been included in analyses relating to adjusted calcium and phosphate control, with data for their prevalent dialysis cohort being supplied directly by the Scottish Renal Registry. The UKRR does not currently collect data regarding different assay methods mainly because a single dialysis centre may process samples in several different laboratories. The audit measure used for serum phosphate was <1.7 mmol/L in both the HD and PD cohorts [2]. However, for the audit measure of composite control of bone parameters it is recommended that all parameters are within the target range and this includes phosphate within the range of 1.1–1.7 mmol/L, so two different phosphate measures are in use in this chapter. 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, the formula provided by each centre (or, if this is not available, a formula in widespread use) was used to calculate adjusted calcium [8]. The audit measure for adjusted calcium depends on the local reference range [2]. 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 [2]. There are also a variety of methods and reference ranges in use to measure PTH. To enable some form of comparative audit the UKRR has used two to nine times the median upper limit of the reference range (8 pmol/L) as the audit measure in line with the RA clinical practice guidelines and KDIGO 2017 guidance, which is unchanged from the previous KDIGO 2009 guidance [2, 6]. 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 and in the PD cohort was 22–30 mmol/L as per the most recent guidelines [3, 4]. The audit measure for pre-dialysis serum potassium in the HD cohort uses the latest RA guideline

Table 8.2. Summary of clinical guideline target ranges and conversion factors from SI units

Biochemical variable	Clinical guideline 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 2.2–2.5 mmol/L)	mg/dl = mmol/L × 4
Parathyroid hormone	2–9 times upper limit of normal	ng/L = pmol/L × 9.4
Bicarbonate	HD patients: 18–24 mmol/L PD patients: 22–30 mmol/L	mg/dl = mmol/L × 6.1
Potassium	HD patients: 4.0–6.0 mmol/L	mEq/L = mmol/L

*There are two measures for phosphate in use: 1. phosphate clinical audit measure is <1.7 mmol/L while 2. the combined CKD-MBD audit measure assesses all parameters within the target ranges listed in the table which includes phosphate within 1.1–1.7 mmol/L

which is 4.0–6.0 mmol/L [3]. 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, bicarbonate and potassium 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 fewer than ten patients with data, both at centre or country level. These data were analysed to calculate summary descriptive statistics (maximum, minimum, mean with the corresponding standard deviation, median and interquartile range). Where applicable, the percentage achieving the RA 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 an adjusted calcium between 2.2–2.5 mmol/L, a phosphate level being maintained between 1.1–1.7 mmol/L and a PTH level between two and nine times the upper limit of normal (i.e. 16–72 pmol/L), were evaluated in combination.

Centres reported several biochemical variables with different levels of accuracy, leading to problems in comparative evaluation. 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 have been rounded in an attempt to make centres more comparable.

Centres were requested to send pre-dialysis potassium levels for HD patients. Outlying centres were contacted and it was identified that post-dialysis potassium data had inadvertently been submitted and these centres have been excluded from the analysis. However, post-dialysis samples may remain within the analysis for some centres. Future data extracts will aim to ensure that only pre-dialysis results be submitted.

The number preceding the centre name in each figure indicates the percentage of missing data for that centre for that variable. Funnel plot analyses were used to identify outlying centres [9]. The percentage within range for each standard was plotted against centre size along with the upper and lower 95% and 99.9% confidence limits. Centres can be identified on these plots by looking up the number of patients treated in each centre 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 2006 to 2016 and were recalculated for each previous year using the rounding procedure.

All data are presented unadjusted for case-mix.

The data were analysed using SAS 9.3.

Results

Mineral and bone variables

Phosphate

In 2016 the following RA 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.' [2]

Audit measure: Percentage of patients CKD5D with serum PO4 <1.7 mmol/L [2]

Haemodialysis

Table 8.3. Summary statistics for serum phosphate in haemodialysis patients in 2016

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	373	1.8	0.6	1.7	1.4	2.0
B QEH	99.6	934	1.5	0.4	1.5	1.2	1.8
Basldn	98.0	147	1.6	0.5	1.6	1.3	1.9
Bradfd	99.1	226	1.5	0.5	1.5	1.2	1.8
Brightn	99.8	418	1.7	0.6	1.6	1.3	2.0
Bristol	100.0	470	1.6	0.5	1.6	1.3	2.0
Camb*							
Carlis	100.0	88	1.6	0.5	1.5	1.3	1.9
Carsh	99.6	771	1.6	0.5	1.5	1.2	1.8
Chelms	100.0	118	1.6	0.5	1.6	1.3	1.8
Colchr	83.6	92	1.5	0.4	1.4	1.2	1.7
Covnt	99.7	345	1.7	0.5	1.6	1.3	1.9
Derby	100.0	227	1.5	0.5	1.5	1.2	1.8
Donc	100.0	177	1.6	0.4	1.6	1.3	1.9

Table 8.3. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Dorset	100.0	263	1.6	0.5	1.5	1.3	1.9
Dudley	100.0	185	1.5	0.4	1.5	1.3	1.8
Exeter	100.0	423	1.6	0.5	1.5	1.2	1.8
Glouc	100.0	228	1.6	0.5	1.6	1.2	1.9
Hull	100.0	302	1.6	0.5	1.6	1.3	1.9
Ipswi	99.3	135	1.5	0.6	1.4	1.2	1.8
Kent	100.0	387	1.8	0.6	1.7	1.4	2.1
L Barts	99.8	953	1.6	0.5	1.6	1.3	1.9
L Guys	99.8	643	1.5	0.5	1.4	1.1	1.8
L Kings	99.8	544	1.5	0.5	1.5	1.2	1.7
L Rfree	99.9	652	1.6	0.5	1.5	1.2	1.8
L St.G	96.9	314	1.5	0.5	1.5	1.2	1.8
L West	91.6	1,262	1.5	0.5	1.4	1.1	1.8
Leeds	100.0	485	1.7	0.5	1.6	1.3	2.0
Leic	99.9	881	1.6	0.5	1.6	1.3	1.9
Liv Ain	97.1	170	1.4	0.5	1.4	1.1	1.8
Liv Roy	97.7	335	1.6	0.5	1.5	1.2	1.8
M RI	94.1	458	1.6	0.5	1.5	1.2	1.9
Middlbr	100.0	310	1.7	0.6	1.6	1.3	1.9
Newc	100.0	287	1.6	0.5	1.5	1.3	1.9
Norwch	99.7	301	1.7	0.5	1.6	1.3	1.9
Nottm	99.7	364	1.5	0.5	1.5	1.3	1.7
Oxford	100.0	401	1.6	0.6	1.5	1.2	2.0
Plymth	99.2	127	1.6	0.6	1.5	1.2	1.7
Ports	99.8	582	1.7	0.6	1.6	1.3	2.0
Prestn	100.0	531	1.7	0.5	1.6	1.3	2.0
Redng	100.0	288	1.6	0.5	1.5	1.3	1.8
Salford	98.3	356	1.6	0.6	1.5	1.2	1.9
Sheff	99.7	576	1.6	0.5	1.5	1.2	1.9
Shrew	100.0	189	1.6	0.5	1.6	1.3	1.9
Stevng	99.8	490	1.7	0.5	1.6	1.3	2.0
Sthend	100.0	109	1.7	0.5	1.7	1.4	2.0
Stoke	99.1	319	1.6	0.5	1.5	1.3	1.8
Sund	0.0	0					
Truro	100.0	156	1.5	0.4	1.4	1.3	1.8
Wirral	98.9	177	1.5	0.5	1.4	1.2	1.8
Wolve	99.0	291	1.5	0.5	1.4	1.1	1.7
York	100.0	181	1.4	0.5	1.3	1.0	1.6
N Ireland							
Antrim	100.0	115	1.3	0.4	1.3	1.0	1.6
Belfast	100.0	185	1.5	0.5	1.5	1.1	1.8
Newry	100.0	80	1.6	0.5	1.6	1.3	1.9
Ulster	100.0	96	1.4	0.5	1.4	1.1	1.7
West NI	100.0	118	1.6	0.5	1.5	1.3	1.9
Scotland							
Abrdn	99.5	217	1.6	0.5	1.5	1.3	1.8
Airdrie	98.8	171	1.4	0.5	1.4	1.0	1.7
D & Gall	97.9	46	1.6	0.5	1.6	1.3	1.9
Dundee	98.8	164	1.8	0.5	1.7	1.5	2.1
Edinb	99.6	268	1.8	0.5	1.7	1.4	2.0
Glasgw	98.9	531	1.7	0.5	1.7	1.4	2.0
Inverns	80.0	68	1.9	0.5	1.8	1.5	2.2
Klmarnk	100.0	128	1.4	0.5	1.3	1.1	1.6
Krkcldy	100.0	135	1.6	0.4	1.5	1.3	1.8
Wales							
Bangor	100.0	68	1.5	0.5	1.5	1.1	1.8
Cardff	99.8	480	1.7	0.5	1.6	1.3	2.0

Table 8.3. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Clwyd	100.0	68	1.7	0.5	1.7	1.3	2.0
Swanse	100.0	343	1.5	0.5	1.5	1.2	1.8
Wrexm	100.0	113	1.3	0.4	1.3	1.0	1.5
England	**97.7**	**19,041**	**1.6**	**0.5**	**1.5**	**1.2**	**1.9**
N Ireland	**100.0**	**594**	**1.5**	**0.5**	**1.4**	**1.1**	**1.8**
Scotland	**98.3**	**1,728**	**1.7**	**0.5**	**1.6**	**1.3**	**1.9**
Wales	**99.9**	**1,072**	**1.6**	**0.5**	**1.5**	**1.2**	**1.9**
UK	**97.9**	**22,435**	**1.6**	**0.5**	**1.5**	**1.2**	**1.9**

Blank cells: centres excluded from analysis due to low patient numbers or poor data completeness
*Cambridge renal centre was unable to submit serum phosphate data for 2016

Table 8.4. Percentage of haemodialysis patients with serum phosphate below and equal to or above 1.7 mmol/L, as specified in the RA audit measure, by centre in 2016

Centre	*N*	% phos <1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos ⩾1.7 mmol/L	Change in % <1.7 mmol/L from 2015	95% LCL change	95% UCL change
England								
B Heart	373	44.2	39.3	49.3	55.8	−13.9	−20.9	−6.9
B QEH	934	65.9	62.7	68.8	34.2	−5.6	−9.9	−1.4
Basldn	147	54.4	46.3	62.3	45.6	−12.0	−23.0	−1.0
Bradfd	226	66.4	60.0	72.2	33.6	−2.3	−11.0	6.4
Brightn	418	53.4	48.6	58.1	46.7	−3.5	−10.4	3.3
Bristol	470	54.0	49.5	58.5	46.0	−8.7	−15.0	−2.5
Carlis	88	56.8	46.3	66.7	43.2	−11.2	−26.0	3.6
Carsh	771	61.6	58.1	65.0	38.4	−5.6	−10.4	−0.8
Chelms	118	64.4	55.4	72.5	35.6	4.3	−7.6	16.2
Colchr	92	75.0	65.2	82.8	25.0	4.3	−8.1	16.6
Covnt	345	53.3	48.1	58.5	46.7	−3.8	−11.2	3.7
Derby	227	64.8	58.3	70.7	35.2	−3.6	−12.3	5.2
Donc	177	55.4	48.0	62.5	44.6	−8.4	−18.8	2.0
Dorset	263	59.7	53.7	65.5	40.3	−14.8	−22.7	−7.0
Dudley	185	68.1	61.1	74.4	31.9	−0.5	−10.4	9.4
Exeter	423	63.6	58.9	68.0	36.4	−3.8	−10.3	2.7
Glouc	228	57.9	51.4	64.1	42.1	−3.4	−12.5	5.7
Hull	302	55.0	49.3	60.5	45.0	−7.2	−14.9	0.5
Ipswi	135	63.7	55.3	71.4	36.3	−10.7	−21.8	0.3
Kent	387	47.3	42.4	52.3	52.7	−5.5	−12.5	1.5
L Barts	953	56.2	53.1	59.4	43.8	−4.2	−8.7	0.2
L Guys	643	67.7	63.9	71.2	32.4	2.3	−2.9	7.5
L Kings	544	66.2	62.1	70.0	33.8	−7.9	−13.4	−2.4
L Rfree	652	62.9	59.1	66.5	37.1	−3.0	−8.2	2.1
L St.G	314	65.9	60.5	71.0	34.1	−5.2	−12.5	2.1
L West	1,262	67.1	64.5	69.7	32.9	−2.1	−5.8	1.5
Leeds	485	53.2	48.7	57.6	46.8	−7.4	−13.6	−1.1
Leic	881	57.8	54.5	61.0	42.2	−2.5	−7.2	2.1
Liv Ain	170	64.7	57.2	71.5	35.3	−13.1	−22.8	−3.3
Liv Roy	335	64.8	59.5	69.7	35.2	1.2	−5.9	8.4
M RI*	458	60.9	56.4	65.3	39.1	−1.6	−8.0	4.7

Table 8.4. Continued

Centre	*N*	% phos <1.7 mmol/L	Lower 95% CI	Upper 95% CI	% phos ⩾1.7 mmol/L	Change in % <1.7 mmol/L from 2015	95% LCL change	95% UCL change
Middlbr	310	53.6	48.0	59.0	46.5	−5.3	−13.0	2.5
Newc	287	62.0	56.3	67.5	38.0	−1.1	−9.1	6.8
Norwch	301	53.5	47.8	59.1	46.5	−15.8	−23.4	−8.2
Nottm	364	65.9	60.9	70.6	34.1	−7.4	−14.1	−0.7
Oxford	401	57.1	52.2	61.9	42.9	0.8	−6.1	7.6
Plymth	127	70.9	62.4	78.1	29.1	11.6	0.1	23.2
Ports	582	54.0	49.9	58.0	46.1	−2.3	−7.9	3.3
Prestn	531	52.2	47.9	56.4	47.8	−5.4	−11.3	0.6
Redng	288	63.2	57.5	68.6	36.8	−2.1	−9.9	5.8
Salford*	356	59.3	54.1	64.3	40.7	−5.0	−12.0	2.1
Sheff	576	58.9	54.8	62.8	41.2	−5.0	−10.7	0.7
Shrew	189	58.2	51.1	65.0	41.8	−1.7	−11.6	8.2
Stevng	490	53.9	49.4	58.3	46.1	−4.7	−10.9	1.6
Sthend	109	46.8	37.6	56.2	53.2	−9.7	−22.9	3.5
Stoke	319	63.3	57.9	68.4	36.7	−1.5	−9.0	6.1
Truro	156	66.7	58.9	73.6	33.3	−4.2	−14.6	6.3
Wirral	177	68.4	61.2	74.8	31.6	0.9	−8.8	10.7
Wolve	291	67.0	61.4	72.2	33.0	4.1	−3.7	11.8
York	181	76.8	70.1	82.4	23.2	−3.2	−12.2	5.8
N Ireland								
Antrim	115	80.0	71.7	86.3	20.0	3.7	−7.0	14.4
Belfast	185	64.3	57.2	70.9	35.7	1.5	−8.5	11.5
Newry	80	56.3	45.3	66.7	43.8	−8.0	−23.0	6.9
Ulster	96	72.9	63.2	80.9	27.1	9.4	−3.7	22.5
West NI	118	59.3	50.3	67.8	40.7	0.9	−11.8	13.6
Scotland								
Abrdn	217	62.7	56.1	68.9	37.3	−11.5	−20.3	−2.7
Airdrie	171	68.4	61.1	74.9	31.6	−1.7	−11.4	8.0
D & Gall	46	63.0	48.4	75.6	37.0	−0.2	−19.6	19.2
Dundee	164	42.1	34.8	49.8	57.9	−5.9	−16.5	4.8
Edinb	268	43.7	37.8	49.7	56.3	−5.5	−14.1	3.1
Glasgw	531	46.0	41.8	50.2	54.1	−8.3	−14.2	−2.3
Inverns	68	39.7	28.8	51.7	60.3	−9.6	−25.8	6.5
Klmarnk	128	75.8	67.6	82.4	24.2	8.0	−3.0	19.1
Krkcldy	135	63.7	55.3	71.4	36.3	−0.4	−12.0	11.1
Wales								
Bangor	68	66.2	54.2	76.4	33.8	−8.2	−23.0	6.7
Cardff	480	54.2	49.7	58.6	45.8	−11.5	−17.7	−5.3
Clwyd	68	50.0	38.3	61.7	50.0	−4.0	−20.3	12.4
Swanse	343	68.8	63.7	73.5	31.2	0.4	−6.6	7.3
Wrexm	113	83.2	75.1	89.0	16.8	−5.7	−15.0	3.6
England	**19,041**	**60.1**	**59.4**	**60.8**	**39.9**	**−4.2**	**−5.1**	**−3.2**
N Ireland	**594**	**66.7**	**62.8**	**70.3**	**33.3**	**1.7**	**−3.7**	**7.2**
Scotland	**1,728**	**53.4**	**51.0**	**55.7**	**46.6**	**−5.3**	**−8.6**	**−2.0**
Wales	**1,072**	**62.4**	**59.5**	**65.3**	**37.6**	**−6.1**	**−10.2**	**−2.1**
UK	**22,435**	**59.9**	**59.2**	**60.5**	**40.1**	**−4.2**	**−5.1**	**−3.3**

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness
*Salford and Manchester RI have been involved in the SPIRiT study; an RCT comparing low phosphate control (0.8–1.4 mmol/L) with high phosphate control (1.8–2.4 mmol/L); HD patients only were recruited

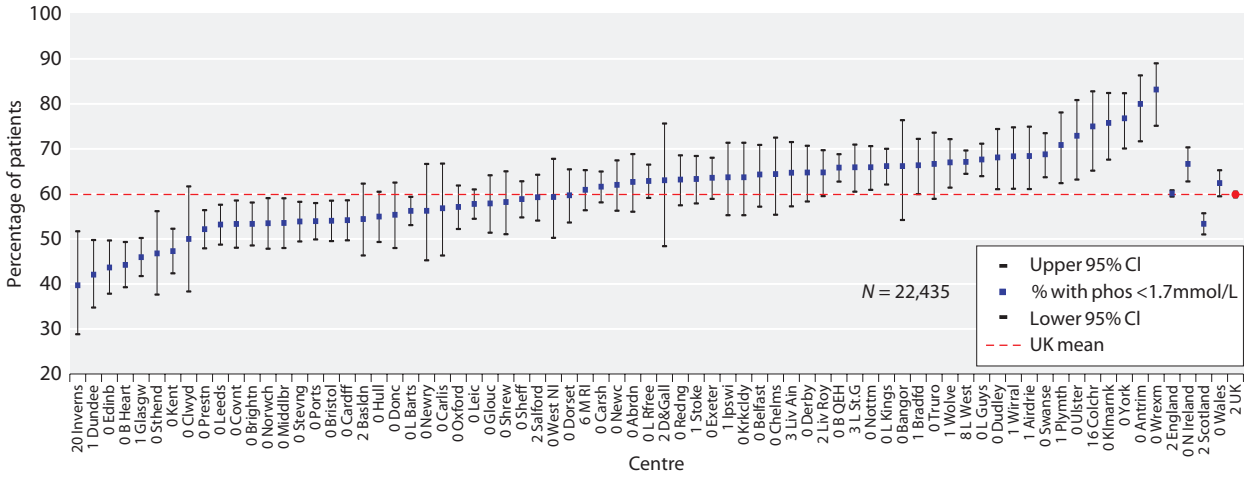

Fig. 8.1. Percentage of haemodialysis patients with serum phosphate below 1.7 mmol/L as specified by the RA audit measure, by centre in 2016

Fig. 8.2. Funnel plot of percentage of haemodialysis patients with serum phosphate below 1.7 mmol/L as specified by the RA clinical audit measure, by centre in 2016

Peritoneal dialysis

Table 8.5. Summary statistics for phosphate in peritoneal dialysis patients in 2016

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	72	1.8	0.5	1.8	1.5	2.2
B QEH	100.0	125	1.6	0.5	1.6	1.3	1.8
Basldn	100.0	30	1.6	0.4	1.5	1.3	1.8
Bradfd	100.0	22	1.7	0.5	1.8	1.3	2.1
Brightn	100.0	56	1.6	0.4	1.6	1.4	1.9
Bristol	100.0	42	1.7	0.5	1.6	1.4	1.9
Camb[a]							
Carlis	96.8	30	1.6	0.4	1.6	1.3	1.9
Carsh	92.1	93	1.6	0.4	1.5	1.3	1.9
Chelms	88.9	24	1.7	0.6	1.5	1.3	1.9
Colchr[b]							
Covnt	96.6	57	1.5	0.4	1.5	1.2	1.7
Derby	100.0	71	1.5	0.4	1.4	1.2	1.6
Donc	100.0	25	1.5	0.3	1.5	1.3	1.6

Table 8.5. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Dorset	100.0	33	1.4	0.4	1.3	1.2	1.6
Dudley	100.0	48	1.8	0.5	1.8	1.5	2.1
Exeter	100.0	73	1.6	0.5	1.6	1.2	1.8
Glouc	97.0	32	1.6	0.4	1.6	1.2	1.8
Hull	100.0	61	1.6	0.4	1.6	1.4	1.9
Ipswi	97.0	32	1.5	0.4	1.5	1.3	1.7
Kent	97.7	42	1.5	0.5	1.4	1.2	1.6
L Barts	97.8	175	1.6	0.4	1.6	1.3	1.9
L Guys	100.0	32	1.7	0.4	1.7	1.4	1.8
L Kings	100.0	75	1.6	0.4	1.5	1.3	1.8
L Rfree	97.8	135	1.6	0.4	1.5	1.4	1.8
L St.G	97.3	36	1.6	0.4	1.6	1.3	1.9
L West	90.6	77	1.6	0.5	1.6	1.4	1.9
Leeds	100.0	36	1.7	0.4	1.8	1.4	1.9
Leic	98.6	69	1.5	0.3	1.5	1.3	1.7
Liv Ain	100.0	23	1.8	0.7	1.7	1.4	1.9
Liv Roy	98.4	63	1.4	0.4	1.3	1.2	1.7
M RI	98.0	48	1.6	0.5	1.6	1.3	2.0
Middlbr	100.0	22	1.8	0.4	1.7	1.5	2.1
Newc	100.0	46	1.7	0.5	1.7	1.5	2.0
Norwch	100.0	41	1.7	0.5	1.6	1.4	1.8
Nottm	100.0	67	1.6	0.4	1.6	1.3	1.8
Oxford	100.0	80	1.7	0.5	1.6	1.4	1.8
Plymth	93.6	29	1.5	0.4	1.4	1.3	1.8
Ports	95.5	64	1.8	0.5	1.7	1.5	2.1
Prestn	100.0	35	1.6	0.4	1.5	1.3	1.9
Redng	100.0	44	1.7	0.4	1.6	1.4	1.9
Salford	98.9	89	1.7	0.5	1.6	1.4	2.0
Sheff	100.0	47	1.6	0.4	1.5	1.3	1.8
Shrew	100.0	29	1.6	0.3	1.6	1.4	1.7
Stevng	100.0	16	1.5	0.3	1.6	1.3	1.8
Sthend	100.0	24	1.5	0.4	1.5	1.3	1.8
Stoke	98.6	70	1.7	0.5	1.7	1.4	2.0
Sund	100.0	17	1.5	0.4	1.5	1.1	1.7
Truro	100.0	17	1.7	0.4	1.7	1.4	2.0
Wirral	93.3	14	1.7	0.3	1.8	1.6	1.9
Wolve	92.2	59	1.6	0.4	1.6	1.3	1.8
York	100.0	27	1.5	0.4	1.5	1.1	1.6
N Ireland							
Antrim	100.0	14	1.4	0.3	1.4	1.2	1.5
Belfast	100.0	22	1.6	0.4	1.5	1.3	1.9
Newry	100.0	19	1.5	0.3	1.4	1.2	1.8
Ulster	100.0	5					
West NI	100.0	9					
Scotland							
Abrdn	100.0	19	1.7	0.5	1.6	1.3	2.1
Airdrie	95.2	20	1.4	0.3	1.4	1.3	1.6
D&Gall	100.0	10	1.6	0.3	1.6	1.4	2.0
Dundee	100.0	13	1.7	0.3	1.7	1.4	1.9
Edinb	90.3	28	1.9	0.6	1.7	1.4	2.1
Glasgw	97.7	42	1.6	0.3	1.6	1.4	1.8
Inverns	33.3	3					
Klmarnk	96.4	27	1.7	0.4	1.6	1.4	1.9
Krkcldy	100.0	15	1.7	0.5	1.6	1.4	1.8

Table 8.5. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Wales							
Bangor	100.0	15	1.5	0.3	1.5	1.2	1.6
Cardff	95.5	64	1.7	0.5	1.6	1.4	1.9
Clwyd	100.0	14	1.5	0.5	1.5	1.2	1.9
Swanse	100.0	58	1.7	0.5	1.6	1.3	2.0
Wrexm	100.0	28	1.5	0.5	1.5	1.3	1.9
England	**98.1**	**2,574**	**1.6**	**0.4**	**1.6**	**1.3**	**1.9**
N Ireland	**100.0**	**69**	**1.5**	**0.3**	**1.4**	**1.3**	**1.8**
Scotland	**93.7**	**177**	**1.7**	**0.4**	**1.6**	**1.4**	**1.9**
Wales	**98.4**	**179**	**1.6**	**0.5**	**1.6**	**1.3**	**1.9**
UK	**97.9**	**2,999**	**1.6**	**0.4**	**1.6**	**1.3**	**1.9**

Blank cells – centres excluded from analysis due to low patient numbers or poor data completeness
[a]Cambridge renal centre was unable to submit serum phosphate data for 2016
[b]Colchester – no PD patients

Table 8.6. Percentage of peritoneal dialysis patients with serum phosphate below and equal to or above 1.7 mmol/L as specified in the RA audit measure in 2016

Centre	*N*	% phos <1.7 mmol/L	Lower 95% CI	Upper 95% CI	% with phos ⩾1.7 mmol/L	Change in % <1.7 mmol/L from 2015	95% LCL change	95% UCL change
England								
B Heart	72	36.1	25.9	47.8	63.9	−13.9	−32.9	5.2
B QEH	125	60.0	51.2	68.2	40.0	1.3	−11.0	13.6
Basldn	30	56.7	38.8	72.9	43.3	4.8	−21.1	30.7
Bradfd	22	45.5	26.5	65.9	54.6	9.7	−22.9	42.3
Brightn	56	57.1	44.0	69.4	42.9	−7.9	−25.6	9.9
Bristol	42	61.9	46.6	75.2	38.1	0.2	−20.0	20.4
Carlis	30	63.3	45.1	78.4	36.7	6.7	−18.1	31.4
Carsh	93	61.3	51.1	70.6	38.7	2.6	−11.5	16.7
Chelms	24	62.5	42.2	79.2	37.5	8.0	−20.5	36.4
Covnt	57	64.9	51.8	76.1	35.1	−13.9	−29.7	2.0
Derby	71	77.5	66.3	85.7	22.5	7.6	−6.7	21.9
Donc	25	80.0	60.0	91.4	20.0	13.3	−13.5	40.2
Dorset	33	75.8	58.5	87.4	24.2	−1.4	−21.6	18.8
Dudley	48	39.6	26.9	53.9	60.4	−22.0	−41.1	−2.8
Exeter	73	57.5	46.0	68.3	42.5	−12.9	−28.4	2.6
Glouc	32	59.4	41.9	74.7	40.6	2.2	−22.8	27.3
Hull	61	50.8	38.5	63.1	49.2	−5.4	−22.9	12.0
Ipswi	32	75.0	57.4	87.0	25.0	8.3	−14.9	31.6
Kent	42	78.6	63.7	88.5	21.4	10.1	−7.5	27.6
L Barts	175	55.4	48.0	62.6	44.6	−7.1	−17.4	3.1
L Guys	32	43.8	27.9	61.0	56.3	−18.3	−43.0	6.3
L Kings	75	68.0	56.7	77.5	32.0	10.5	−4.6	25.6
L Rfree	135	62.2	53.8	70.0	37.8	5.1	−6.7	16.8
L St.G	36	52.8	36.8	68.3	47.2	−12.3	−34.0	9.3
L West	77	58.4	47.2	68.9	41.6	−12.7	−29.2	3.8
Leeds	36	47.2	31.7	63.3	52.8	1.2	−20.2	22.6
Leic	69	69.6	57.8	79.2	30.4	7.5	−7.1	22.1
Liv Ain	23	43.5	25.2	63.7	56.5	−19.5	−46.7	7.8
Liv Roy	63	74.6	62.5	83.8	25.4	18.9	2.4	35.3
M RI	48	56.3	42.1	69.5	43.8	−2.4	−21.3	16.5
Middlbr	22	45.5	26.5	65.9	54.6	−26.0	−57.5	5.5
Newc	46	45.7	32.0	60.0	54.4	−12.2	−33.5	9.1
Norwch	41	61.0	45.5	74.5	39.0	0.3	−23.2	23.7

Table 8.6. Continued

Centre	*N*	% phos <1.7 mmol/L	Lower 95% CI	Upper 95% CI	% with phos ⩾1.7 mmol/L	Change in % <1.7 mmol/L from 2015	95% LCL change	95% UCL change
Nottm	67	65.7	53.6	76.0	34.3	−3.1	−19.1	13.0
Oxford	80	58.8	47.7	69.0	41.3	1.8	−13.6	17.1
Plymth	29	58.6	40.4	74.8	41.4	−15.5	−39.8	8.9
Ports	64	42.2	30.8	54.5	57.8	−5.2	−22.9	12.6
Prestn	35	57.1	40.6	72.3	42.9	−12.3	−33.1	8.6
Redng	44	52.3	37.7	66.4	47.7	−24.0	−42.3	−5.7
Salford	89	50.6	40.3	60.8	49.4	3.0	−12.0	18.0
Sheff	47	59.6	45.2	72.5	40.4	2.4	−16.7	21.5
Shrew	29	62.1	43.6	77.6	37.9	10.2	−15.6	36.0
Stevng	16	56.3	32.4	77.5	43.8	25.5	−9.5	60.4
Sthend	24	70.8	50.2	85.4	29.2	−2.5	−31.3	26.3
Stoke	70	50.0	38.5	61.5	50.0	−14.7	−31.0	1.6
Sund	17	58.8	35.2	79.0	41.2	5.0	−30.8	40.8
Truro	17	47.1	25.5	69.7	52.9	−16.1	−48.2	16.0
Wirral	14	28.6	11.2	56.1	71.4	−6.7	−39.5	26.1
Wolve	59	62.7	49.8	74.0	37.3	−8.9	−25.3	7.5
York	27	77.8	58.6	89.7	22.2	15.9	−10.1	41.9
N Ireland								
Antrim	14	86	57	96	14	15.1	−13.3	43.5
Belfast	22	64	42	81	36	0.5	−29.1	30.1
Newry	19	68	45	85	32	−20.5	−45.9	5.0
Scotland								
Abrdn	19	53	31	73	47	9.8	−21.1	40.6
Airdrie	20	80	57	92	20			
D & Gall	10	60.0	29.7	84.2	40.0	0.0	−42.9	42.9
Dundee	13	38.5	17.0	65.6	61.5	−17.8	−53.7	18.1
Edinb	28	42.9	26.2	61.3	57.1	−16.0	−45.7	13.8
Glasgw	42	64.3	48.9	77.2	35.7	12.0	−8.7	32.7
Klmarnk	27	55.6	36.9	72.8	44.4	22.2	−2.5	46.9
Krkcldy	15	60.0	34.8	80.8	40.0	10.0	−24.9	44.9
Wales								
Bangor	15	80.0	53.0	93.4	20.0	33.9	0.0	67.7
Cardff	64	54.7	42.5	66.4	45.3	−1.0	−17.9	15.8
Clwyd	14	71.4	44.0	88.9	28.6	17.6	−18.4	53.6
Swanse	58	56.9	44.0	68.9	43.1	−1.3	−19.5	17.0
Wrexm	28	57.1	38.7	73.8	42.9	−0.4	−25.3	24.5
England	**2,574**	**58.6**	**56.6**	**60.4**	**41.5**	**−2.8**	**−5.4**	**−0.1**
N Ireland	**55**	**70.9**	**57.7**	**81.4**	**29.1**	**−3.2**	**−19.9**	**13.6**
Scotland	**174**	**57.5**	**50.0**	**64.6**	**42.5**	**9.2**	**−1.3**	**19.7**
Wales	**179**	**59.2**	**51.9**	**66.2**	**40.8**	**3.2**	**−6.9**	**13.4**
UK	**2,999**	**58.7**	**57.0**	**60.5**	**41.3**	**−1.8**	**−4.3**	**0.6**

Centres missing from the table were excluded from analysis due to low patient numbers, poor data completeness or no patients on PD
Blank cells indicate no data for 2015

Overall, data from 22,435 HD and 2,999 PD patients across the UK were included in the analyses of serum phosphate in 2016. The overall data completeness for serum phosphate across the UK was 97.9% for both HD and PD patients, with some variation between centres (tables 8.3, 8.5). HD centre returns were all >90%, except Cambridge and Sunderland at 0%, and Colchester and Inverness with completeness between 80–85%. For PD patients, Cambridge also returned no data and only two other centres (Chelmsford and Inverness) returned less than 90% data, compared with five centres in the previous audit.

The individual centre means and standard deviations are shown in tables 8.3 and 8.5 for HD and PD patients respectively.

For those receiving HD, 59.9% of patients achieved a phosphate level below 1.7 mmol/L, the audit measure specified by the RA, and for those on PD this was

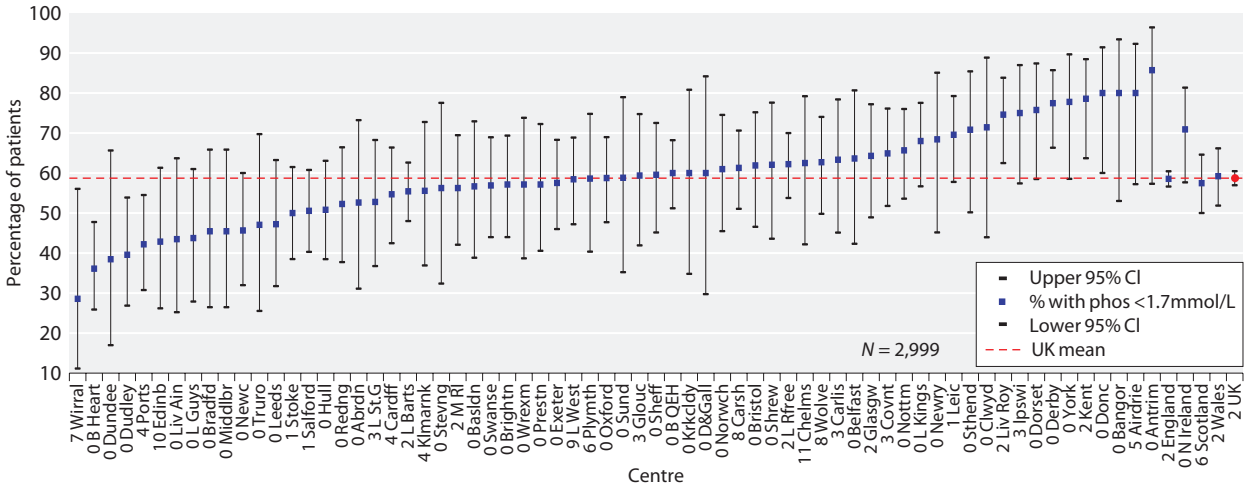

Fig. 8.3. Percentage of peritoneal dialysis patients with serum phosphate below 1.7 mmol/L as specified by the RA audit measure, by centre in 2016

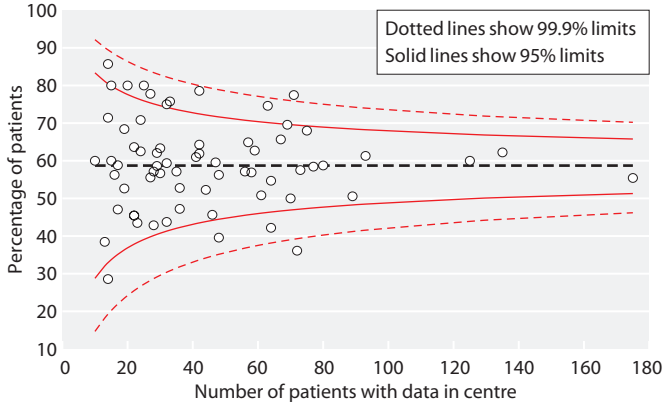

Fig. 8.4. Funnel plot of percentage of peritoneal dialysis patients with phosphate below 1.7 mmol/L as specified by the RA clinical audit measure, by centre in 2016

58.7% (tables 8.4, 8.6). In 2015, the equivalent figures were 64.1% and 60.5% respectively.

There was inter-centre variation in the proportion of patients below and equal to or above the phosphate target specified by the clinical performance audit measure. The majority of centres saw a fall in the proportion of HD patients attaining the phosphate target (figures 8.1–8.4, tables 8.4, 8.6).

Funnel plots for HD patients with controlled phosphataemia (<1.7 mmol/L), show a number of centres attaining this standard in a significantly high proportion of patients: Antrim, Birmingham QEH, Kilmarnock, London Guys, London West, Swansea, Wrexham and York. All these centres achieved above the 99.9% upper confidence interval following correction for centre size.

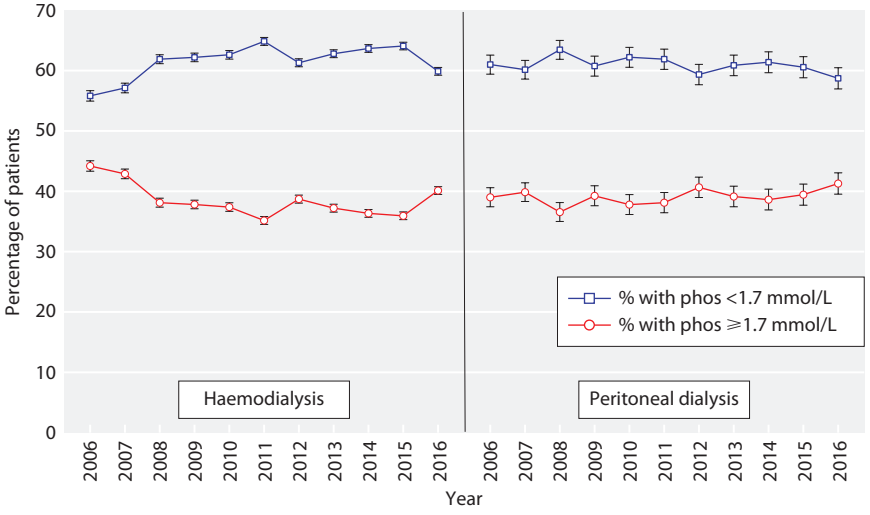

Fig. 8.5. Longitudinal change in percentage of patients with phosphate below and equal to or above 1.7 mmol/L, as specified by the RA clinical audit measure, by dialysis modality 2006–2016

In addition, a number of centres had achieved the serum phosphate control standard in a lower than expected proportion of patients (being below the lower 99.9% confidence interval): Birmingham Heartlands, Dundee, Edinburgh, Glasgow, Inverness, Kent and Preston (figure 8.2).

Funnel plots for PD patients indicated that the control of phosphate levels were similar in all centres. Only two significant outliers were identified, Birmingham Heartlands and Derby, achieving the serum phosphate control standard respectively in a lower and in a higher than expected proportion of PD patients (figure 8.4).

Longitudinal analysis demonstrates that the proportion of HD and PD patients with hyperphosphataemia had seen modest improvement over the last decade however this proportion has increased in both modalities this year (figure 8.5). Data showing the performance of centres in attaining phosphate control within the guideline target range (1.1–1.7 mmol/L) can be found in appendix 1 of this chapter (rather than the audit measure of <1.7 mmol/L presented here).

Simultaneous control of adjusted calcium, phosphate and PTH in preventing severe hyperparathyroidism

In 2016 the following RA audit measure for combined biochemical control applied:

'Percentage of patients with all bone parameters within target range (Calcium/Phosphate/PTH)' [2]

The RA guideline does not explicitly outline the target ranges to be used in the audit measure itself therefore the authors have interpreted this to include the target ranges suggested for each biochemical measure in the guideline. Therefore the combined audit measure comprised the following: phosphate 1.1–1.7 mmol/L, adjusted calcium 2.2–2.5 mmol/L and PTH 16–72 pmol/L. Please note this phosphate measure is discrepant with the preceding audit measure for phosphate alone (of <1.7 mmol/L). This section presents only the audit measure of composite control, however data regarding attainment of each of the three components individually can be found in appendix 1.

There were combined biochemical results to assess mineral bone disease available from 57 HD and 55 PD centres, including 17,684 HD and 2,366 PD patients, from England, Wales and Northern Ireland in 2016. Table 8.7 demonstrates the percentage of patients achieving results within the target range for none, one, two or all three bone mineral parameters, by centre for patients receiving HD and figure 8.6 shows the variation between centres in the proportion achieving control of all three parameters. Table 8.8 and figure 8.7 show the same data for patients receiving PD.

Overall, 5.0% of HD and 3.3% of PD patients across England, Wales and Northern Ireland had none of the three bone mineral parameters controlled within the target ranges described above. Control of one parameter was reported in 24.8% of HD and 20.5% of PD patients;

Table 8.7. Percentage of haemodialysis patients achieving simultaneous control of the three key bone and mineral disorder parameters (adjusted calcium, phosphate and parathyroid hormone) by centre, in 2016

		Number of parameters			
Centre	*N*	None	One	Two	Three
England					
B Heart	367	8.7	28.9	38.1	24.3
Basldn	132	9.8	19.7	38.6	31.8
Bradfd	225	5.8	23.1	41.8	29.3
Brightn	406	5.4	25.9	45.8	22.9
Bristol	468	5.6	29.5	42.3	22.6
Carlis	87	2.3	26.4	44.8	26.4
Carsh	641	5.6	23.7	40.7	30.0
Chelms	118	2.5	19.5	50.0	28.0
Colchr	89	3.4	15.7	36.0	44.9
Covnt	341	3.8	28.7	39.9	27.6
Derby	227	4.8	18.5	43.6	33.0
Donc	176	5.1	17.6	42.6	34.7
Dorset	261	2.3	29.1	39.8	28.7
Dudley	180	3.9	18.9	44.4	32.8

Table 8.7. Continued

Centre	*N*	Number of parameters			
		None	One	Two	Three
Exeter	412	2.2	26.2	47.3	24.3
Glouc	226	4.4	23.5	42.9	29.2
Hull	290	5.9	25.9	43.1	25.2
Ipswi	135	6.7	25.2	43.7	24.4
Kent	386	4.7	27.5	45.3	22.5
L Barts	929	5.4	24.9	43.4	26.4
L Guys	453	3.3	19.6	43.5	33.6
L Kings	528	5.1	25.4	43.0	26.5
L Rfree	647	3.9	23.6	42.7	29.8
L St.G	294	5.4	22.1	51.0	21.4
L West	1,012	7.2	30.9	42.6	19.3
Leeds	476	5.9	27.7	42.4	23.9
Leic	857	5.3	25.6	43.5	25.7
Liv Ain	119	4.2	36.1	45.4	14.3
Liv Roy	264	6.1	24.2	40.2	29.5
M RI	437	5.5	29.3	41.4	23.8
Middlbr	300	4.0	26.7	41.7	27.7
Newc	287	3.8	24.4	42.2	29.6
Norwch	297	5.4	19.9	41.4	33.3
Nottm	356	4.2	21.6	42.1	32.0
Oxford	399	4.5	22.6	42.6	30.3
Plymth	122	2.5	22.1	41.0	34.4
Ports	558	6.3	23.3	44.3	26.2
Prestn	494	4.5	22.9	45.3	27.3
Redng	286	4.9	22.7	39.9	32.5
Shrew	183	3.8	19.7	39.3	37.2
Stevng	479	4.6	18.8	45.1	31.5
Sthend	99	13.1	26.3	43.4	17.2
Stoke	256	3.5	19.5	43.0	34.0
Truro	156	3.2	27.6	39.7	29.5
Wirral	128	2.3	21.9	45.3	30.5
Wolve	285	7.4	29.5	43.9	19.3
York	173	3.5	31.8	39.3	25.4
N Ireland					
Antrim	115	1.7	21.7	40.0	36.5
Belfast	183	3.8	29.0	48.1	19.1
Newry	80	5.0	21.3	36.3	37.5
Ulster	94	9.6	20.2	47.9	22.3
West NI	117	2.6	14.5	47.0	35.9
Wales					
Bangor	67	4.5	34.3	40.3	20.9
Cardff	469	5.1	23.9	43.5	27.5
Clwyd	65	4.6	30.8	43.1	21.5
Swanse	342	2.3	19.9	43.9	33.9
Wrexm	111	4.5	31.5	35.1	28.8
England	**16,041**	**5.1**	**24.9**	**42.9**	**27.1**
N Ireland	**589**	**4.2**	**22.2**	**44.7**	**28.9**
Wales	**1,054**	**4.1**	**24.5**	**42.5**	**28.9**
E, W & NI	**17,684**	**5.0**	**24.8**	**42.9**	**27.3**

Centres excluded if they did not have at least 50% completeness for all of the three variables

Table 8.8. Percentage of peritoneal dialysis patients achieving simultaneous control of the three key bone and mineral disorder parameters (adjusted calcium, phosphate and parathyroid hormone) by centre, in 2016

		Number of parameters			
Centre	*N*	None	One	Two	Three
England					
B Heart	68	2.9	33.8	38.2	25.0
Basldn	30	0.0	16.7	36.7	46.7
Bradfd	21	4.8	42.9	33.3	19.0
Brightn	52	1.9	19.2	55.8	23.1
Bristol	42	7.1	11.9	40.5	40.5
Carlis	30	0.0	16.7	40.0	43.3
Carsh	78	3.8	21.8	43.6	30.8
Chelms	22	13.6	22.7	40.9	22.7
Covnt	54	1.9	24.1	51.9	22.2
Derby	69	2.9	10.1	44.9	42.0
Donc	25	0.0	8.0	32.0	60.0
Dorset	32	6.3	25.0	37.5	31.3
Dudley	39	5.1	23.1	53.8	17.9
Exeter	73	1.4	19.2	49.3	30.1
Glouc	24	4.2	29.2	25.0	41.7
Hull	56	1.8	23.2	39.3	35.7
Ipswi	31	0.0	9.7	38.7	51.6
Kent	41	2.4	17.1	48.8	31.7
L Barts	162	4.3	22.8	42.0	30.9
L Guys	27	3.7	7.4	48.1	40.7
L Kings	66	3.0	25.8	53.0	18.2
L Rfree	131	3.1	17.6	39.7	39.7
L St.G	35	2.9	22.9	40.0	34.3
L West	69	7.2	14.5	47.8	30.4
Leeds	36	5.6	27.8	50.0	16.7
Leic	65	3.1	10.8	52.3	33.8
Liv Ain	22	0.0	40.9	36.4	22.7
Liv Roy	63	1.6	22.2	39.7	36.5
M RI	47	2.1	25.5	44.7	27.7
Middlbr	15	0.0	6.7	66.7	26.7
Newc	41	9.8	29.3	31.7	29.3
Norwch	31	6.5	16.1	38.7	38.7
Nottm	66	4.5	13.6	39.4	42.4
Oxford	78	2.6	12.8	46.2	38.5
Plymth	26	3.8	19.2	38.5	38.5
Ports	55	1.8	20.0	50.9	27.3
Prestn	34	0.0	23.5	47.1	29.4
Redng	42	4.8	21.4	35.7	38.1
Shrew	29	0.0	10.3	31.0	58.6
Stevng	14	0.0	21.4	42.9	35.7
Sthend	17	5.9	17.6	35.3	41.2
Stoke	62	6.5	35.5	35.5	22.6
Sund	17	5.9	11.8	47.1	35.3
Truro	15	0.0	20.0	60.0	20.0
Wirral	12	8.3	8.3	66.7	16.7
Wolve	57	1.8	19.3	35.1	43.9
York	25	0.0	24.0	48.0	28.0
N Ireland					
Antrim	14	0.0	14.3	57.1	28.6
Belfast	21	4.8	9.5	47.6	38.1
Newry	19	0.0	21.1	42.1	36.8

Table 8.8. Continued

Centre	*N*	Number of parameters			
		None	One	Two	Three
Wales					
Bangor	15	0.0	20.0	40.0	40.0
Cardff	53	3.8	28.3	34.0	34.0
Clwyd	13	0.0	30.8	38.5	30.8
Swanse	57	3.5	21.1	42.1	33.3
Wrexm	28	3.6	32.1	32.1	32.1
England	**2,146**	**3.4**	**20.3**	**43.2**	**33.1**
N Ireland	**54**	**1.9**	**14.8**	**48.1**	**35.2**
Wales	**166**	**3.0**	**25.9**	**37.3**	**33.7**
E, W & NI	**2,366**	**3.3**	**20.5**	**42.9**	**33.2**

Centres excluded if they did not have at least 50% completeness for all of the three variables

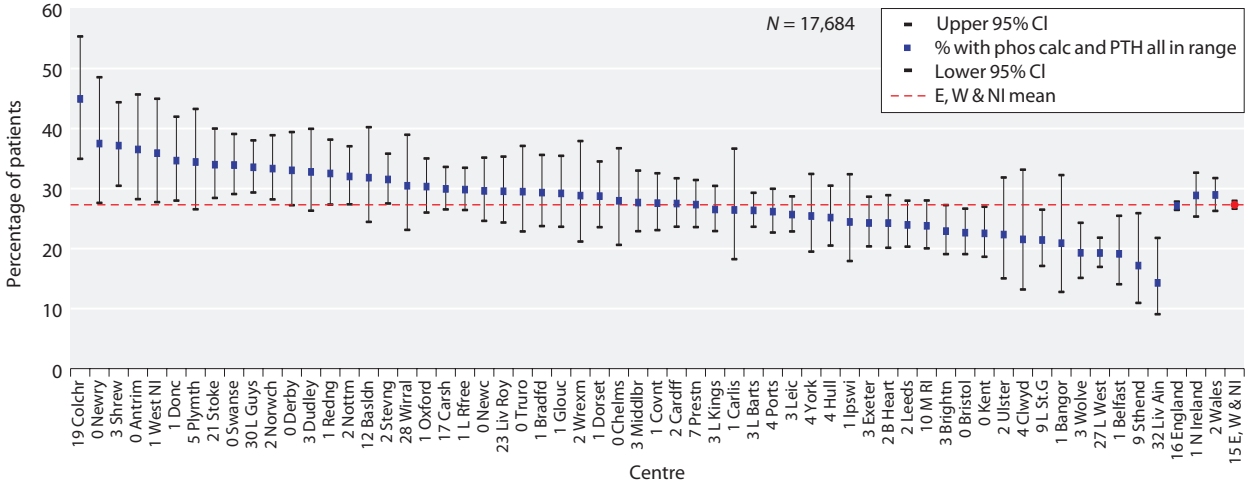

Fig. 8.6. Percentage of HD patients achieving simultaneous control of the three key mineral bone disorders (adjusted calcium, phosphate and parathyroid hormone) in preventing severe hyperparathyroidism, by centre in 2016

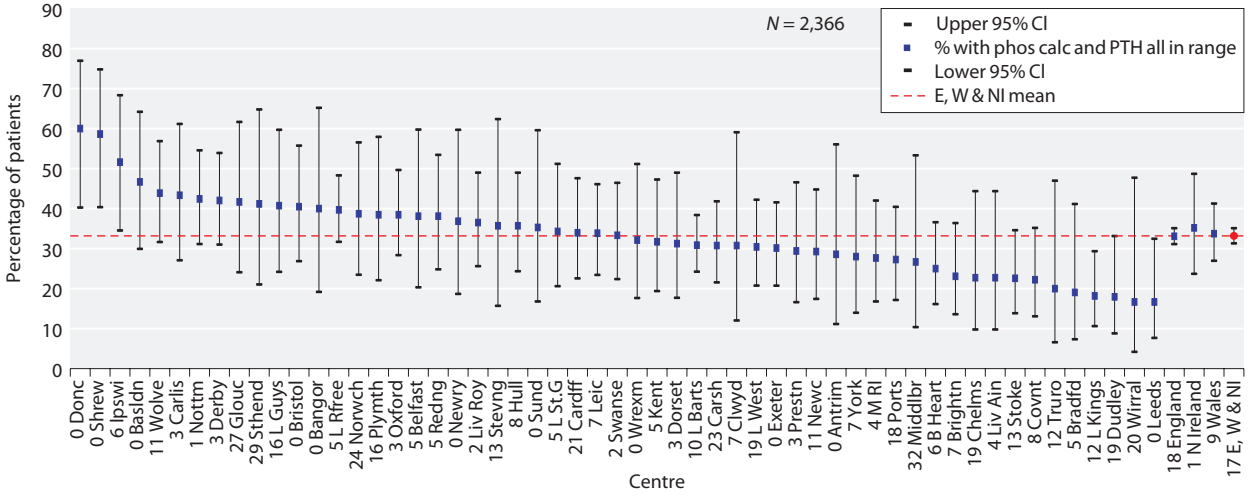

Fig. 8.7. Percentage of PD patients achieving simultaneous control of all three mineral bone disorders (adjusted calcium, phosphate and parathyroid hormone) in preventing severe hyperparathyroidism, by centre in 2016

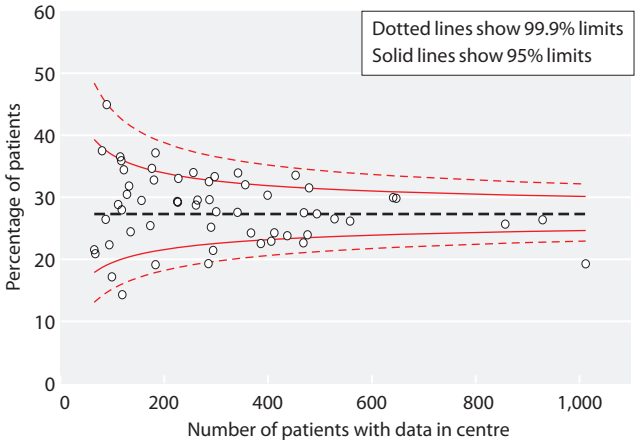

Fig. 8.8. Funnel plot of percentage of HD patients achieving simultaneous control of all three mineral bone disorders (adjusted calcium, phosphate and parathyroid hormone) in preventing severe hyperparathyroidism, by centre in 2016

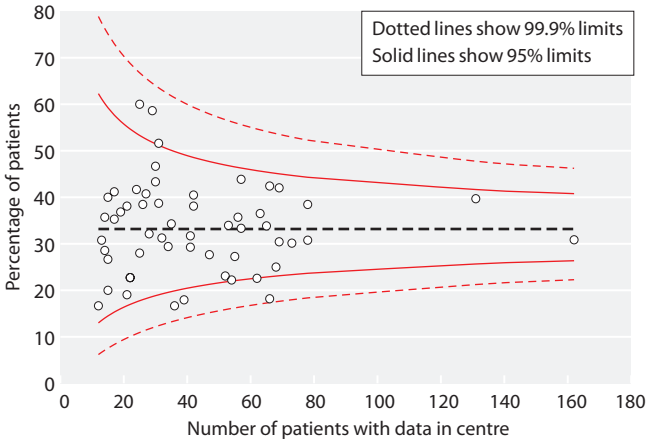

Fig. 8.9. Funnel plot of percentage of PD patients achieving simultaneous control of all three mineral bone disorders (adjusted calcium, phosphate and parathyroid hormone) in preventing severe hyperparathyroidism, by centre in 2016

of two parameters in 42.9% of both HD and PD patients; of all three parameters in 27.3% of HD and 33.2% of PD patients (tables 8.7, 8.8). In 2015, 27.6% of HD and 33.1% of PD patients achieved simultaneous control of all three parameters.

Figures 8.8 and 8.9 are funnel plots showing the percentage with control of the three bone mineral parameters by centre (who contributed data to these analyses). There was some variation in the percentage achieving simultaneous control of the three bone mineral parameters for HD patients, with three centres being below the 99.9% confidence interval and none above. There was even less variation for PD centres with no centre above or below the 99.9% confidence interval.

Bicarbonate

In 2016 the following RA clinical practice guidelines regarding bicarbonate management were applicable:

Haemodialysis Guideline 6.3 – HD: 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' [3]

Peritoneal Dialysis Guideline 6.2 – PD: Metabolic factors

'We recommend that plasma bicarbonate should be maintained within the normal range' [4]

Haemodialysis

Table 8.9. Summary statistics for serum bicarbonate in haemodialysis patients by centre in 2016

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	97.9	365	22.0	3.0	22	20	24
B QEH	98.6	925	23.2	2.5	23	22	25
Basldn	98.0	147	23.2	2.9	23	22	25
Bradfd	99.6	227	24.1	2.6	24	22	26
Brightn	98.3	412	22.9	3.1	23	21	25
Bristol	100.0	470	23.9	2.4	24	22	25
Camb*							
Carlis	100.0	88	21.7	2.1	22	20	23
Carsh	70.8	548	25.2	2.5	25	24	27
Chelms	100.0	118	22.4	2.2	22	21	24

Table 8.9. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Colchr	83.6	92	22.9	1.8	23	22	24
Covnt	87.3	302	23.8	3.2	24	22	26
Derby	100.0	227	22.3	2.7	22	20	24
Donc	100.0	177	23.6	2.7	23	22	25
Dorset	100.0	263	22.4	2.5	23	21	24
Dudley	100.0	185	24.7	2.8	25	23	27
Exeter	100.0	423	22.9	2.8	23	21	24
Glouc	100.0	228	22.5	2.7	23	21	24
Hull	100.0	302	24.3	2.5	24	23	26
Ipswi	99.3	135	21.4	3.1	21	20	24
Kent	100.0	387	21.6	2.6	22	20	23
L Barts	99.8	953	22.6	3.0	23	21	25
L Guys	93.0	599	23.6	3.1	24	22	26
L Kings	99.8	544	23.7	2.0	24	22	25
L Rfree	99.7	651	22.0	2.8	22	20	24
L St.G	86.4	280	25.7	2.9	26	24	28
L West	59.4	818	20.0	2.7	20	18	22
Leeds	100.0	485	22.9	2.9	23	21	25
Leic	98.8	871	24.9	3.7	25	22	27
Liv Ain	97.7	171	24.6	3.6	24	22	27
Liv Roy	86.6	297	25.4	3.2	25	23	28
M RI	94.1	458	22.1	3.0	22	20	24
Middlbr	100.0	310	27.1	3.0	27	25	29
Newc	100.0	287	23.5	3.2	24	21	25
Norwch	99.0	299	22.3	2.9	22	20	24
Nottm	93.7	342	24.1	2.7	24	23	26
Oxford	100.0	401	22.8	3.3	23	21	25
Plymth	99.2	127	24.9	2.9	25	24	27
Ports	95.4	556	23.3	3.1	23	21	25
Prestn	99.3	527	23.3	2.8	24	22	25
Redng	100.0	288	25.3	3.0	25	23	27
Salford	8.8	32					
Sheff	99.7	576	23.6	3.0	24	22	25
Shrew	100.0	189	23.3	3.1	23	21	26
Stevng	99.4	488	23.3	2.5	23	22	25
Sthend	100.0	109	24.1	3.0	24	22	26
Stoke	99.1	319	25.9	2.7	26	24	28
Sund	75.3	168	29.0	1.9	29	28	30
Truro	100.0	156	21.2	2.7	21	19	23
Wirral	100.0	179	24.3	2.5	24	23	26
Wolve	99.0	291	20.1	2.7	20	18	22
York	100.0	181	24.1	2.7	24	22	26
N Ireland							
Antrim	100.0	115	24.7	2.8	24	23	27
Belfast	100.0	185	23.0	3.4	23	21	24
Newry	33.8	27					
Ulster	100.0	96	22.9	2.0	23	22	24
West NI	100.0	118	23.0	3.0	23	22	25
Wales							
Bangor	100.0	68	23.9	3.0	23	22	25
Cardff	94.8	456	22.0	3.6	22	20	24
Clwyd	100.0	68	22.7	2.3	23	21	24

Table 8.9. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Swanse	100.0	343	23.6	2.9	24	22	26
Wrexm	100.0	113	26.4	2.8	27	25	28
England	**92.2**	**17,973**	**23.3**	**3.2**	**23**	**21**	**25**
N Ireland	**91.1**	**541**	**23.3**	**3.0**	**23**	**22**	**25**
Wales	**97.7**	**1,048**	**23.2**	**3.5**	**23**	**21**	**26**
E, W & NI	**92.5**	**19,562**	**23.3**	**3.2**	**23**	**21**	**25**

Blank cells: centres excluded from analysis due to low patient numbers or poor data completeness
*Cambridge renal centre was unable to submit bicarbonate data for 2016

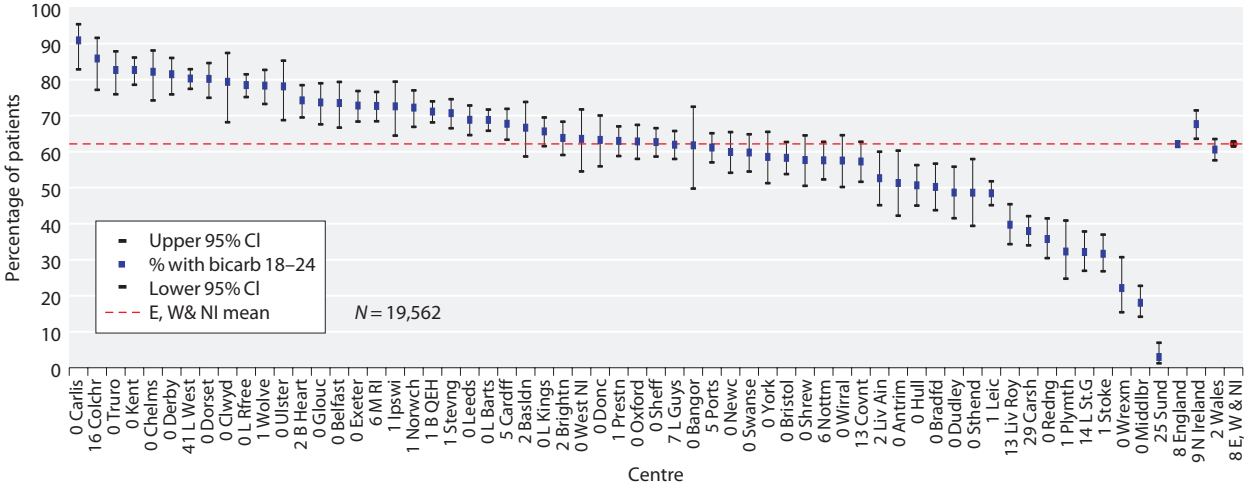

Fig. 8.10. Percentage of haemodialysis patients with serum bicarbonate within range (18–24 mmol/L) by centre in 2016

A total of 19,562 HD and 2,538 PD patients' data were available for serum bicarbonate analysis from England, Wales and Northern Ireland in 2016. Data were 92.5% complete for HD patients and 88.3% complete for PD patients (tables 8.9, 8.11). Data completeness for serum bicarbonate levels in HD and PD patients has not changed significantly over a decade. The proportion of HD patients with serum bicarbonate within the audit measure range was 62.2% in 2016 (95% CI 61.5–62.8%) (table 8.10); the mean bicarbonate in HD patients was 23.3 mmol/L (table 8.9). The proportion with serum bicarbonate within the audit standard in PD patients was 80.7% (CI 79.2–82.2%) (table 8.12). The mean bicarbonate level in PD patients was 25.1 mmol/L (table 8.11).

As in previous reports, inter-centre variation was observed in attainment of the audit standard (tables 8.10, 8.12, figures 8.10–8.13). The funnel plot of serum bicarbonate values in 2016 for HD patients (figure 8.11) showed a large dispersal of attainment, 21 centres being above the 99.9% limit and 13 below the 99.9% limit. In contrast, the funnel plot for PD patients (figure 8.13) showed few outliers. Sample processing, case-mix, differences in dialysis, residual renal function and oral

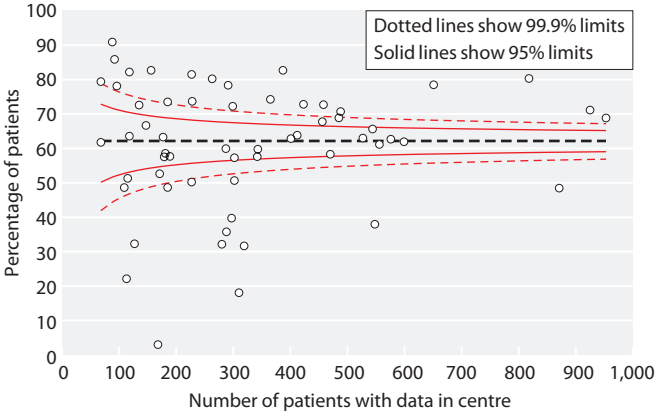

Fig. 8.11. Funnel plot for percentage of haemodialysis patients within range for bicarbonate (18–24 mmol/L) by centre in 2016

Table 8.10. Percentage of haemodialysis patients within, below and above the range for bicarbonate (18–24 mmol/L) by centre in 2016

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 2015	95% LCL change	95% UCL change
England									
B Heart	365	74.3	69.5	78.5	5.8	20.0	−3.9	−9.9	2.2
B QEH	925	71.1	68.1	74.0	1.2	27.7	0.6	−3.6	4.7
Basldn	147	66.7	58.7	73.8	3.4	29.9	−19.5	−28.9	−10.1
Bradfd	227	50.2	43.8	56.7	1.3	48.5	−0.5	−9.8	8.8
Brightn	412	63.8	59.1	68.3	4.1	32.0	−14.9	−21.0	−8.8
Bristol	470	58.3	53.8	62.7	1.3	40.4	−26.8	−32.2	−21.3
Carlis	88	90.9	82.9	95.4	0.0	9.1	0.2	−8.7	9.2
Carsh	548	38.0	34.0	42.1	0.4	61.7	−5.1	−10.9	0.7
Chelms	118	82.2	74.2	88.1	2.5	15.3	9.7	−0.4	19.9
Colchr	92	85.9	77.2	91.6	0.0	14.1	0.0	−9.7	9.8
Covnt	302	57.3	51.6	62.8	2.3	40.4	−4.2	−12.0	3.6
Derby	227	81.5	75.9	86.0	3.1	15.4	1.9	−5.5	9.2
Donc	177	63.3	55.9	70.1	1.7	35.0	−12.2	−21.9	−2.5
Dorset	263	80.2	75.0	84.6	2.7	17.1	−2.4	−9.0	4.2
Dudley	185	48.7	41.5	55.8	0.5	50.8	−11.6	−22.1	−1.1
Exeter	423	72.8	68.4	76.8	2.8	24.4	−2.3	−8.2	3.7
Glouc	228	73.7	67.6	79.0	4.0	22.4	−3.7	−11.7	4.2
Hull	302	50.7	45.0	56.3	0.7	48.7	−14.0	−21.6	−6.3
Ipswi	135	72.6	64.5	79.5	9.6	17.8	18.3	6.9	29.8
Kent	387	82.7	78.6	86.1	5.7	11.6	5.8	0.2	11.4
L Barts	953	68.8	65.8	71.7	4.8	26.3	−9.3	−13.3	−5.4
L Guys	599	61.9	58.0	65.7	1.7	36.4	7.7	2.1	13.3
L Kings	544	65.6	61.5	69.5	0.4	34.0	−0.2	−5.9	5.5
L Rfree	651	78.5	75.2	81.5	5.4	16.1	0.7	−3.8	5.2
L St.G	280	32.1	26.9	37.8	0.7	67.1	−14.6	−22.5	−6.6
L West	818	80.3	77.5	82.9	15.3	4.4	−0.1	−4.0	3.8
Leeds	485	68.9	64.6	72.8	3.9	27.2	1.5	−4.4	7.4
Leic	871	48.5	45.1	51.8	1.4	50.2	4.5	−0.3	9.2
Liv Ain	171	52.6	45.1	60.0	1.8	45.6	−1.6	−12.5	9.3
Liv Roy	297	39.7	34.3	45.4	1.0	59.3	2.4	−5.3	10.1
M RI	458	72.7	68.4	76.6	6.3	21.0	−5.0	−10.6	0.6
Middlbr	310	18.1	14.2	22.8	0.0	81.9	−5.8	−12.1	0.5
Newc	287	59.9	54.2	65.4	3.8	36.2	−5.0	−12.9	2.9
Norwch	299	72.2	66.9	77.0	4.4	23.4	−1.3	−8.4	5.8
Nottm	342	57.6	52.3	62.7	1.5	40.9	18.3	10.9	25.6
Oxford	401	62.8	58.0	67.4	5.5	31.7	−1.6	−8.3	5.1
Plymth	127	32.3	24.7	40.9	2.4	65.4	6.9	−4.1	17.9
Ports	556	61.2	57.0	65.1	4.1	34.7	2.9	−2.8	8.6
Prestn	527	63.0	58.8	67.0	3.2	33.8	1.5	−4.3	7.4
Redng	288	35.8	30.4	41.5	1.7	62.5	−22.8	−30.7	−14.8
Sheff	576	62.7	58.7	66.5	1.7	35.6	−8.2	−13.7	−2.7
Shrew	189	57.7	50.5	64.5	3.7	38.6	−2.8	−12.6	7.1
Stevng	488	70.7	66.5	74.6	1.2	28.1	−4.3	−9.9	1.4
Sthend	109	48.6	39.4	58.0	2.8	48.6	−3.2	−16.5	10.1
Stoke	319	31.7	26.8	37.0	0.0	68.3	−2.1	−9.8	5.7
Sund	168	3.0	1.2	7.0	0.0	97.0	−3.3	−7.5	0.9
Truro	156	82.7	75.9	87.9	7.1	10.3	7.7	−1.5	16.9
Wirral	179	57.5	50.2	64.6	0.0	42.5	2.9	−7.6	13.5
Wolve	291	78.4	73.3	82.7	15.5	6.2	5.6	−1.4	12.6
York	181	58.6	51.3	65.5	0.0	41.4	−4.9	−15.5	5.7
N Ireland									
Antrim	115	51.3	42.2	60.3	0.0	48.7	26.7	14.7	38.8
Belfast	185	73.5	66.7	79.4	2.2	24.3	−9.1	−17.6	−0.5

Table 8.10. 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 2015	95% LCL change	95% UCL change
Ulster	96	78.1	68.8	85.3	1.0	20.8	−6.3	−17.3	4.8
West NI	118	63.6	54.5	71.7	3.4	33.1	−24.9	−35.4	−14.5
Wales									
Bangor	68	61.8	49.8	72.5	1.5	36.8	−1.1	−16.8	14.7
Cardff	456	67.8	63.3	71.9	8.3	23.9	7.1	0.8	13.4
Clwyd	68	79.4	68.2	87.4	0.0	20.6	12.3	−2.0	26.6
Swanse	343	59.8	54.5	64.8	2.0	38.2	−4.3	−11.5	3.0
Wrexm	113	22.1	15.4	30.7	0.9	77.0	−2.1	−13.5	9.3
England	**17,973**	**62.1**	**61.4**	**62.8**	**3.4**	**34.5**	**−2.4**	**−3.4**	**−1.4**
N Ireland	**541**	**67.7**	**63.6**	**71.5**	**1.9**	**30.5**	**−3.0**	**−8.4**	**2.4**
Wales	**1,048**	**60.6**	**57.6**	**63.5**	**4.5**	**34.9**	**1.7**	**−2.6**	**5.9**
E, W & NI	**19,562**	**62.2**	**61.5**	**62.8**	**3.5**	**34.4**	**−2.2**	**−3.2**	**−1.3**

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness

Peritoneal dialysis

Table 8.11. Summary statistics for serum bicarbonate in peritoneal dialysis patients by centre in 2016

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	72	22.5	2.7	23	21	25
B QEH	91.2	114	24.4	3.2	24	22	27
Basldn	100.0	30	26.5	3.6	26	24	30
Bradfd	100.0	22	27.9	3.1	28	26	30
Brightn	98.2	55	27.0	2.9	27	25	29
Bristol	100.0	42	23.2	2.4	23	22	25
Camb[a]							
Carlis	100.0	31	25.0	3.1	25	23	27
Carsh	0.0	–					
Chelms	85.2	23	24.5	3.5	24	22	27
Colchr[b]							
Covnt	94.9	56	25.7	3.4	25	23	28
Derby	100.0	71	23.9	3.0	24	23	26
Donc	100.0	25	24.5	2.5	25	23	26
Dorset	100.0	33	23.4	3.5	23	21	26
Dudley	100.0	48	25.6	3.8	25	23	29
Exeter	100.0	73	24.0	2.9	24	22	26
Glouc	97.0	32	24.0	3.7	23	22	27
Hull	100.0	61	25.9	2.8	26	24	28
Ipswi	97.0	32	25.7	3.6	26	24	28
Kent	95.4	41	24.9	3.5	25	23	27
L Barts	97.8	175	23.5	3.6	24	21	26
L Guys	100.0	32	25.5	2.8	26	24	27
L Kings	100.0	75	27.4	2.3	28	26	29
L Rfree	85.5	118	25.2	3.6	25	23	28
L St.G	97.3	36	24.6	2.5	25	23	27
L West	87.1	74	23.1	2.9	23	21	25
Leeds	100.0	36	27.2	3.7	28	26	30
Leic	95.7	67	25.9	3.4	26	24	28
Liv Ain	100.0	23	26.2	2.6	26	25	28

Table 8.11. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Liv Roy	98.4	63	26.4	2.8	26	24	29
M RI	98.0	48	24.7	2.6	25	24	26
Middlbr	100.0	22	27.6	2.5	27	26	29
Newc	100.0	46	25.8	3.7	26	24	27
Norwch	100.0	41	23.3	2.7	23	21	25
Nottm	49.3	33					
Oxford	81.3	65	24.1	3.3	24	21	26
Plymth	96.8	30	23.7	3.4	24	22	26
Ports	92.5	62	25.7	2.8	26	24	28
Prestn	100.0	35	23.8	2.8	24	22	26
Redng	100.0	44	27.0	3.0	27	25	29
Salford	11.1	10					
Sheff	97.9	46	23.4	3.0	23	21	26
Shrew	100.0	29	26.3	2.8	26	24	27
Stevng	93.8	15	24.4	2.3	24	22	26
Sthend	100.0	24	26.0	3.4	27	24	29
Stoke	100.0	71	28.1	3.1	28	26	30
Sund	41.2	7					
Truro	88.2	15	26.1	2.7	26	24	28
Wirral	100.0	15	27.5	2.6	28	25	30
Wolve	92.2	59	23.7	2.5	24	22	25
York	100.0	27	26.0	1.9	26	25	27
N Ireland							
Antrim	100.0	14	25.5	2.4	26	24	27
Belfast	100.0	22	25.1	2.7	25	23	27
Newry	100.0	19	24.6	4.1	26	21	27
Ulster	100.0	5					
West NI	100.0	9					
Wales							
Bangor	100.0	15	25.9	3.7	26	25	28
Cardff	74.6	50	24.2	3.6	25	21	27
Clwyd	100.0	14	23.5	2.5	23	22	25
Swanse	100.0	58	26.8	2.9	27	25	29
Wrexm	100.0	28	27.6	3.3	27	25	30
England	**87.8**	**2,304**	**25.0**	**3.4**	**25**	**23**	**27**
N Ireland	**100.0**	**69**	**25.1**	**3.2**	**26**	**23**	**27**
Wales	**90.7**	**165**	**25.8**	**3.5**	**26**	**24**	**28**
E, W & NI	**88.3**	**2,538**	**25.1**	**3.4**	**25**	**23**	**27**

Blank cells: centres excluded from analysis due to low patient numbers or poor data completeness
[a]Cambridge renal centre was unable to submit bicarbonate data for 2016
[b]Colchester – no PD patients

bicarbonate prescriptions may all contribute to the variation observed.

Serial trends in serum bicarbonate measures between 2006 and 2016 by dialysis modality are presented in figure 8.14. Achievement of bicarbonate audit measures has not changed significantly over the past decade for either modality. There has been a consistent difference between the modalities in the percentage with raised bicarbonate measures.

Potassium

In 2016 the following RA clinical practice guideline regarding potassium management in haemodialysis was applicable:

Haemodialysis Guideline 6.4 – HD: Pre-dialysis serum potassium concentrations

'We suggest that pre-dialysis serum potassium should be between 4.0 and 6.0 mmol/L in HD patients.' [3]

Table 8.12. Percentage of peritoneal dialysis patients within, below and above the range for bicarbonate (22–30 mmol/L) by centre in 2016

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 2015	95% LCL change	95% UCL change
England									
B Heart	72	63.9	52.2	74.1	36.1	0.0	8.9	−10.1	27.9
B QEH	114	85.1	77.3	90.5	14.0	0.9	3.8	−5.9	13.6
Basldn	30	70.0	51.7	83.6	10.0	20.0	−15.2	−36.4	6.0
Bradfd	22	81.8	60.4	93.0	4.6	13.6	−10.5	−32.2	11.2
Brightn	55	85.5	73.5	92.6	3.6	10.9	3.8	−9.7	17.3
Bristol	42	78.6	63.7	88.5	21.4	0.0	33.9	15.0	52.8
Carlis	31	83.9	66.6	93.1	9.7	6.5	3.9	−15.4	23.2
Chelms	23	73.9	52.8	87.8	17.4	8.7	−7.9	−32.0	16.2
Covnt	56	80.4	67.9	88.8	10.7	8.9	−2.7	−16.6	11.1
Derby	71	78.9	67.9	86.8	21.1	0.0	−1.9	−15.1	11.2
Donc	25	88.0	68.7	96.1	12.0	0.0	26.9	1.0	52.8
Dorset	33	69.7	52.3	82.9	30.3	0.0	1.1	−20.8	23.1
Dudley	48	72.9	58.8	83.6	16.7	10.4	−13.6	−29.2	2.0
Exeter	73	84.9	74.8	91.5	15.1	0.0	7.5	−5.3	20.2
Glouc	32	71.9	54.2	84.7	25.0	3.1	−10.3	−31.3	10.8
Hull	61	90.2	79.8	95.5	4.9	4.9	10.5	−1.9	22.8
Ipswi	32	87.5	71.1	95.2	9.4	3.1	−5.1	−20.2	10.0
Kent	41	80.5	65.6	89.9	14.6	4.9	−4.7	−20.1	10.7
L Barts	175	72.0	64.9	78.2	26.9	1.1	−9.6	−18.3	−0.8
L Guys	32	87.5	71.1	95.2	6.3	6.3	4.7	−13.2	22.6
L Kings	75	89.3	80.1	94.6	2.7	8.0	−3.1	−12.2	6.0
L Rfree	118	82.2	74.2	88.1	15.3	2.5	−1.3	−11.1	8.5
L St.G	36	86.1	70.7	94.1	13.9	0.0	−9.2	−22.2	3.7
L West	74	70.3	59.0	79.6	28.4	1.4	5.1	−12.2	22.3
Leeds	36	80.6	64.5	90.4	11.1	8.3	10.6	−7.6	28.7
Leic	67	82.1	71.1	89.5	9.0	9.0	7.4	−5.4	20.2
Liv Ain	23	87.0	66.5	95.7	4.4	8.7	−5.6	−22.6	11.3
Liv Roy	63	90.5	80.4	95.7	3.2	6.4	2.0	−8.8	12.8
M RI	48	85.4	72.4	92.9	12.5	2.1	9.6	−5.3	24.4
Middlbr	22	90.9	70.0	97.7	0.0	9.1	33.8	5.2	62.3
Newc	46	87.0	73.9	94.0	10.9	2.2	0.1	−14.4	14.6
Norwch	41	65.9	50.3	78.6	31.7	2.4	−0.8	−23.8	22.1
Oxford	65	69.2	57.1	79.2	27.7	3.1	−3.6	−18.9	11.7
Plymth	30	80.0	62.1	90.7	20.0	0.0	−0.8	−21.6	20.1
Ports	62	87.1	76.3	93.4	9.7	3.2	3.8	−9.2	16.7
Prestn	35	77.1	60.5	88.1	22.9	0.0	−8.6	−25.6	8.4
Redng	44	84.1	70.2	92.2	2.3	13.6	−4.1	−17.6	9.5
Sheff	46	71.7	57.2	82.8	28.3	0.0	7.4	−10.6	25.5
Shrew	29	96.6	79.2	99.5	0.0	3.5	7.7	−5.9	21.2
Stevng	15	86.7	59.5	96.6	13.3	0.0	11.7	−18.3	41.6
Sthend	24	83.3	63.1	93.6	12.5	4.2	−16.7	−31.6	−1.8
Stoke	71	77.5	66.3	85.7	1.4	21.1	−10.8	−23.2	1.6
Truro	15	93.3	64.8	99.1	0.0	6.7	5.1	−14.8	24.9
Wirral	15	86.7	59.5	96.6	0.0	13.3	−1.6	−24.6	21.5
Wolve	59	88.1	77.1	94.2	11.9	0.0	22.5	8.4	36.5
York	27	96.3	77.9	99.5	3.7	0.0	15.4	−2.9	33.6
N Ireland									
Antrim	14	92.9	63.0	99.0	7.1	0.0	4.6	−15.8	25.0
Belfast	22	90.9	70.0	97.7	9.1	0.0	1.4	−16.9	19.7
Newry	19	68.4	45.2	85.1	26.3	5.3	−14.9	−42.0	12.2

Table 8.12. 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 2015	95% LCL change	95% UCL change
Wales									
Bangor	15	86.7	59.5	96.6	6.7	6.7	−5.6	−28.1	16.8
Cardff	50	70.0	56.0	81.0	28.0	2.0	−21.2	−35.6	−6.8
Clwyd	14	78.6	50.6	92.9	21.4	0.0	1.6	−29.8	33.1
Swanse	58	84.5	72.8	91.7	1.7	13.8	−6.3	−18.4	5.8
Wrexm	28	82.1	63.6	92.4	0.0	17.9	0.3	−19.0	19.7
England	**2,304**	**80.8**	**79.1**	**82.3**	**14.8**	**4.4**	**1.1**	**−1.2**	**3.4**
N Ireland	**69**	**82.6**	**71.8**	**89.9**	**14.5**	**2.9**	**−4.3**	**−16.3**	**7.6**
Wales	**165**	**79.4**	**72.5**	**84.9**	**11.5**	**9.1**	**−9.0**	**−16.7**	**−1.3**
E, W & NI	**2,538**	**80.7**	**79.2**	**82.2**	**14.6**	**4.7**	**0.3**	**−1.9**	**2.5**

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness

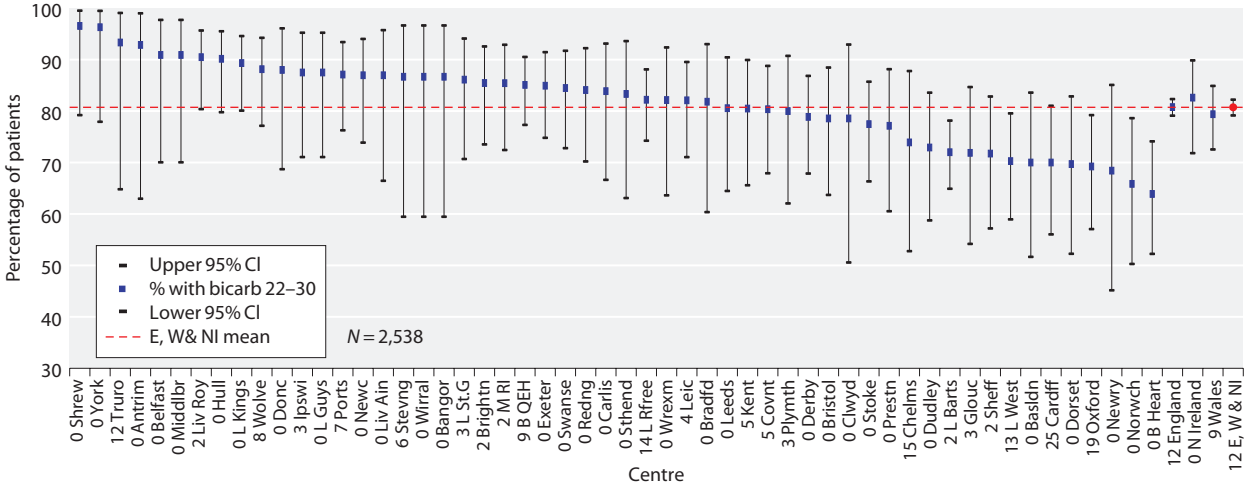

Fig. 8.12. Percentage of peritoneal dialysis patients with serum bicarbonate within range (22–30 mmol/L) by centre in 2016

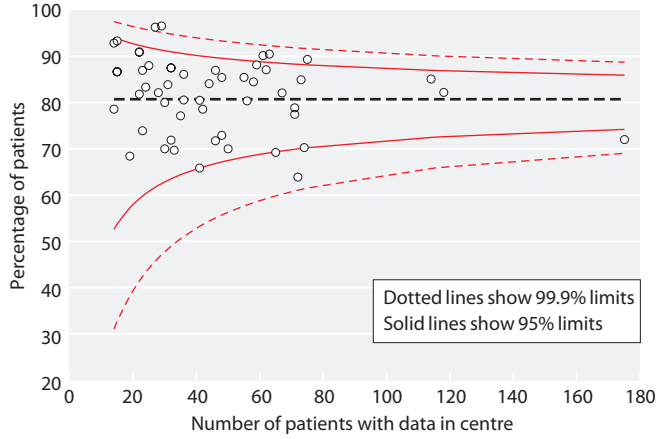

Fig. 8.13. Funnel plot for percentage of peritoneal dialysis patients within range for bicarbonate (22–30 mmol/L) by centre in 2016

The PD guideline contains no recommendation with regard to serum potassium.

A total of 10,568 HD patients' data were available for serum potassium analysis from 27 centres in England, all five centres in Northern Ireland but no centres in Wales in 2016. In total, data were 50.0% complete for HD patients (table 8.13). However, when considering only centres that submitted at least some data for serum potassium, centre completeness was 98% or higher apart from Stoke. The proportion of HD patients with serum potassium within the audit measure range was 84.1% in 2016 (95% CI 83.4–84.8%) (table 8.14); the mean serum potassium in HD patients was 4.9 mmol/L (table 8.13).

Some inter-centre variation was observed in attainment of the audit standard (table 8.14, figures 8.15, 8.16). One centre was above and one below the 99.9%

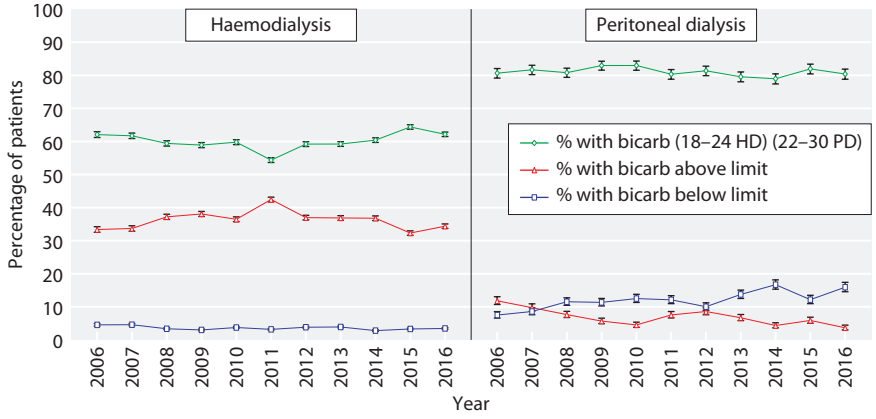

Fig. 8.14. Longitudinal change in percentage of patients within the range for bicarbonate by dialysis modality 2006–2016

Haemodialysis

Table 8.13. Summary statistics for serum potassium in haemodialysis patients by centre in 2016

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	373	4.9	0.8	4.8	4.4	5.3
B QEH	99.8	936	4.9	0.8	4.8	4.4	5.4
Basldn	98.0	147	4.7	0.7	4.7	4.3	5.2
Bradfd	99.6	227	4.7	0.8	4.6	4.1	5.1
Brightn	0.0	0					
Bristol	100.0	470	4.7	0.7	4.6	4.2	5.1
Camb[a]							
Carlis[b]	0.0	0					
Carsh	0.0	0					
Chelms	100.0	118	5.1	0.6	5.1	4.7	5.4
Colchr[b]	0.0	0					
Covnt[c]	0.0	0					
Derby	0.0	0					
Donc	100.0	177	4.9	0.7	4.8	4.4	5.3
Dorset	100.0	263	4.9	0.7	4.9	4.4	5.3
Dudley	100.0	185	4.9	0.8	4.9	4.4	5.4
Exeter	100.0	423	4.6	0.8	4.6	4.1	5.1
Glouc	0.0	0					
Hull	100.0	302	4.7	0.7	4.7	4.3	5.2
Ipswi	0.0	0					
Kent	100.0	387	4.7	0.9	4.8	4.2	5.3
L Barts	0.0	0					
L Guys[c]	0.0	0					
L Kings	0.0	0					
L Rfree	99.9	652	5.0	0.8	5	4.4	5.5
L St.G	0.0	0					
L West	0.0	0					
Leeds	100.0	485	5.2	0.7	5.2	4.7	5.7
Leic	100.0	882	5.0	0.8	4.9	4.4	5.4
Liv Ain	0.0	0					
Liv Roy	0.0	0					
M RI	0.0	0					
Middlbr	100.0	310	4.9	0.7	4.8	4.4	5.3
Newc	0.0	0					
Norwch	99.7	301	5.2	0.6	5.2	4.8	5.6
Nottm	99.7	364	4.9	0.7	4.9	4.5	5.3
Oxford	100.0	401	5.0	0.7	4.9	4.5	5.4
Plymth	99.2	127	4.7	0.8	4.7	4.2	5.2

Table 8.13. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Ports	99.8	582	4.9	0.7	4.8	4.4	5.3
Prestn	0.0	0					
Redng	0.0	0					
Salford	0.0	0					
Sheff	100.0	578	5.0	0.8	5	4.5	5.5
Shrew	0.0	0					
Stevng	99.8	490	5.0	0.8	5.05	4.5	5.5
Sthend	100.0	109	4.7	0.7	4.7	4.2	5.1
Stoke	17.4	56					
Sund	0.0	0					
Truro	100.0	156	4.9	0.6	4.9	4.5	5.3
Wirral	0.0	0					
Wolve	99.3	292	4.9	0.8	4.8	4.3	5.3
York	100.0	181	5.1	0.7	5.1	4.6	5.7
N Ireland							
Antrim	100.0	115	4.9	0.7	4.8	4.5	5.4
Belfast	100.0	185	5.1	0.7	5.1	4.6	5.6
Newry	100.0	80	5.1	0.8	5	4.6	5.5
Ulster	100.0	96	5.0	0.7	5	4.5	5.4
West NI	100.0	118	4.9	0.8	4.8	4.5	5.3
Wales							
Bangor	0.0	0					
Cardff	0.0	0					
Clwyd	0.0	0					
Swanse	0.0	0					
Wrexm	0.0	0					
England	**51.2**	**9,974**	**4.9**	**0.8**	**4.9**	**4.4**	**5.4**
N Ireland	**100.0**	**594**	**5.0**	**0.7**	**5**	**4.5**	**5.4**
Wales	**0.0**	**0**					
E, W & NI	**50.0**	**10,568**	**4.9**	**0.8**	**4.9**	**4.4**	**5.4**

Blank cells: centres excluded from analysis due to low patient numbers or poor data completeness
[a]Cambridge renal centre was unable to submit patient-level data for 2016
[b]Carlisle and Colchester renal centres submitted potassium data rounded to unit in HD patients, and were therefore excluded from this analysis
[c]Coventry and London Guys renal centres returned potassium data post-haemodialysis and were therefore excluded from this analysis

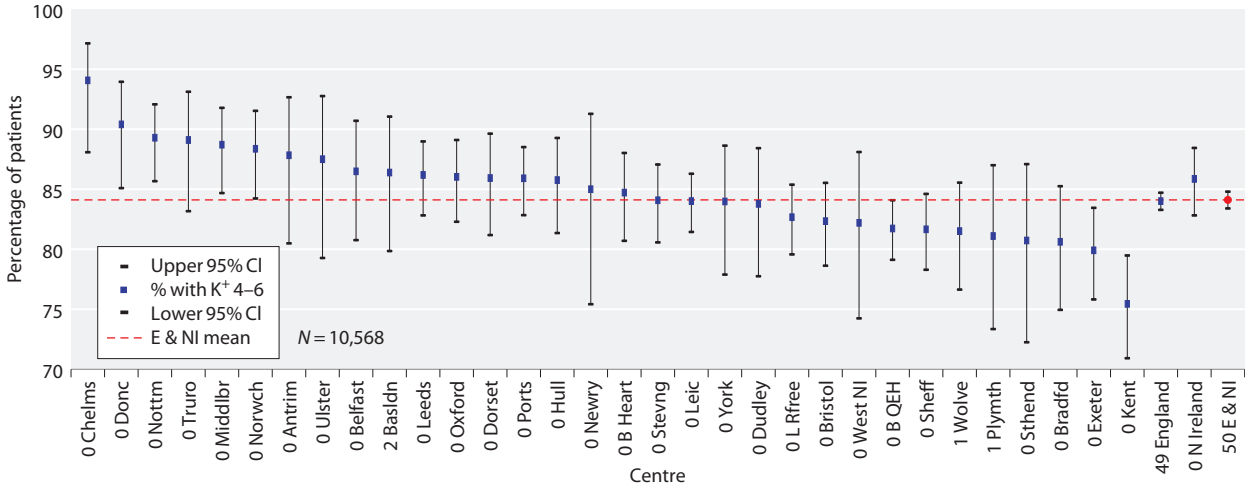

Fig. 8.15. Percentage of haemodialysis patients with serum potassium within range (4–6 mmol/L) by centre in 2016

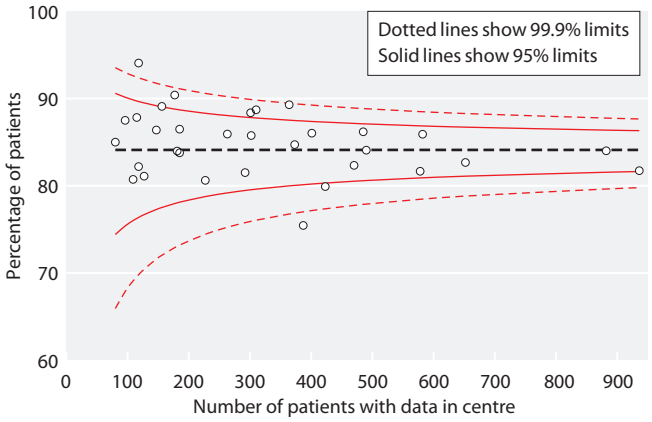

Fig. 8.16. Funnel plot for percentage of haemodialysis patients within range for serum potassium (4–6 mmol/L) by centre in 2016

confidence interval limits. The serum potassium measurement will be particularly sensitive to differences in the timing and technique of sample processing by centre.

Discussion

Observational data continues to accumulate linking disordered calcium, phosphate and PTH levels with higher mortality in dialysis patients [10–16]. Despite this, trial data on specific target values or the best treatment approaches are lacking as reflected in recently published international guidelines [6]. The guidelines re-enforce the importance in identifying trends in parameters rather than reacting to isolated measurements and to appreciate the complex interdependency of parameters.

This chapter presents the results of mineral bone disease management for patients established on regular dialysis in the UK. Over the last decade there have been modest improvements in the attainment of target measures. In the latest analysis, a stable proportion of patients with all bone parameters within target range masks higher levels of hyperphosphataemia with improvement in attainment of target PTH. Increased

Table 8.14. Percentage of haemodialysis patients within, below and above the range for serum potassium (4–6 mmol/L) by centre in 2016

Centre	*N*	% potassium 4–6 mmol/L	Lower 95% CI	Upper 95% CI	% potassium <4 mmol/L	% potassium >6 mmol/L
England						
B Heart	373	84.7	80.7	88.0	9.4	5.9
B QEH	936	81.7	79.1	84.1	11.4	6.8
Basldn	147	86.4	79.9	91.1	10.2	3.4
Bradfd	227	80.6	75.0	85.3	15.9	3.5
Bristol	470	82.3	78.6	85.5	15.5	2.1
Chelms	118	94.1	88.1	97.2	2.5	3.4
Donc	177	90.4	85.1	94.0	6.2	3.4
Dorset	263	85.9	81.2	89.6	8.8	5.3
Dudley	185	83.8	77.8	88.4	7.0	9.2
Exeter	423	79.9	75.8	83.5	18.0	2.1
Hull	302	85.8	81.4	89.3	10.9	3.3
Kent	387	75.5	70.9	79.5	19.1	5.4
L Rfree	652	82.7	79.6	85.4	10.4	6.9
Leeds	485	86.2	82.8	89.0	2.5	11.3
Leic	882	84.0	81.4	86.3	8.5	7.5
Middlbr	310	88.7	84.7	91.8	6.8	4.5
Norwch	301	88.4	84.2	91.5	2.0	9.6
Nottm	364	89.3	85.7	92.1	5.5	5.2
Oxford	401	86.0	82.3	89.1	6.5	7.5
Plymth	127	81.1	73.4	87.0	15.8	3.2
Ports	582	85.9	82.8	88.5	9.5	4.6
Sheff	578	81.7	78.3	84.6	9.0	9.3
Stevng	490	84.1	80.6	87.1	6.7	9.2
Sthend	109	80.7	72.3	87.1	16.5	2.8
Truro	156	89.1	83.2	93.1	7.1	3.9
Wolve	292	81.5	76.6	85.6	12.0	6.5
York	181	84.0	77.9	88.6	2.8	13.3

Table 8.14. Continued

Centre	*N*	% potassium 4–6 mmol/L	Lower 95% CI	Upper 95% CI	% potassium <4 mmol/L	% potassium >6 mmol/L
N Ireland						
Antrim	115	87.8	80.5	92.7	7.0	5.2
Belfast	185	86.5	80.8	90.7	4.3	9.2
Newry	80	85.0	75.4	91.3	3.8	11.3
Ulster	96	87.5	79.3	92.8	4.2	8.3
West NI	118	82.2	74.2	88.1	7.6	10.2
England	**9,974**	**84.0**	**83.3**	**84.7**	**9.7**	**6.3**
N Ireland	**594**	**85.9**	**82.8**	**88.4**	**5.4**	**8.8**
Wales	**0**					
E, W & NI	**10,568**	**84.1**	**83.4**	**84.8**	**9.4**	**6.5**

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness

hyperphosphataemia was seen across the majority of centres although there continued to be significant inter and intra centre variation in the attainment of target measures in part reflecting the challenge of managing the varied CKD-MBD phenotypes [6, 13]. As previously described, there were problems related to variations in calcium and PTH measurements between centres [17]. Comorbidity, dialysis dose and dialysate concentrations, as well as the use of phosphate binders, calcium mimetics and vitamin D analogues are also likely to be significant confounding variables at the patient level. The hope is that the expanded dataset will allow adjustment for these covariates in the near future.

Serum bicarbonate levels have not changed significantly compared with recent years, but there remained marked variation between centres in HD patients. The UKRR has previously conducted a limited survey [18] into the possible underlying causes of serum bicarbonate variation. The study examined measures of sample processing and of dialysis treatment. It did not adjust for case-mix and was unable to detect any significant differences between centres. Studies have identified an increased risk of death stratified by a reduced pre-dialysis serum bicarbonate level (<17 mmol/L) or with raised levels (>27 mmol/L) [19–21], as well as with raised dialysate bicarbonate concentrates [11]. Future analysis of management of acidosis will have to re-explore the factors associated with an increased trend in developing alkalosis in HD patients.

Sufficient data were received from renal centres for the first time to analyse pre-dialysis potassium levels. Observational data has shown that pre-dialysis potassium levels both above 6.0 mmol/L and below 4.0 mmol/L have been associated with higher mortality thus forming the basis for the current guideline target range [3, 22–23]. More recent analysis of the DOPPS data has shown, that after adjustment for patient factors including nutritional indicators, only higher potassium levels remained associated with higher mortality. Of the samples collected, 84.1% were within the target range which is slightly higher than the international data (81%) which included UK data [24]. Serum potassium levels are likely to be particularly sensitive to differences in the timing and processing of samples as well as differences in case-mix. Inter and intra centre variability therefore needs to be interpreted with caution. The current analysis used data collected before a 'short-gap' dialysis session in line with guidelines but in future it is planned to also analyse potassium collected before a 'long-gap' session if data completeness permits.

Conflicts of interest: the authors declare no conflict of interest

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Appendix 1 Attainment of individual standard for adjusted calcium, phosphate and PTH

This appendix includes analyses of the individual mineral bone measures that are included in the composite audit measure, namely adjusted calcium, phosphate and PTH within the recommended target ranges.

Adjusted calcium

In 2016, the following RA clinical practice guideline regarding calcium management was applicable:

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)' [2]

In 2016, data from 22,552 HD and 3,006 PD patients across the UK were available for serum adjusted calcium

Haemodialysis

Table 8.15. Summary statistics for adjusted calcium in haemodialysis patients in 2016

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	373	2.4	0.2	2.4	2.3	2.5
B QEH	99.7	935	2.3	0.2	2.3	2.2	2.4
Basldn	98.0	147	2.4	0.2	2.4	2.3	2.5
Bradfd	99.1	226	2.4	0.1	2.4	2.4	2.5
Brightn	99.8	418	2.4	0.2	2.3	2.2	2.4
Bristol	100.0	470	2.4	0.2	2.4	2.3	2.5
Camb*							
Carlis	100.0	88	2.3	0.2	2.3	2.2	2.4
Carsh	99.7	772	2.3	0.2	2.3	2.2	2.4
Chelms	100.0	118	2.3	0.2	2.3	2.2	2.4
Colchr	83.6	92	2.4	0.1	2.4	2.3	2.5
Covnt	99.7	345	2.3	0.2	2.3	2.2	2.4
Derby	100.0	227	2.4	0.1	2.4	2.3	2.5
Donc	100.0	177	2.3	0.2	2.3	2.3	2.4
Dorset	100.0	263	2.3	0.2	2.3	2.2	2.4
Dudley	100.0	185	2.3	0.2	2.3	2.2	2.4
Exeter	100.0	423	2.3	0.1	2.3	2.2	2.4
Glouc	100.0	228	2.4	0.2	2.3	2.3	2.5
Hull	100.0	302	2.4	0.2	2.4	2.3	2.5
Ipswi	99.3	135	2.4	0.2	2.4	2.2	2.5
Kent	100.0	387	2.4	0.2	2.4	2.3	2.5
L Barts	99.8	953	2.3	0.2	2.3	2.2	2.4
L Guys	99.8	643	2.4	0.2	2.4	2.3	2.4
L Kings	99.8	544	2.3	0.2	2.3	2.2	2.4
L Rfree	99.9	652	2.3	0.2	2.3	2.2	2.4
L St.G	96.9	314	2.3	0.2	2.3	2.2	2.4
L West	85.6	1,180	2.3	0.2	2.3	2.2	2.5
Leeds	100.0	485	2.4	0.2	2.4	2.3	2.5
Leic	99.9	881	2.3	0.2	2.3	2.2	2.4
Liv Ain	97.1	170	2.4	0.2	2.4	2.3	2.4
Liv Roy	98.0	336	2.3	0.2	2.3	2.2	2.5
M RI	94.1	458	2.4	0.2	2.4	2.3	2.5
Middlbr	100.0	310	2.3	0.2	2.3	2.1	2.4

Table 8.15. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Newc	100.0	287	2.3	0.2	2.3	2.2	2.4
Norwch	99.7	301	2.4	0.2	2.4	2.3	2.5
Nottm	99.7	364	2.3	0.2	2.3	2.2	2.4
Oxford	100.0	401	2.4	0.2	2.3	2.3	2.4
Plymth	99.2	127	2.3	0.2	2.3	2.2	2.4
Ports	99.8	582	2.3	0.2	2.3	2.2	2.4
Prestn	93.8	498	2.3	0.2	2.3	2.2	2.4
Redng	100.0	288	2.3	0.2	2.3	2.2	2.4
Salford	97.5	353	2.3	0.2	2.3	2.2	2.4
Sheff	99.8	577	2.3	0.2	2.3	2.2	2.4
Shrew	100.0	189	2.4	0.2	2.4	2.3	2.5
Stevng	99.8	490	2.4	0.2	2.3	2.2	2.5
Sthend	100.0	109	2.4	0.2	2.4	2.3	2.6
Stoke	98.8	318	2.4	0.2	2.4	2.3	2.5
Sund	100.0	223	2.3	0.2	2.2	2.1	2.3
Truro	100.0	156	2.3	0.2	2.3	2.2	2.4
Wirral	99.4	178	2.3	0.2	2.3	2.2	2.4
Wolve	99.0	291	2.4	0.2	2.4	2.3	2.5
York	100.0	181	2.4	0.1	2.4	2.3	2.5
N Ireland							
Antrim	100.0	115	2.4	0.2	2.4	2.3	2.5
Belfast	100.0	185	2.3	0.2	2.3	2.2	2.4
Newry	100.0	80	2.4	0.2	2.4	2.3	2.5
Ulster	99.0	95	2.5	0.1	2.5	2.4	2.6
West NI	100.0	118	2.3	0.1	2.3	2.2	2.4
Scotland							
Abrdn	99.5	217	2.4	0.2	2.4	2.3	2.5
Airdrie	100.0	173	2.4	0.2	2.4	2.3	2.5
D & Gall	97.9	46	2.3	0.2	2.3	2.2	2.4
Dundee	98.8	164	2.4	0.2	2.4	2.3	2.5
Edinb	100.0	269	2.4	0.2	2.4	2.3	2.5
Glasgw	100.0	537	2.4	0.2	2.4	2.3	2.5
Inverns	80.0	68	2.4	0.2	2.3	2.3	2.4
Klmarnk	100.0	128	2.4	0.2	2.4	2.3	2.6
Krkcldy	100.0	135	2.4	0.2	2.3	2.3	2.4
Wales							
Bangor	100.0	68	2.3	0.2	2.3	2.2	2.4
Cardff	99.8	480	2.4	0.2	2.4	2.3	2.5
Clwyd	100.0	68	2.4	0.1	2.4	2.3	2.5
Swanse	100.0	343	2.4	0.2	2.4	2.3	2.4
Wrexm	100.0	113	2.3	0.1	2.3	2.2	2.4
England	**98.3**	**19,150**	**2.3**	**0.2**	**2.3**	**2.2**	**2.4**
N Ireland	**99.8**	**593**	**2.4**	**0.2**	**2.3**	**2.2**	**2.5**
Scotland	**98.8**	**1,737**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
Wales	**99.9**	**1,072**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
UK	**98.4**	**22,552**	**2.3**	**0.2**	**2.3**	**2.2**	**2.4**

*Cambridge renal centre was unable to submit calcium data for 2016

Table 8.16. Percentage of haemodialysis patients within, below and above the range for adjusted calcium (2.2–2.5 mmol/L) in 2016

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 2015	95% LCL change	95% UCL change
England									
B Heart	373	78.0	73.5	81.9	6.2	15.8	−2.7	−8.4	3.0
B QEH	935	75.0	72.1	77.7	18.4	6.6	−1.4	−5.3	2.5
Basldn	147	80.3	73.1	85.9	2.0	17.7	−2.0	−10.8	6.9
Bradfd	226	77.0	71.1	82.0	2.2	20.8	−12.0	−18.8	−5.1
Brightn	418	80.6	76.6	84.1	9.3	10.1	−1.4	−6.7	4.0
Bristol	470	79.2	75.2	82.6	3.0	17.9	−10.6	−15.2	−6.1
Carlis	88	81.8	72.4	88.6	14.8	3.4	11.2	−1.9	24.2
Carsh	772	76.3	73.2	79.2	17.6	6.1	−0.5	−4.7	3.8
Chelms	118	83.1	75.2	88.8	10.2	6.8	4.8	−4.9	14.4
Colchr	92	89.1	81.0	94.1	0.0	10.9	−0.5	−9.1	8.1
Covnt	345	78.3	73.6	82.3	13.0	8.7	−0.4	−6.6	5.7
Derby	227	78.0	72.1	82.9	2.6	19.4	6.9	−1.1	15.0
Donc	177	84.2	78.0	88.9	9.0	6.8	−1.7	−9.3	5.9
Dorset	263	80.2	75.0	84.6	17.1	2.7	−5.8	−12.1	0.6
Dudley	185	78.9	72.5	84.2	15.1	6.0	−1.2	−9.8	7.4
Exeter	423	88.9	85.5	91.6	3.8	7.3	−2.0	−6.1	2.1
Glouc	228	81.6	76.0	86.1	9.2	9.2	−5.1	−11.8	1.7
Hull	302	79.1	74.2	83.4	5.3	15.6	2.9	−3.6	9.4
Ipswi	135	73.3	65.3	80.1	13.3	13.3	−1.9	−12.4	8.7
Kent	387	78.0	73.6	81.9	6.7	15.3	4.4	−1.6	10.4
L Barts	953	75.5	72.6	78.1	14.7	9.9	3.0	−1.0	7.0
L Guys	643	79.8	76.5	82.7	9.5	10.7	−0.9	−5.3	3.5
L Kings	544	78.5	74.8	81.7	17.5	4.0	−2.5	−7.3	2.3
L Rfree	652	81.3	78.1	84.1	13.5	5.2	0.4	−3.9	4.6
L St.G	314	76.4	71.4	80.8	15.3	8.3	−1.6	−8.2	5.0
L West	1,180	70.3	67.6	72.8	15.5	14.2	−3.3	−6.9	0.3
Leeds	485	79.4	75.6	82.8	4.7	15.9	−4.9	−9.8	−0.1
Leic	881	81.2	78.4	83.6	10.4	8.4	0.3	−3.4	4.1
Liv Ain	170	82.4	75.9	87.4	8.2	9.4	−2.6	−10.7	5.4
Liv Roy	336	77.7	72.9	81.8	11.9	10.4	−2.8	−8.9	3.2
M RI	458	76.6	72.5	80.3	8.3	15.1	−4.8	−10.0	0.5
Middlbr	310	71.9	66.7	76.7	26.5	1.6	6.0	−1.2	13.2
Newc	287	82.2	77.4	86.2	10.8	7.0	1.5	−4.8	7.9
Norwch	301	79.1	74.1	83.3	4.7	16.3	3.3	−3.3	10.0
Nottm	364	85.2	81.1	88.5	7.7	7.1	2.2	−3.2	7.6
Oxford	401	84.0	80.1	87.3	6.0	10.0	5.6	0.2	11.0
Plymth	127	74.8	66.5	81.6	20.5	4.7	1.0	−9.7	11.6
Ports	582	81.1	77.7	84.1	10.1	8.8	2.1	−2.4	6.7
Prestn	498	80.5	76.8	83.8	16.1	3.4	−1.2	−6.0	3.7
Redng	288	80.2	75.2	84.4	11.8	8.0	0.4	−6.1	7.0
Salford	353	72.2	67.3	76.7	16.4	11.3	−3.1	−9.5	3.3
Sheff	577	79.9	76.4	83.0	13.7	6.4	−0.6	−5.3	4.0
Shrew	189	83.1	77.0	87.8	6.9	10.1	3.4	−4.4	11.2
Stevng	490	79.2	75.4	82.6	8.6	12.2	0.6	−4.6	5.7
Sthend	109	64.2	54.8	72.6	10.1	25.7	−9.8	−22.1	2.4
Stoke	318	82.1	77.5	85.9	8.5	9.4	−2.9	−8.7	3.0
Sund	223	63.7	57.2	69.7	30.5	5.8	−8.7	−17.4	0.1
Truro	156	77.6	70.4	83.4	14.7	7.7	−8.6	−17.2	0.1
Wirral	178	77.5	70.8	83.1	15.2	7.3	−4.2	−12.6	4.2
Wolve	291	76.6	71.4	81.1	8.3	15.1	−2.0	−8.8	4.8
York	181	87.9	82.2	91.9	3.9	8.3	0.3	−6.9	7.4

Table 8.16. 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 2015	95% LCL change	95% UCL change
N Ireland									
Antrim	115	83.5	75.5	89.2	7.8	8.7	5.4	−4.8	15.6
Belfast	185	82.7	76.6	87.5	11.4	6.0	−4.5	−11.9	2.9
Newry	80	82.5	72.6	89.4	10.0	7.5	−12.7	−22.2	−3.2
Ulster	95	65.3	55.2	74.1	2.1	32.6	6.3	−7.5	20.1
West NI	118	84.8	77.1	90.2	11.9	3.4	10.4	0.1	20.8
Scotland									
Abrdn	217	75.6	69.4	80.8	7.8	16.6	3.4	−5.0	11.8
Airdrie	173	81.5	75.0	86.6	7.5	11.0	−0.1	−8.3	8.1
D & Gall	46	71.7	57.2	82.8	19.6	8.7	−4.3	−21.9	13.3
Dundee	164	76.2	69.1	82.1	4.3	19.5	−7.4	−16.0	1.1
Edinb	269	77.0	71.5	81.6	6.0	17.1	13.4	5.5	21.2
Glasgw	537	81.9	78.5	85.0	5.4	12.7	−1.5	−6.0	3.0
Inverns	68	82.4	71.4	89.7	11.8	5.9	0.5	−12.0	13.0
Klmarnk	128	73.4	65.1	80.4	1.6	25.0	−6.4	−16.8	4.0
Krkcldy	135	82.2	74.8	87.8	8.9	8.9	2.8	−6.6	12.3
Wales									
Bangor	68	80.9	69.8	88.6	11.8	7.4	0.1	−12.7	12.9
Cardff	480	78.3	74.4	81.8	6.9	14.8	2.0	−3.3	7.4
Clwyd	68	88.2	78.2	94.0	2.9	8.8	6.7	−4.9	18.3
Swanse	343	84.6	80.3	88.0	7.3	8.2	1.2	−4.3	6.7
Wrexm	113	91.2	84.3	95.2	5.3	3.5	12.4	2.8	22.0
England	**19,150**	**78.4**	**77.8**	**79.0**	**11.7**	**9.9**	**−0.9**	**−1.8**	**−0.1**
N Ireland	**593**	**80.4**	**77.1**	**83.4**	**9.1**	**10.5**	**1.0**	**−3.6**	**5.6**
Scotland	**1,737**	**78.9**	**77.0**	**80.8**	**6.5**	**14.6**	**0.7**	**−2.0**	**3.5**
Wales	**1,072**	**82.5**	**80.1**	**84.6**	**6.9**	**10.6**	**2.9**	**−0.4**	**6.3**
UK	**22,552**	**78.7**	**78.2**	**79.2**	**11.0**	**10.3**	**−0.6**	**−1.3**	**0.2**

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness

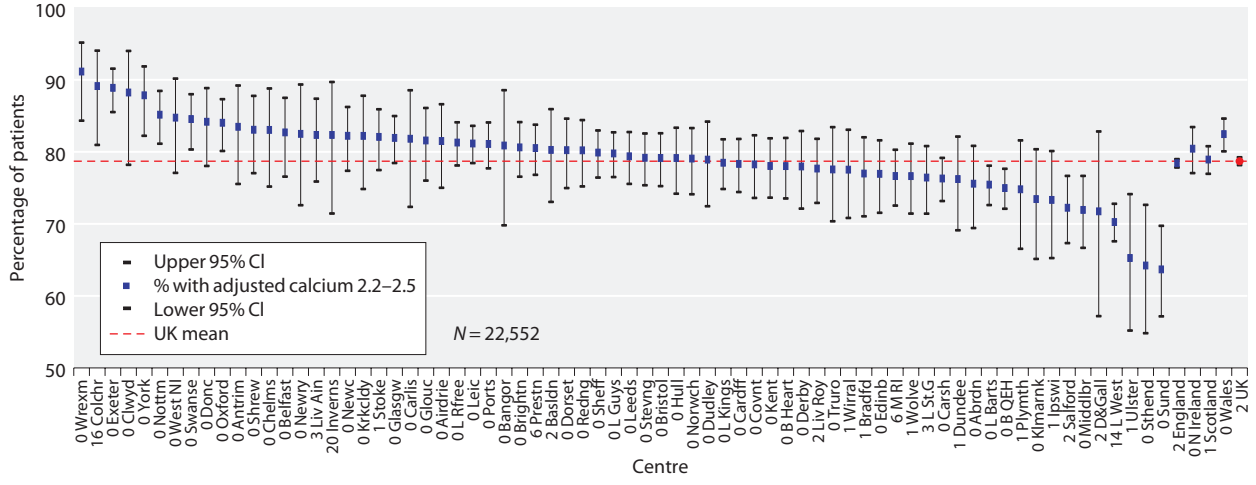

Fig. 8.17. Percentage of haemodialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2016

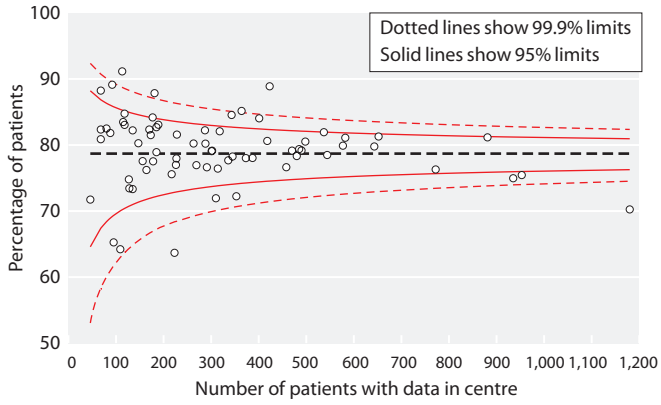

Fig. 8.18. Funnel plot of percentage of haemodialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2016

analysis. The data were 98.4% complete for HD patients and 98.1% complete for PD patients overall, although there was inter-centre variation (tables 8.15, 8.17).

Belfast, Colchester, London West and Preston did not return locally adjusted calcium results for most or all of their patients, whilst Sunderland, Wirral, Liverpool Aintree, Dorset and Portsmouth returned adjusted calcium results for only a proportion of their patients. Hence these data are shown after adjustment using a generic formula, and specific formulae provided some years ago by the laboratories serving Colchester, London West and Preston, have been applied.

Those formulae may not be applicable to the calcium and albumin methods used locally in 2016 and may have over- or under-estimated the adjusted calcium. These centres are served by laboratories that report adjusted calcium results and therefore it is hoped that adjusted calcium values be reported to the UKRR in future.

Of HD patients, 78.7% (95% CI 78.2–79.2%) and of PD patients 79.7% (95% CI 78.3–81.1%) had an adjusted calcium between 2.2–2.5 mmol/L (tables 8.16, 8.18, figures 8.17, 8.19).

The proportion of hypocalcaemic patients in the UK was 11.0% for HD and 8.3% for PD (tables 8.16, 8.18). The proportion of hypercalcaemic patients in the UK was 10.3% for HD and 12.0% for PD (tables 8.16, 8.18).

Peritoneal dialysis

Table 8.17. Summary statistics for adjusted calcium in peritoneal dialysis patients in 2016

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	100.0	72	2.3	0.2	2.3	2.2	2.4
B QEH	100.0	125	2.3	0.2	2.3	2.2	2.5
Basldn	100.0	30	2.4	0.1	2.4	2.3	2.5
Bradfd	100.0	22	2.5	0.1	2.5	2.4	2.5
Brightn	100.0	56	2.4	0.2	2.4	2.3	2.5
Bristol	100.0	42	2.4	0.1	2.4	2.3	2.5
Camb[a]							
Carlis	100.0	31	2.3	0.1	2.3	2.3	2.4
Carsh	92.1	93	2.3	0.2	2.3	2.2	2.4
Chelms	88.9	24	2.4	0.2	2.4	2.3	2.5
Colchr[b]							
Covnt	98.3	58	2.4	0.1	2.4	2.3	2.4
Derby	100.0	71	2.5	0.1	2.5	2.4	2.5
Donc	100.0	25	2.4	0.1	2.4	2.3	2.5
Dorset	100.0	33	2.3	0.2	2.3	2.2	2.4
Dudley	100.0	48	2.3	0.2	2.3	2.2	2.4
Exeter	100.0	73	2.3	0.2	2.3	2.2	2.5
Glouc	97.0	32	2.4	0.2	2.4	2.3	2.5
Hull	100.0	61	2.4	0.1	2.4	2.3	2.5
Ipswi	100.0	33	2.4	0.1	2.3	2.3	2.4
Kent	97.7	42	2.5	0.2	2.5	2.4	2.6
L Barts	97.8	175	2.3	0.2	2.3	2.2	2.4
L Guys	100.0	32	2.4	0.1	2.4	2.3	2.5
L Kings	100.0	75	2.3	0.2	2.3	2.2	2.4
L Rfree	97.8	135	2.3	0.2	2.4	2.2	2.5
L St.G	97.3	36	2.4	0.1	2.4	2.3	2.5
L West	90.6	77	2.4	0.2	2.4	2.3	2.5

Table 8.17. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Leeds	100.0	36	2.4	0.2	2.4	2.3	2.5
Leic	98.6	69	2.4	0.2	2.4	2.3	2.5
Liv Ain	100.0	23	2.4	0.1	2.3	2.3	2.4
Liv Roy	98.4	63	2.4	0.2	2.4	2.2	2.5
M RI	98.0	48	2.4	0.1	2.4	2.3	2.5
Middlbr	100.0	22	2.2	0.1	2.2	2.2	2.3
Newc	97.8	45	2.4	0.2	2.4	2.3	2.5
Norwch	100.0	41	2.4	0.2	2.4	2.3	2.5
Nottm	100.0	67	2.3	0.2	2.4	2.2	2.4
Oxford	100.0	80	2.4	0.1	2.4	2.3	2.5
Plymth	96.8	30	2.3	0.2	2.4	2.2	2.4
Ports	98.5	66	2.4	0.2	2.4	2.3	2.4
Prestn	100.0	35	2.4	0.1	2.4	2.3	2.5
Redng	100.0	44	2.4	0.1	2.4	2.3	2.5
Salford	98.9	89	2.4	0.2	2.4	2.3	2.5
Sheff	100.0	47	2.3	0.1	2.3	2.2	2.4
Shrew	100.0	29	2.4	0.1	2.4	2.4	2.5
Stevng	100.0	16	2.3	0.2	2.4	2.2	2.4
Sthend	100.0	24	2.4	0.2	2.4	2.3	2.5
Stoke	91.6	65	2.4	0.2	2.4	2.3	2.5
Sund	100.0	17	2.3	0.2	2.3	2.2	2.3
Truro	100.0	17	2.3	0.2	2.4	2.2	2.5
Wirral	100.0	15	2.4	0.1	2.3	2.2	2.4
Wolve	93.8	60	2.3	0.2	2.3	2.2	2.4
York	100.0	27	2.4	0.2	2.4	2.3	2.5
N Ireland							
Antrim	100.0	14	2.4	0.1	2.4	2.3	2.5
Belfast	100.0	22	2.4	0.2	2.4	2.3	2.5
Newry	100.0	19	2.4	0.2	2.4	2.3	2.5
Ulster	100.0	5					
West NI	100.0	9					
Scotland							
Abrdn	100.0	19	2.4	0.2	2.4	2.2	2.5
Airdrie	100.0	21	2.3	0.2	2.3	2.3	2.4
D & Gall	100.0	10	2.4	0.2	2.4	2.3	2.4
Dundee	100.0	13	2.5	0.2	2.5	2.3	2.6
Edinb	100.0	31	2.4	0.2	2.4	2.3	2.5
Glasgw	100.0	43	2.5	0.2	2.5	2.4	2.5
Inverns	33.3	3					
Klmarnk	96.4	27	2.4	0.2	2.4	2.3	2.5
Krkcldy	100.0	15	2.5	0.1	2.5	2.4	2.6
Wales							
Bangor	100.0	15	2.3	0.1	2.3	2.3	2.4
Cardff	95.5	64	2.4	0.1	2.4	2.3	2.5
Clwyd	100.0	14	2.5	0.2	2.5	2.4	2.5
Swanse	100.0	58	2.4	0.2	2.4	2.3	2.5
Wrexm	100.0	28	2.4	0.2	2.4	2.3	2.5
England	**98.2**	**2,576**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
N Ireland	**100.0**	**69**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
Scotland	**96.3**	**182**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
Wales	**98.4**	**179**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**
UK	**98.1**	**3,006**	**2.4**	**0.2**	**2.4**	**2.3**	**2.5**

Blank cells: centres excluded from analysis due to low patient numbers or poor data completeness
[a]Cambridge renal centre was unable to submit calcium data for 2016
[b]Colchester – no PD patients

Table 8.18. Percentage of peritoneal dialysis patients within, below and above the range for adjusted calcium (2.2–2.5 mmol/L) in 2016

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 2015	95% LCL change	95% UCL change
England									
B Heart	72	79.2	68.3	87.0	12.5	8.3	−3.3	−18.4	11.7
B QEH	125	77.6	69.5	84.1	12.8	9.6	2.4	−8.2	13.0
Basldn	30	90.0	73.2	96.7	3.3	6.7	8.5	−9.6	26.7
Bradfd	22	77.3	55.6	90.2	0.0	22.7	−1.3	−29.0	26.4
Brightn	56	78.6	66.0	87.4	8.9	12.5	3.6	−11.8	18.9
Bristol	42	81.0	66.3	90.2	0.0	19.1	0.1	−16.3	16.5
Carlis	31	87.1	70.3	95.1	9.7	3.2	−6.2	−21.0	8.6
Carsh	93	73.1	63.2	81.1	21.5	5.4	−5.4	−17.7	6.9
Chelms	24	70.8	50.2	85.4	16.7	12.5	7.2	−19.9	34.3
Covnt	58	82.8	70.8	90.5	8.6	8.6	3.7	−10.1	17.4
Derby	71	77.5	66.3	85.7	1.4	21.1	9.0	−5.5	23.4
Donc	25	88.0	68.7	96.1	4.0	8.0	10.2	−12.8	33.3
Dorset	33	69.7	52.3	82.9	18.2	12.1	−16.0	−35.5	3.5
Dudley	48	83.3	70.1	91.4	10.4	6.3	21.8	4.9	38.7
Exeter	73	87.7	78.0	93.5	4.1	8.2	7.4	−4.5	19.3
Glouc	32	68.8	51.0	82.3	9.4	21.9	0.9	−22.7	24.5
Hull	61	85.3	74.0	92.1	0.0	14.8	8.7	−5.0	22.4
Ipswi	33	90.9	75.3	97.0	6.1	3.0	28.0	7.3	48.6
Kent	42	71.4	56.1	83.0	0.0	28.6	10.3	−8.5	29.2
L Barts	175	74.9	67.9	80.7	18.9	6.3	−10.0	−18.3	−1.7
L Guys	32	84.4	67.5	93.3	3.1	12.5	12.0	−8.6	32.5
L Kings	75	76.0	65.1	84.3	17.3	6.7	−5.3	−18.2	7.7
L Rfree	135	76.3	68.4	82.7	14.1	9.6	−5.7	−15.4	4.1
L St.G	36	80.6	64.5	90.4	0.0	19.4	15.4	−3.8	34.7
L West	77	71.4	60.4	80.4	5.2	23.4	11.8	−4.9	28.5
Leeds	36	75.0	58.5	86.5	2.8	22.2	−19.0	−34.6	−3.4
Leic	69	82.6	71.8	89.9	4.4	13.0	5.8	−6.6	18.1
Liv Ain	23	91.3	71.1	97.8	4.4	4.4	6.1	−11.6	23.8
Liv Roy	63	79.4	67.6	87.6	4.8	15.9	−10.8	−23.3	1.7
M RI	48	87.5	74.9	94.3	2.1	10.4	3.0	−10.2	16.2
Middlbr	22	77.3	55.6	90.2	22.7	0.0	−1.3	−29.0	26.4
Newc	45	84.4	70.8	92.4	2.2	13.3	5.5	−11.2	22.2
Norwch	41	80.5	65.6	89.9	12.2	7.3	16.2	−5.3	37.7
Nottm	67	83.6	72.7	90.7	11.9	4.5	−5.5	−17.2	6.2
Oxford	80	90.0	81.3	94.9	2.5	7.5	0.1	−9.2	9.5
Plymth	30	80.0	62.1	90.7	16.7	3.3	−1.5	−22.0	19.0
Ports	66	86.4	75.8	92.8	3.0	10.6	8.8	−4.8	22.3
Prestn	35	82.9	66.7	92.1	8.6	8.6	9.4	−8.2	27.0
Redng	44	86.4	72.8	93.7	2.3	11.4	5.0	−9.2	19.2
Salford	89	71.9	61.7	80.3	6.7	21.4	6.1	−7.8	19.9
Sheff	47	80.9	67.1	89.7	12.8	6.4	−4.9	−19.4	9.7
Shrew	29	89.7	72.4	96.6	3.5	6.9	0.8	−15.5	17.0
Stevng	16	81.3	55.3	93.8	6.3	12.5	−11.1	−35.1	12.9
Sthend	24	75.0	54.4	88.3	4.2	20.8	1.7	−26.6	30.0
Stoke	65	69.2	57.1	79.2	6.2	24.6	−6.6	−22.1	8.9
Sund	17	76.5	51.5	90.9	17.7	5.9	−15.8	−40.7	9.0
Truro	17	76.5	51.5	90.9	17.7	5.9	−23.5	−43.7	−3.4
Wirral	15	93.3	64.8	99.1	0.0	6.7	22.7	−2.3	47.8
Wolve	60	80.0	68.0	88.3	10.0	10.0	6.9	−7.8	21.5
York	27	74.1	54.7	87.1	7.4	18.5	−11.6	−33.9	10.7
N Ireland									
Antrim	14	85.7	57.3	96.4	0.0	14.3	15.1	−13.3	43.5
Belfast	22	77.3	55.6	90.2	4.6	18.2	−1.7	−27.0	23.7
Newry	19	84.2	60.9	94.8	5.3	10.5	12.0	−14.4	38.4

Table 8.18. 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 2015	95% LCL change	95% UCL change
Scotland									
Abrdn	19	79.0	55.5	91.9	5.3	15.8	12.3	−15.0	39.5
Airdrie*	21	90.5	68.9	97.6	4.8	4.8			
D & Gall	10	70.0	37.6	90.0	10.0	20.0	0.0	−40.2	40.2
Dundee	13	69.2	40.9	88.0	0.0	30.8	6.7	−27.8	41.3
Edinb	31	80.7	63.1	91.0	3.2	16.1	15.9	−10.7	42.6
Glasgw	43	76.7	61.9	87.0	2.3	20.9	1.7	−16.2	19.7
Klmarnk	27	85.2	66.5	94.3	3.7	11.1	6.4	−12.9	25.7
Krkcldy	15	73.3	46.7	89.6	0.0	26.7	−14.2	−41.8	13.5
Wales									
Bangor	15	86.7	59.5	96.6	13.3	0.0	25.1	−6.4	56.7
Cardff	64	79.7	68.1	87.8	6.3	14.1	10.7	−3.9	25.3
Clwyd	14	78.6	50.6	92.9	0.0	21.4	1.6	−29.8	33.1
Swanse	58	86.2	74.8	93.0	3.5	10.3	0.8	−12.1	13.6
Wrexm	28	82.1	63.6	92.4	3.6	14.3	6.4	−14.0	26.8
England	**2,576**	**79.5**	**77.9**	**81.1**	**8.9**	**11.6**	**1.1**	**−1.1**	**3.4**
N Ireland	**69**	**79.7**	**68.6**	**87.6**	**7.3**	**13.0**	**5.8**	**−8.3**	**19.9**
Scotland	**182**	**79.7**	**73.2**	**84.9**	**3.3**	**17.0**	**7.2**	**−1.6**	**16.0**
Wales	**179**	**82.7**	**76.4**	**87.6**	**5.0**	**12.3**	**7.5**	**−0.8**	**15.9**
UK	**3,006**	**79.7**	**78.3**	**81.1**	**8.3**	**12.0**	**2.0**	**−0.1**	**4.1**

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness
*Blank cells indicate no data for 2015

Figure 8.18 presents the funnel plot of HD patients attaining adjusted calcium levels between 2.2 and 2.5 mmol/L in 2016. Two centre's results fell below the lower 99.9% confidence interval: London West and Sunderland. However, data for both centres may be misleading since London West and Sunderland failed to return locally adjusted calcium results on all and half of their HD patients respectively. The percentage of HD patients with serum calcium within the reference range was significantly higher than the average (above the 99.9% confidence limit) in Exeter, Nottingham, Wrexham and York.

Figure 8.20 presents the funnel plot of PD patients attaining the adjusted calcium levels between 2.2 and 2.5 mmol/L in 2016. Once corrected for centre size, no centre was significantly lower or higher than the national average.

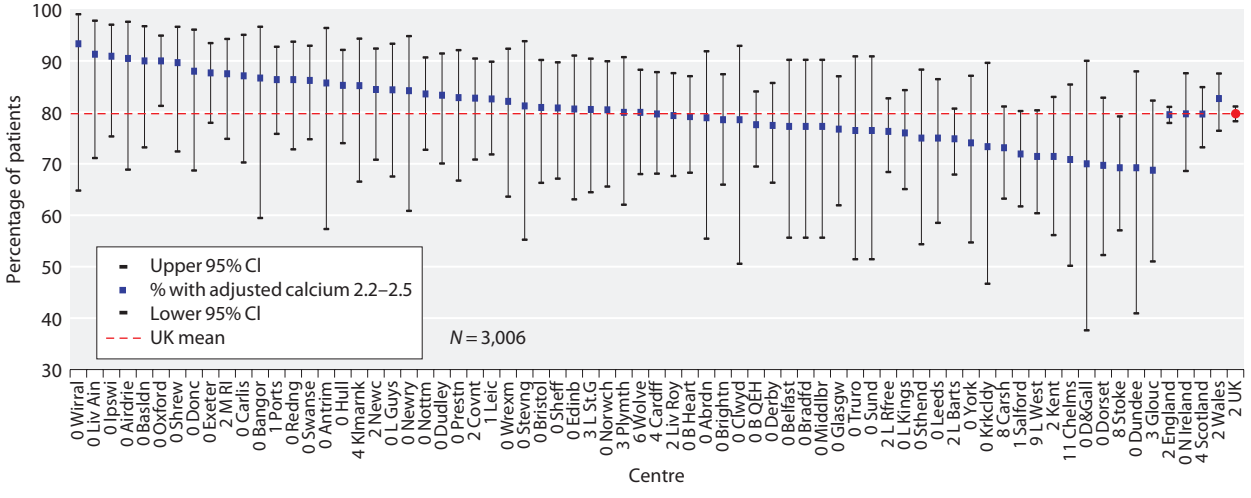

Fig. 8.19. Percentage of peritoneal dialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2016

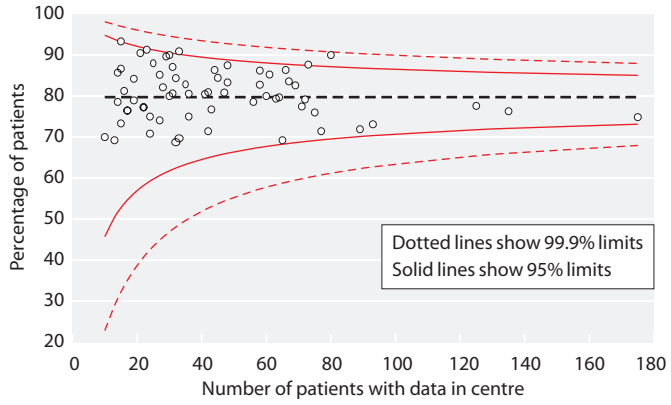

Fig. 8.20. Funnel plot of percentage of peritoneal dialysis patients with adjusted calcium within range (2.2–2.5 mmol/L) by centre in 2016

Longitudinal measures of serum adjusted calcium show stable attainment of national standards over the last decade (figure 8.21).

Phosphate

In 2016 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)' [2]

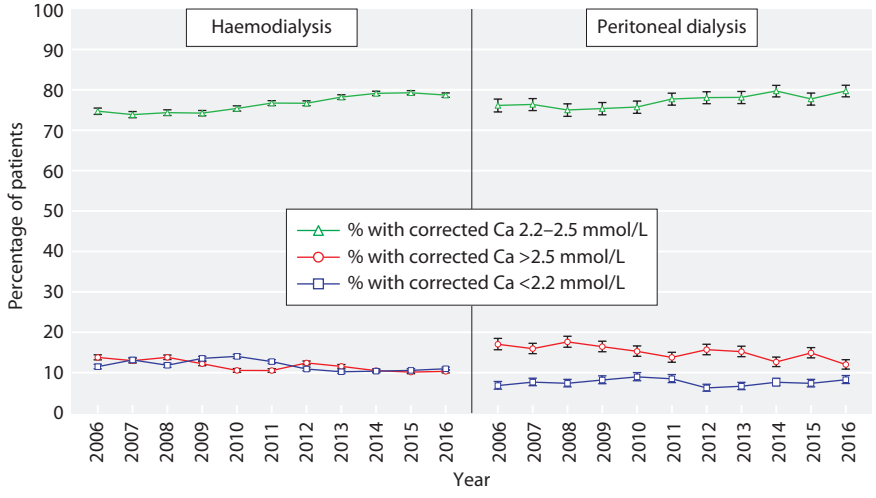

Fig. 8.21. Longitudinal change in percentage of patients with adjusted calcium <2.2 mmol/L, 2.2–2.5 mmol/L and >2.5 mmol/L by dialysis modality 2006–2016

Haemodialysis

Table 8.19. Percentage of haemodialysis patients with serum phosphate within, below or above the target range of 1.1–1.7 mmol/L, as specified in the RA guidelines, by centre in 2016

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 2015	95% LCL change	95% UCL change
England									
B Heart	373	43.7	38.8	48.8	8.9	47.5	−11.2	−26.4	4.1
B QEH	934	63.2	60.0	66.2	10.4	26.5	0.5	−12.0	13.0
Basldn	147	57.1	49.0	64.9	7.5	35.4	3.2	−12.0	18.4
Bradfd	226	56.6	50.1	63.0	16.4	27.0	−1.0	−15.5	13.6
Brightn	418	51.0	46.2	55.7	10.3	38.8	−5.4	−20.0	9.1
Bristol	470	47.9	43.4	52.4	12.3	39.8	−12.7	−27.4	2.0
Carlis	88	55.7	45.2	65.7	11.4	33.0	2.4	−14.9	19.6
Carsh	771	59.0	55.5	62.4	11.0	30.0	−1.0	−14.1	12.2
Chelms	118	62.7	53.7	71.0	6.8	30.5	10.5	−4.4	25.4
Colchr	92	68.5	58.3	77.1	10.9	20.7	1.5	−13.2	16.2
Covnt	345	55.1	49.8	60.3	6.7	38.3	−2.3	−16.5	11.9

Table 8.19. 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 2015	95% LCL change	95% UCL change
Derby	227	59.9	53.4	66.1	12.8	27.3	1.5	−12.7	15.7
Donc	177	57.6	50.2	64.7	7.3	35.0	−6.2	−21.0	8.7
Dorset	263	55.1	49.1	61.0	12.2	32.7	−10.6	−24.9	3.8
Dudley	185	65.4	58.3	71.9	9.2	25.4	2.6	−11.6	16.7
Exeter	423	57.9	53.2	62.5	13.2	28.8	−2.3	−16.0	11.4
Glouc	228	54.4	47.9	60.7	11.8	33.8	−5.5	−20.3	9.3
Hull	302	54.0	48.3	59.5	8.9	37.1	−3.4	−17.7	11.0
Ipswi	135	54.8	46.4	63.0	16.3	28.9	−3.3	−19.0	12.4
Kent	387	47.8	42.9	52.8	6.2	46.0	−7.0	−21.9	7.8
L Barts	953	52.5	49.3	55.6	12.5	35.1	0.9	−13.1	14.8
L Guys	643	52.3	48.4	56.1	19.8	28.0	−2.5	−16.6	11.6
L Kings	544	61.8	57.6	65.8	13.6	24.6	0.0	−13.1	13.0
L Rfree	652	56.1	52.3	59.9	14.1	29.8	−2.4	−16.0	11.2
L St.G	314	56.7	51.2	62.1	15.6	27.7	2.3	−11.9	16.4
L West	1,262	55.2	52.5	58.0	18.5	26.3	−2.7	−16.1	10.8
Leeds	485	50.7	46.3	55.2	9.5	39.8	−3.9	−18.4	10.5
Leic	881	58.5	55.2	61.7	8.6	32.9	3.6	−9.6	16.8
Liv Ain	170	48.8	41.4	56.3	24.7	26.5	−8.7	−24.6	7.2
Liv Roy	335	60.3	55.0	65.4	11.6	28.1	1.8	−11.7	15.4
M RI*	458	50.2	45.7	54.8	14.6	35.2	−1.6	−16.1	13.0
Middlbr	310	56.5	50.9	61.9	7.7	35.8	−1.4	−15.5	12.7
Newc	287	57.8	52.1	63.4	10.5	31.7	0.0	−14.1	14.0
Norwch	301	58.1	52.5	63.6	5.7	36.2	−6.4	−20.3	7.5
Nottm	364	64.6	59.5	69.3	10.7	24.7	−0.2	−13.2	12.8
Oxford	401	51.9	47.0	56.7	12.7	35.4	2.6	−11.8	17.1
Plymth	127	63.0	54.3	70.9	12.6	24.4	3.0	−11.9	17.9
Ports	582	50.5	46.5	54.6	12.0	37.5	0.3	−14.0	14.6
Prestn	531	52.4	48.1	56.6	7.9	39.7	−4.6	−18.8	9.6
Redng	288	57.3	51.5	62.9	11.8	30.9	−1.9	−16.1	12.2
Salford*	356	50.8	45.7	56.0	15.7	33.4	−1.7	−16.3	12.9
Sheff	576	55.2	51.1	59.2	12.7	32.1	−3.9	−17.7	9.9
Shrew	189	62.4	55.3	69.1	4.8	32.8	4.1	−10.1	18.3
Stevng	490	55.1	50.7	59.5	8.6	36.3	−0.9	−14.8	13.1
Sthend	109	46.8	37.6	56.2	8.3	45.0	−6.0	−22.8	10.8
Stoke	319	59.6	54.1	64.8	11.3	29.2	4.5	−9.3	18.4
Truro	156	66.0	58.3	73.0	7.7	26.3	3.5	−10.8	17.8
Wirral	177	57.1	49.7	64.2	15.3	27.7	6.2	−8.7	21.1
Wolve	291	51.9	46.2	57.6	23.7	24.4	3.3	−11.5	18.0
York	181	55.3	47.9	62.3	27.1	17.7	−4.8	−20.1	10.6
N Ireland									
Antrim	115	59.1	49.9	67.7	29.6	11.3	−2.3	−17.8	13.3
Belfast	185	47.6	40.5	54.8	22.7	29.7	2.2	−13.6	18.0
Newry	80	52.5	41.6	63.2	10.0	37.5	−7.0	−24.0	9.9
Ulster	96	61.5	51.4	70.6	19.8	18.8	1.0	−14.8	16.9
West NI	118	59.3	50.3	67.8	8.5	32.2	−1.7	−17.3	13.8
Scotland									
Abrdn	217	57.1	50.5	63.6	11.5	31.3	−1.9	−16.5	12.7
Airdrie	171	51.5	44.0	58.9	26.9	21.6	−4.9	−20.3	10.6
D & Gall	46	56.5	42.1	70.0	10.9	32.6	−6.8	−25.4	11.9
Dundee	164	45.7	38.3	53.4	5.5	48.8	−4.6	−20.5	11.4
Edinb	268	47.4	41.5	53.4	4.5	48.1	−6.2	−21.6	9.1
Glasgw	531	50.3	46.0	54.5	5.5	44.3	−2.8	−17.2	11.6
Inverns	68	45.6	34.2	57.5	1.5	52.9	−3.8	−21.5	14.0
Klmarnk	128	57.8	49.1	66.1	24.2	18.0	−0.3	−15.8	15.3
Krkcldy	135	61.5	53.0	69.3	8.9	29.6	1.2	−13.9	16.2

Table 8.19. 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 2015	95% LCL change	95% UCL change
Wales									
Bangor	68	51.5	39.7	63.1	22.1	26.5	−13.9	−30.9	3.1
Cardff	480	53.5	49.1	58.0	7.1	39.4	−6.2	−20.4	7.9
Clwyd	68	44.1	32.9	56.0	10.3	45.6	−8.5	−26.3	9.3
Swanse	343	59.5	54.2	64.6	14.6	26.0	−2.8	−16.5	10.9
Wrexm	113	59.3	50.0	68.0	30.1	10.6	5.8	−10.3	21.8
England	**19,041**	**55.6**	**54.8**	**56.3**	**12.2**	**32.2**	**−1.6**	**−14.7**	**11.5**
N Ireland	**594**	**55.1**	**51.0**	**59.0**	**19.0**	**25.9**	**−1.1**	**−14.9**	**12.7**
Scotland	**1,728**	**51.8**	**49.4**	**54.1**	**9.8**	**38.4**	**−3.2**	**−17.0**	**10.6**
Wales	**1,072**	**55.3**	**52.3**	**58.3**	**13.1**	**31.6**	**−4.6**	**−18.1**	**8.9**
UK	**22,435**	**55.2**	**54.6**	**55.9**	**12.3**	**32.5**	**−1.8**	**−15.0**	**11.3**

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness
*Salford and Manchester RI have been involved in the SPIRiT study – an RCT comparing low phosphate control (0.8–1.4 mmol/L) with high phosphate control (1.8–2.4 mmol/L); HD patients only were recruited

For those receiving HD, 55.2% of patients achieved a phosphate level between 1.1–1.7 mmol/L, the guideline specified by the RA (as opposed to the audit measure), and for those on PD this was 60.3% (tables 8.19, 8.20).

There was inter-centre variation in the proportion of patients within the phosphate target range specified by the clinical guideline (figures 8.22–8.25, tables 8.19, 8.20).

Funnel plots for HD patients with phosphate within the target range (1.1–1.7 mmol/L), show two centres (Birmingham Queen Elizabeth, Nottingham) attaining this standard in a significantly high proportion of patients (being above the 99.9% upper confidence interval following correction for centre size). In addition, only one centre (Birmingham Heartlands) had achieved the serum phosphate control standard in a lower than expected proportion of patients (being below the lower 99.9% confidence interval), (figure 8.23). Differences in outlier status can be seen when this guideline target measure is applied compared to the audit measure of phosphate <1.7 mmol/L, namely fewer centres were found to be outliers.

The funnel plot for PD patients indicated that the control of phosphate levels was similar in all centres. No significant outliers were identified (figure 8.25).

Longitudinal analysis had demonstrated stable performance against the clinical guideline recommendation

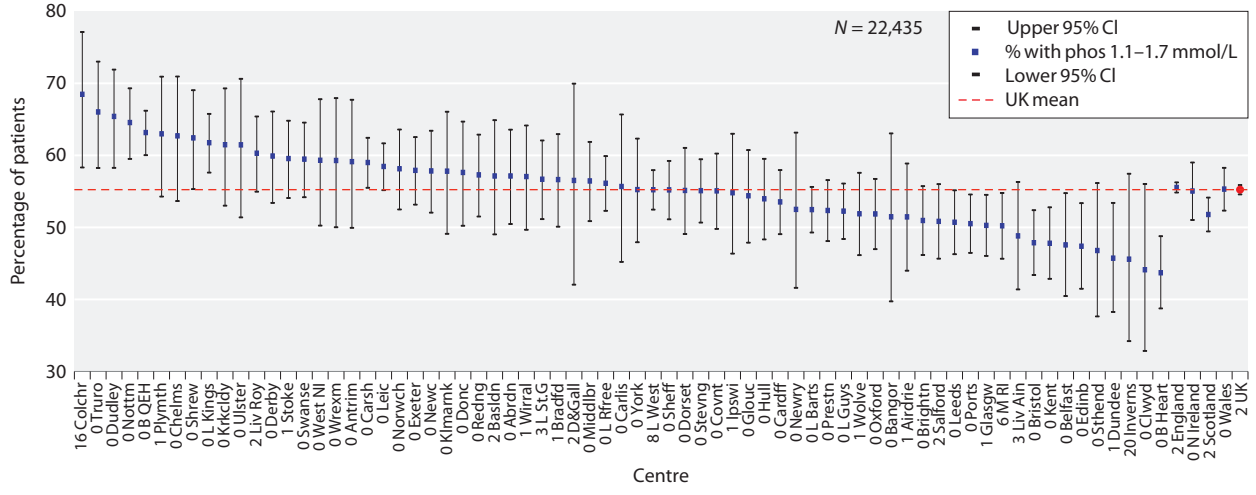

Fig. 8.22. Percentage of haemodialysis patients with phosphate within the range specified by the RA guideline (1.1–1.7 mmol/L) by centre in 2016

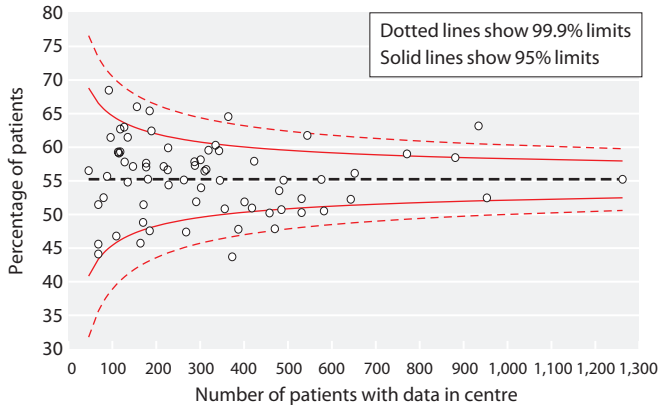

Fig. 8.23. Funnel plot of percentage of haemodialysis patients with phosphate within the range specified by the RA guideline (1.1–1.7 mmol/L) by centre in 2016

for those receiving HD and PD in recent years although there has been an increase in hyperphosphataemia in 2016 in both treatment modalities (figure 8.26).

Parathyroid hormone

At the beginning of 2016 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)' [2]

Peritoneal dialysis

Table 8.20. Percentage of peritoneal dialysis patients within, below and above the range specified in the RA guideline for phosphate (1.1–1.7 mmol/L) in 2016

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 2015	95% LCL change	95% UCL change
England									
B Heart	72	44.4	33.5	56.0	2.8	52.8	−5.6	−24.8	13.7
B QEH	125	61.6	52.8	69.7	5.6	32.8	5.4	−6.9	17.7
Basldn	30	63.3	45.1	78.4	6.7	30.0	4.1	−21.2	29.4
Bradfd	22	40.9	22.8	61.8	9.1	50.0	5.2	−27.2	37.6
Brightn	56	55.4	42.3	67.7	8.9	35.7	−13.0	−30.5	4.6
Bristol	42	64.3	48.9	77.2	2.4	33.3	0.5	−19.5	20.4
Carlis	30	60.0	42.0	75.7	6.7	33.3	−3.3	−27.9	21.3
Carsh	93	60.2	50.0	69.6	6.5	33.3	2.6	−11.6	16.8
Chelms	24	58.3	38.3	75.9	4.2	37.5	17.4	−11.1	45.9
Covnt	57	63.2	50.0	74.6	14.0	22.8	−5.0	−21.8	11.8
Derby	71	74.7	63.3	83.4	9.9	15.5	7.5	−7.3	22.3
Donc	25	80.0	60.0	91.4	4.0	16.0	−3.3	−26.6	20.0
Dorset	33	72.7	55.4	85.2	15.2	12.1	−4.4	−25.0	16.2
Dudley	48	45.8	32.4	59.9	0.0	54.2	−23.4	−42.3	−4.5
Exeter	73	61.6	50.1	72.0	9.6	28.8	−11.6	−26.8	3.6
Glouc	32	56.3	39.0	72.1	9.4	34.4	−4.5	−29.4	20.5
Hull	61	52.5	40.0	64.6	11.5	36.1	−6.9	−24.3	10.5
Ipswi	32	81.3	64.1	91.3	3.1	15.6	18.3	−4.4	41.0
Kent	42	64.3	48.9	77.2	16.7	19.1	−2.4	−21.6	16.8
L Barts	175	58.9	51.4	65.9	5.1	36.0	−1.5	−11.7	8.7
L Guys	32	56.3	39.0	72.1	6.3	37.5	−9.3	−33.7	15.1
L Kings	75	66.7	55.3	76.4	8.0	25.3	7.9	−7.3	23.1
L Rfree	135	65.9	57.5	73.4	4.4	29.6	5.0	−6.5	16.5
L St.G	36	58.3	41.9	73.1	5.6	36.1	−6.8	−28.3	14.7
L West	77	57.1	45.9	67.7	7.8	35.1	−6.3	−23.5	10.8
Leeds	36	44.4	29.3	60.7	5.6	50.0	−3.6	−24.9	17.8
Leic	69	76.8	65.4	85.3	2.9	20.3	17.9	3.8	31.9
Liv Ain	23	43.5	25.2	63.7	8.7	47.8	−15.8	−43.2	11.7

Table 8.20. 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 2015	95% LCL change	95% UCL change
Liv Roy	63	69.8	57.5	79.9	14.3	15.9	15.7	−1.1	32.6
M RI	48	54.2	40.1	67.6	12.5	33.3	2.5	−16.6	21.5
Middlbr	22	63.6	42.3	80.7	0.0	36.4	−7.8	−38.8	23.3
Newc	46	47.8	34.0	62.1	4.4	47.8	−12.7	−33.9	8.5
Norwch	41	63.4	47.9	76.6	4.9	31.7	2.7	−20.6	26.0
Nottm	67	70.2	58.2	79.9	3.0	26.9	−1.7	−17.3	13.8
Oxford	80	63.8	52.7	73.5	3.8	32.5	1.7	−13.3	16.7
Plymth	29	62.1	43.6	77.6	10.3	27.6	−0.9	−26.3	24.5
Ports	64	48.4	36.5	60.5	4.7	46.9	−6.0	−23.8	11.9
Prestn	35	48.6	32.7	64.7	8.6	42.9	−16.7	−38.0	4.5
Redng	44	61.4	46.4	74.5	2.3	36.4	−16.6	−34.5	1.2
Salford	89	52.8	42.5	62.9	3.4	43.8	−4.5	−19.4	10.4
Sheff	47	68.1	53.6	79.8	0.0	31.9	2.0	−16.2	20.2
Shrew	29	75.9	57.3	88.0	0.0	24.1	9.2	−14.4	32.8
Stevng	16	62.5	37.7	82.1	12.5	25.0	16.4	−19.7	52.4
Sthend	24	66.7	46.1	82.4	8.3	25.0	0.0	−30.4	30.4
Stoke	70	41.4	30.5	53.2	11.4	47.1	−24.8	−40.9	−8.6
Sund	17	64.7	40.4	83.2	11.8	23.5	18.6	−16.8	53.9
Truro	17	58.8	35.2	79.0	5.9	35.3	−4.3	−36.2	27.6
Wirral	14	42.9	20.7	68.4	7.1	50.0	−4.2	−39.3	30.9
Wolve	59	64.4	51.5	75.5	5.1	30.5	−2.8	−19.4	13.9
York	27	70.4	51.0	84.4	11.1	18.5	13.2	−14.1	40.5
N Ireland									
Antrim	14	78.6	50.6	92.9	7.1	14.3	19.8	−12.0	51.5
Belfast	22	63.6	42.3	80.7	4.6	31.8	0.5	−29.1	30.1
Newry	19	63.2	40.3	81.3	5.3	31.6	−20.2	−47.9	7.5
Scotland									
Abrdn	19	47.4	26.8	68.9	10.5	42.1	4.5	−26.3	35.4
Airdrie	20	75.0	52.2	89.2	10.0	15.0			
D & Gall	10	70.0	37.6	90.0	0.0	30.0	30.0	−11.6	71.6
Dundee	13	53.9	28.2	77.6	0.0	46.2	−2.4	−38.8	34.0
Edinb	28	53.6	35.4	70.8	0.0	46.4	−11.1	−40.4	18.1
Glasgw	42	59.5	44.3	73.1	4.8	35.7	−1.8	−22.5	18.8
Klmarnk	27	55.6	36.9	72.8	7.4	37.0	16.2	−8.9	41.3
Krkcldy	15	73.3	46.7	89.6	0.0	26.7	4.6	−27.3	36.5
Wales									
Bangor	15	80.0	53.0	93.4	6.7	13.3	33.9	0.0	67.7
Cardff	64	56.3	44.0	67.8	6.3	37.5	−6.6	−23.2	10.0
Clwyd	14	50.0	26.0	74.0	21.4	28.6	−11.5	−48.8	25.7
Swanse	58	55.2	42.3	67.4	5.2	39.7	−3.0	−21.3	15.3
Wrexm	28	50.0	32.3	67.7	17.9	32.1	−7.6	−32.6	17.5
England	**2,574**	**60.3**	**58.4**	**62.2**	**6.6**	**33.1**	**−1.6**	**−4.2**	**1.1**
N Ireland	**69**	**68.1**	**56.3**	**78.0**	**4.4**	**27.5**	**−2.9**	**−18.2**	**12.5**
Scotland	**177**	**59.9**	**52.5**	**66.9**	**4.5**	**35.6**	**7.1**	**−3.2**	**17.4**
Wales	**179**	**56.4**	**49.1**	**63.5**	**8.9**	**34.6**	**−2.8**	**−13.0**	**7.3**
UK	**2,999**	**60.3**	**58.5**	**62.0**	**6.6**	**33.2**	**−1.2**	**−3.6**	**1.3**

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness
Blank cells indicate no data for 2015

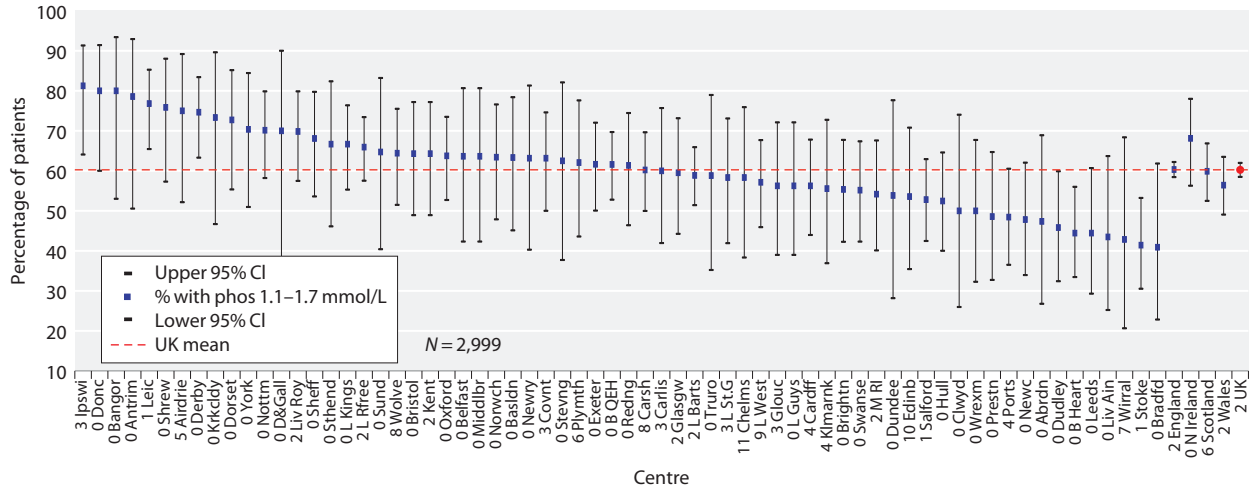

Fig. 8.24. Percentage of peritoneal dialysis patients with phosphate within the range specified by the RA guideline (1.1–1.7 mmol/L) by centre in 2016

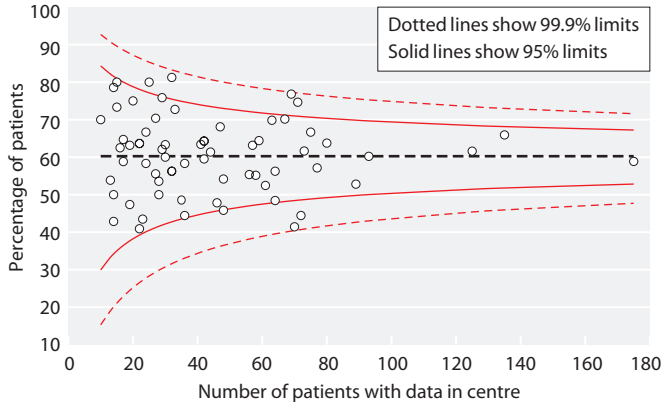

Fig. 8.25. Funnel plot of percentage of peritoneal dialysis patients with phosphate within the range specified by the RA guideline (1.1–1.7 mmol/L) by centre in 2016

PTH results from 18,420 HD patients and 2,404 PD patients from England, Northern Ireland and Wales were available for analysis from 2016. The data were 87.1% complete for HD patients and 83.7% for PD patients overall, although there was inter-centre variation (tables 8.21, 8.23). For the analyses, Birmingham Queen Elizabeth, Cambridge, Salford and Sheffield were excluded due to poor data completeness.

Median PTH amongst HD patients was 32 pmol/L (IQR 16–58 pmol/L) and amongst PD patients was 31 pmol/L (IQR 18–52 pmol/L) for the three countries.

Of HD patients, 58.3% (95% CI 57.6–59.0%) and of PD patients, 65.7% (95% CI 63.8–67.6%) achieved a PTH between 16–72 pmol/L (tables 8.22, 8.24, figures 8.27, 8.29).

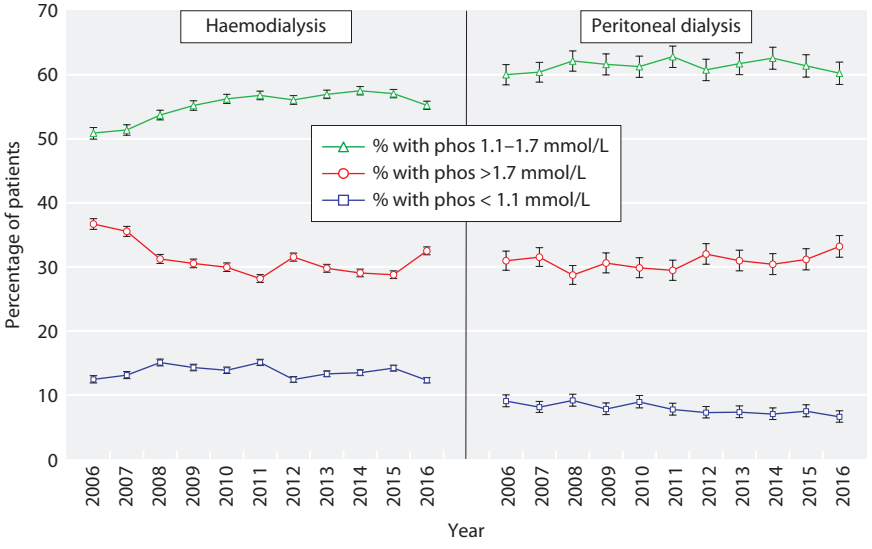

Fig. 8.26. Longitudinal change in percentage of patients with phosphate below, within and above the RA guideline by dialysis modality 2006–2016

Table 8.21. Summary statistics for PTH in haemodialysis patients in 2016

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	98.4	367	57.1	46.1	45	22	80
B QEH	29.2	274					
Basldn	88.0	132	51.1	35.4	44	25	72
Bradfd	99.1	226	37.8	33.9	29	14	51
Brightn	96.9	406	50.9	57.0	34	16	66
Bristol	99.6	468	41.8	42.4	30	13	55
Camb*							
Carlis	98.9	87	31.4	33.1	23	11	40
Carsh	83.1	643	63.1	57.7	46	23	82
Chelms	100.0	118	50.7	47.6	39	19	67
Colchr	84.6	93	33.4	28.5	26	14	43
Covnt	98.6	341	38.2	40.0	28	14	46
Derby	100.0	227	40.0	42.6	31	16	50
Donc	99.4	176	60.6	48.9	49	30	72
Dorset	99.2	261	33.4	30.7	25	13	43
Dudley	97.3	180	35.0	34.2	27	14	42
Exeter	97.4	412	24.6	25.9	17	8	30
Glouc	99.1	226	42.6	45.8	31	16	51
Hull	96.0	290	45.7	50.0	31	15	55
Ipswi	99.3	135	33.4	31.3	24	12	43
Kent	99.7	386	55.9	49.9	38	19	76
L Barts	97.3	929	51.3	44.1	38	23	67
L Guys	70.3	453	26.9	15.0	27	15	40
L Kings	96.9	528	45.1	44.9	30	14	62
L Rfree	99.1	647	39.5	35.1	30	15	52
L St.G	90.7	294	58.8	58.0	43	18	77
L West	79.8	1,100	62.2	60.9	44	20	85
Leeds	98.1	476	43.2	50.2	28	13	52
Leic	97.3	858	47.9	50.3	32	13	65
Liv Ain	68.0	119	23.8	31.3	12	6	26
Liv Roy	77.6	266	42.4	38.6	30	15	57
M RI	89.7	437	49.5	56.6	33	16	61
Middlbr	96.8	300	50.2	42.4	42	22	63
Newc	100.0	287	54.3	56.5	37	18	71
Norwch	98.7	298	38.4	39.5	30	16	49
Nottm	97.5	356	40.9	42.2	27	13	51
Oxford	99.5	399	47.4	39.5	36	21	65
Plymth	95.3	122	50.8	46.2	38	22	63
Ports	95.7	558	51.7	48.5	38	20	69
Prestn	99.3	527	48.0	48.4	35	19	61
Redng	99.3	286	45.8	44.1	33	20	57
Salford	28.7	104					
Sheff	0.0						
Shrew	96.8	183	45.3	37.5	37	19	60
Stevng	97.6	479	46.6	39.2	36	23	59
Sthend	90.8	99	67.8	64.4	47	28	91
Stoke	79.8	257	41.2	31.2	32	19	54
Sund	98.7	220	42.9	43.5	29	15	54
Truro	100.0	156	25.4	25.3	19	8	34
Wirral	72.1	129	30.6	21.4	27	15	39
Wolve	97.3	286	35.7	45.7	21	9	45
York	95.6	173	34.5	40.1	19	8	46
N Ireland							
Antrim	100.0	115	32.3	29.4	26	15	40
Belfast	98.9	183	35.7	55.0	20	9	38

Table 8.21. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Newry	100.0	80	28.6	24.8	23	15	36
Ulster	99.0	95	26.7	24.3	20	11	30
West NI	99.2	117	28.4	19.3	24	15	37
Wales							
Bangor	98.5	67	29.6	37.3	18	10	35
Cardff	97.7	470	47.6	43.5	37	20	63
Clwyd	95.6	65	40.2	40.9	28	11	53
Swanse	99.7	342	39.9	39.6	30	16	52
Wrexm	98.2	111	25.4	31.7	12	5	34
England	**86.1**	**16,775**	**46.3**	**46.5**	**33**	**16**	**60**
N Ireland	**99.3**	**590**	**31.2**	**36.9**	**23**	**13**	**38**
Wales	**98.3**	**1,055**	**41.2**	**41.2**	**31**	**14**	**54**
E, W & NI	**87.1**	**18,420**	**45.5**	**46.0**	**32**	**16**	**58**

Blank cells: centres excluded from analysis due to low patient numbers or poor data completeness
*Cambridge renal centre was unable to submit PTH data for 2016

Table 8.22. Percentage of haemodialysis patients within, below and above the range for PTH (16–72 pmol/L) in 2016

Centre	*N*	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
England									
B Heart	367	55.0	49.9	60.1	16.1	28.9	−3.8	−10.8	3.2
Basldn	132	60.6	52.0	68.6	15.2	24.2	2.6	−8.9	14.1
Bradfd	226	60.2	53.7	66.4	28.8	11.1	6.2	−3.1	15.4
Brightn	406	53.9	49.1	58.7	24.4	21.7	−2.8	−9.7	4.1
Bristol	468	55.1	50.6	59.6	27.8	17.1	−0.9	−7.3	5.4
Carlis	87	58.6	48.0	68.5	34.5	6.9	2.5	−12.9	17.8
Carsh	643	58.3	54.5	62.1	12.8	28.9	5.7	0.4	10.9
Chelms	118	57.6	48.6	66.2	20.3	22.0	−5.4	−17.4	6.6
Colchr	93	64.5	54.3	73.6	28.0	7.5	6.0	−7.5	19.5
Covnt	341	57.8	52.5	62.9	29.6	12.6	5.7	−1.8	13.2
Derby	227	67.0	60.6	72.8	22.9	10.1	−6.3	−14.8	2.1
Donc	176	65.3	58.0	72.0	10.2	24.4	3.0	−7.3	13.2
Dorset	261	59.0	52.9	64.8	31.0	10.0	6.8	−1.7	15.2
Dudley	180	62.8	55.5	69.5	26.7	10.6	7.5	−3.1	18.1
Exeter	412	47.3	42.6	52.2	47.6	5.1	3.6	−3.3	10.4
Glouc	226	60.6	54.1	66.8	24.3	15.0	1.9	−7.4	11.1
Hull	290	55.5	49.8	61.1	26.2	18.3	2.0	−5.9	9.9
Ipswi	135	57.8	49.3	65.8	31.1	11.1	−2.4	−14.3	9.5
Kent	386	60.1	55.1	64.9	13.0	26.9	−0.2	−7.0	6.7
L Barts	929	63.3	60.1	66.3	15.0	21.7	1.3	−3.1	5.7
L Guys	453	74.2	69.9	78.0	25.8	0.0	22.1	16.5	27.7
L Kings	528	51.7	47.4	55.9	27.8	20.5	2.3	−3.8	8.4
L Rfree	647	61.1	57.2	64.7	25.5	13.5	−4.5	−9.7	0.7
L St.G	294	55.1	49.4	60.7	18.0	26.9	−0.1	−8.1	8.0
L West	1,100	49.5	46.5	52.4	19.5	31.1	0.5	−3.7	4.7
Leeds	476	54.6	50.1	59.1	29.4	16.0	0.8	−5.6	7.1
Leic	858	49.5	46.2	52.9	28.9	21.6	−0.4	−5.1	4.4
Liv Ain	119	35.3	27.3	44.3	58.0	6.7	−2.0	−13.7	9.7
Liv Roy	266	57.1	51.1	63.0	25.9	16.9	5.9	−2.4	14.2
M RI	437	57.2	52.5	61.8	23.8	19.0	−2.3	−8.8	4.3
Middlbr	300	64.0	58.4	69.2	16.3	19.7	1.6	−6.0	9.2
Newc	287	57.5	51.7	63.1	18.5	24.0	−1.7	−9.7	6.4

Table 8.22. Continued

Centre	*N*	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
Norwch	298	65.1	59.5	70.3	23.8	11.1	2.7	−5.0	10.3
Nottm	356	52.0	46.8	57.1	31.2	16.9	−9.3	−16.6	−1.9
Oxford	399	62.9	58.1	67.5	18.8	18.3	4.5	−2.4	11.3
Plymth	122	66.4	57.6	74.2	13.9	19.7	4.6	−7.4	16.6
Ports	558	58.4	54.3	62.5	18.8	22.8	−2.2	−7.9	3.4
Prestn	527	63.0	58.8	67.0	19.4	17.7	5.2	−0.7	11.1
Redng	286	62.6	56.8	68.0	20.3	17.1	−4.1	−11.9	3.8
Shrew	183	63.9	56.7	70.6	18.6	17.5	9.7	−0.3	19.6
Stevng	479	69.7	65.5	73.7	14.2	16.1	6.4	0.4	12.4
Sthend	99	53.5	43.7	63.1	14.1	32.3	4.6	−9.4	18.6
Stoke	257	70.4	64.6	75.7	16.0	13.6	5.5	−2.5	13.6
Sund	220	56.4	49.7	62.8	26.8	16.8	2.6	−6.9	12.1
Truro	156	51.9	44.1	59.7	42.3	5.8	7.2	−4.1	18.5
Wirral	129	69.8	61.3	77.1	25.6	4.7	1.7	−8.9	12.3
Wolve	286	47.2	41.5	53.0	39.9	12.9	−2.8	−11.1	5.5
York	173	43.4	36.2	50.8	42.8	13.9	2.2	−8.8	13.2
N Ireland									
Antrim	115	68.7	59.7	76.5	26.1	5.2	4.7	−7.6	16.9
Belfast	183	51.9	44.7	59.1	39.9	8.2	−0.5	−10.9	10.0
Newry	80	71.3	60.4	80.1	25.0	3.8	4.6	−9.6	18.7
Ulster	95	55.8	45.7	65.4	37.9	6.3	−0.6	−14.7	13.6
West NI	117	72.7	63.9	80.0	26.5	0.9	11.9	−0.2	24.1
Wales									
Bangor	67	46.3	34.8	58.2	47.8	6.0	−10.1	−26.4	6.1
Cardff	470	61.7	57.2	66.0	18.7	19.6	−3.2	−9.4	3.1
Clwyd	65	50.8	38.8	62.7	32.3	16.9	−3.3	−19.9	13.4
Swanse	342	65.2	60.0	70.1	23.1	11.7	2.6	−4.7	9.8
Wrexm	111	38.7	30.2	48.1	54.1	7.2	−3.5	−16.9	9.8
England	**16,775**	**58.1**	**57.4**	**58.9**	**23.4**	**18.5**	**1.7**	**0.6**	**2.7**
N Ireland	**590**	**62.5**	**58.6**	**66.4**	**32.2**	**5.3**	**3.5**	**−2.2**	**9.1**
Wales	**1,055**	**58.8**	**55.8**	**61.7**	**26.5**	**14.7**	**−1.8**	**−6.1**	**2.4**
E, W & NI	**18,420**	**58.3**	**57.6**	**59.0**	**23.8**	**17.9**	**1.6**	**0.6**	**2.6**

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness

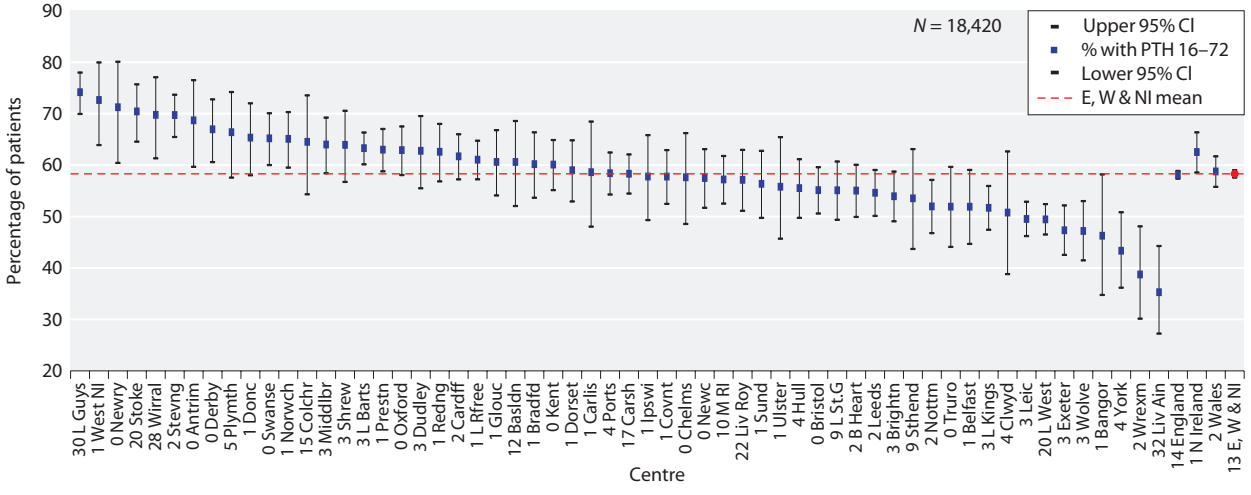

Fig. 8.27. Percentage of haemodialysis patients with PTH within range (16–72 pmol/L) by centre in 2016

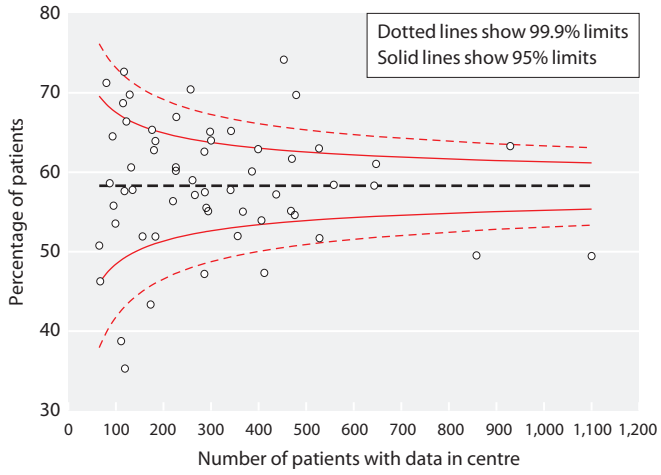

Fig. 8.28. Funnel plot of percentage of haemodialysis patients with PTH within range (16–72 pmol/L) by centre in 2016

In 2016, the proportion of HD patients with a PTH above the upper limit of the range (>72 pmol/L) was 17.9% and the proportion below the lower limit of the range (<16 pmol/L) was 23.8%.

The proportion of PD patients with PTH above the upper limit (>72 pmol/L) of the range was 13.4% and the proportion below the lower limit of the range (<16 pmol/L) was 20.9% (tables 8.22, 8.24).

There was significant variation by centre following unadjusted analyses for the proportion of patients below, within and above the range specified by the clinical performance measures. The funnel plot (figure 8.28) for HD patients showed above average achievement of the target range in London Guys, Stevenage, Stoke and West NI and below average achievement for Exeter, Leicester, Liverpool Aintree, London West,

Peritoneal dialysis

Table 8.23. Summary statistics for PTH in peritoneal dialysis patients in 2016

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
England							
B Heart	94.4	68	58.5	36.2	61	31	75
B QEH	0.0	0					
Basldn	100.0	30	41.7	26.4	37	22	58
Bradfd	95.5	21	53.8	42.6	39	18	79
Brightn	92.9	52	51.2	70.6	31	17	52
Bristol	100.0	42	30.0	24.5	28	15	34
Camb[a]							
Carlis	100.0	31	35.5	23.4	34	17	43
Carsh	79.2	80	68.0	44.5	58	35	89
Chelms	85.2	23	55.8	55.7	33	20	91
Colchr[b]							
Covnt	93.2	55	28.8	31.8	22	11	37
Derby	97.2	69	32.6	23.2	27	19	38
Donc	100.0	25	34.1	18.4	32	23	38
Dorset	97.0	32	30.2	31.2	20	11	37
Dudley	81.3	39	40.1	32.1	32	15	48
Exeter	100.0	73	27.7	22.4	22	12	38
Glouc	72.7	24	29.8	16.8	26	17	38
Hull	91.8	56	27.2	18.2	24	13	37
Ipswi	97.0	32	22.9	16.1	23	15	27
Kent	97.7	42	36.7	35.2	29	19	48
L Barts	91.6	164	43.8	33.7	37	21	56
L Guys	84.4	27	29.5	12.4	29	18	40
L Kings	88.0	66	61.4	52.2	42	24	92
L Rfree	95.7	132	34.7	24.2	31	19	44
L St.G	94.6	35	36.9	32.3	24	18	38
L West	84.7	72	45.7	38.1	36	26	56
Leeds	100.0	36	43.2	35.8	36	15	68
Leic	92.9	65	39.0	39.2	26	13	49
Liv Ain	95.7	22	20.8	18.9	16	10	28
Liv Roy	98.4	63	21.2	13.6	20	11	30
M RI	95.9	47	49.5	41.3	41	18	60
Middlbr	68.2	15	55.3	40.3	52	27	71

Table 8.23. Continued

Centre	% completeness	Patients with data *N*	Mean	SD	Median	Lower quartile	Upper quartile
Newc	91.3	42	36.4	30.3	26	12	60
Norwch	75.6	31	45.5	30.7	44	27	57
Nottm	98.5	66	36.5	32.4	28	17	46
Oxford	97.5	78	35.7	25.8	32	15	43
Plymth	87.1	27	30.3	20.0	28	17	37
Ports	85.1	57	47.7	35.2	36	23	59
Prestn	97.1	34	33.4	24.2	27	20	37
Redng	95.5	42	39.7	24.6	32	23	65
Salford	0.0	0					
Sheff	0.0	0					
Shrew	100.0	29	45.6	33.1	36	24	57
Stevng	87.5	14	50.2	22.4	50	34	66
Sthend	70.8	17	41.1	28.4	36	23	54
Stoke	94.4	67	50.6	36.0	43	23	70
Sund	100.0	17	26.0	15.3	26	14	39
Truro	88.2	15	35.2	32.7	29	13	34
Wirral	86.7	13	32.2	35.1	23	14	32
Wolve	89.1	57	44.0	43.5	33	21	54
York	92.6	25	38.4	34.8	30	17	49
N Ireland							
Antrim	100.0	14	24.3	19.6	22	7	40
Belfast	95.5	21	29.1	18.8	25	19	40
Newry	100.0	19	24.1	12.8	26	10	34
Ulster	100.0	5					
West NI	100.0	9					
Wales							
Bangor	100.0	15	34.6	26.6	30	15	54
Cardff	80.6	54	55.7	41.4	43	31	75
Clwyd	92.9	13	50.8	41.9	41	22	62
Swanse	98.3	57	38.1	36.9	26	17	45
Wrexm	100.0	28	33.1	25.6	25	15	37
England	**82.7**	**2,169**	**40.4**	**35.1**	**31**	**18**	**52**
N Ireland	**98.6**	**68**	**25.2**	**16.9**	**24**	**11**	**34**
Wales	**91.8**	**167**	**43.6**	**37.3**	**32**	**19**	**59**
E, W & NI	**83.7**	**2,404**	**40.2**	**35.0**	**31**	**18**	**52**

Blank cells: centres excluded from analysis due to small numbers or poor data completeness
[a]Cambridge renal centre was unable to submit PTH data for 2016
[b]Colchester – no PD patients

Table 8.24. Percentage of peritoneal dialysis patients within, below and above the range for PTH (16–72 pmol/L) in 2016

Centre	*N*	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
England									
B Heart	68	60.3	48.3	71.2	10.3	29.4	8.9	−10.9	28.8
Basldn	30	76.7	58.5	88.5	13.3	10.0	2.6	−19.8	25.0
Bradfd	21	52.4	31.8	72.2	19.1	28.6	−32.2	−61.2	−3.2
Brightn	52	63.5	49.7	75.3	23.1	13.5	5.8	−12.3	24.0
Bristol	42	69.1	53.7	81.1	26.2	4.8	3.1	−16.7	22.9
Carlis	31	77.4	59.6	88.8	16.1	6.5	10.8	−12.3	33.8
Carsh	80	58.8	47.7	69.0	6.3	35.0	4.6	−10.5	19.7
Chelms	23	52.2	32.5	71.2	21.7	26.1	−9.7	−38.9	19.4
Covnt	55	52.7	39.7	65.4	40.0	7.3	5.1	−13.0	23.2

Table 8.24. Continued

Centre	*N*	% PTH 16–72 pmol/L	Lower 95% CI	Upper 95% CI	% PTH <16 pmol/L	% PTH >72 pmol/L	Change in % within range from 2015	95% LCL change	95% UCL change
Derby	69	73.9	62.3	82.9	18.8	7.3	−9.9	−23.5	3.7
Donc	25	84.0	64.3	93.9	12.0	4.0	11.8	−13.4	37.0
Dorset	32	53.1	36.1	69.4	34.4	12.5	−2.0	−27.1	23.0
Dudley	39	59.0	43.2	73.1	25.6	15.4	0.6	−20.2	21.4
Exeter	73	58.9	47.4	69.6	34.3	6.9	2.6	−13.6	18.7
Glouc	24	79.2	58.7	91.1	20.8	0.0	−8.3	−29.3	12.6
Hull	56	69.6	56.5	80.2	28.6	1.8	10.4	−7.4	28.2
Ipswi	32	71.9	54.2	84.7	25.0	3.1	16.3	−8.1	40.7
Kent	42	71.4	56.1	83.0	23.8	4.8	1.1	−17.2	19.4
L Barts	164	69.5	62.1	76.1	15.9	14.6	−0.8	−10.6	9.0
L Guys	27	92.6	74.8	98.1	7.4	0.0	17.6	−2.4	37.5
L Kings	66	47.0	35.3	59.0	18.2	34.9	−7.2	−23.9	9.5
L Rfree	132	74.2	66.1	81.0	16.7	9.1	7.6	−3.6	18.8
L St.G	35	68.6	51.7	81.7	20.0	11.4	22.1	0.6	43.5
L West	72	70.8	59.4	80.2	13.9	15.3	3.5	−13.3	20.3
Leeds	36	58.3	41.9	73.1	27.8	13.9	−15.7	−35.8	4.5
Leic	65	53.9	41.7	65.5	30.8	15.4	3.9	−12.1	19.8
Liv Ain	22	45.5	26.5	65.9	50.0	4.6	−4.6	−34.8	25.7
Liv Roy	63	61.9	49.4	73.0	38.1	0.0	−7.7	−24.7	9.3
M RI	47	55.3	41.1	68.8	23.4	21.3	−7.8	−26.8	11.1
Middlbr	15	66.7	40.6	85.4	13.3	20.0			
Newc	42	50.0	35.3	64.7	31.0	19.1	−2.9	−25.5	19.6
Norwch	31	77.4	59.6	88.8	9.7	12.9	3.7	−20.9	28.4
Nottm	66	66.7	54.5	76.9	24.2	9.1	−6.3	−22.1	9.4
Oxford	78	65.4	54.2	75.1	25.6	9.0	−5.1	−19.8	9.5
Plymth	27	74.1	54.7	87.1	22.2	3.7	26.1	0.4	51.7
Ports	57	71.9	59.0	82.0	7.0	21.1	19.9	1.5	38.2
Prestn	34	76.5	59.5	87.8	17.7	5.9	5.0	−14.0	24.1
Redng	42	61.9	46.6	75.2	19.1	19.1	−19.9	−37.8	−2.0
Shrew	29	82.8	64.7	92.6	6.9	10.3	17.4	−5.5	40.3
Stevng	14	78.6	50.6	92.9	7.1	14.3	42.2	6.6	77.8
Sthend	17	70.6	45.8	87.2	17.7	11.8			
Stoke	67	64.2	52.1	74.7	11.9	23.9	−1.9	−18.4	14.5
Sund	17	70.6	45.8	87.2	29.4	0.0	−6.3	−37.9	25.2
Truro	15	60.0	34.8	80.8	26.7	13.3	10.0	−23.9	43.9
Wirral	13	61.5	34.4	83.0	30.8	7.7	−19.7	−52.3	12.9
Wolve	57	75.4	62.7	84.9	14.0	10.5	12.4	−3.8	28.6
York	25	64.0	44.0	80.1	24.0	12.0	27.6	0.1	55.2
N Ireland									
Antrim	14	50.0	26.0	74.0	42.9	7.1	−20.6	−54.6	13.4
Belfast	21	76.2	54.0	89.7	19.1	4.8	7.8	−20.0	35.5
Newry	19	68.4	45.2	85.1	31.6	0.0	12.9	−18.2	43.9
Wales									
Bangor	15	53.3	29.3	75.9	33.3	13.3	−31.3	−63.3	0.7
Cardff	54	64.8	51.3	76.3	7.4	27.8	5.1	−12.5	22.8
Clwyd	13	69.2	40.9	88.0	7.7	23.1			
Swanse	57	63.2	50.0	74.6	22.8	14.0	2.8	−15.4	21.0
Wrexm	28	60.7	42.0	76.7	28.6	10.7	−15.1	−38.3	8.2
England	**2,169**	**65.9**	**63.9**	**67.9**	**20.8**	**13.3**	**2.5**	**−0.4**	**5.3**
N Ireland	**68**	**64.7**	**52.7**	**75.1**	**32.4**	**2.9**	**2.4**	**−13.7**	**18.5**
Wales	**167**	**62.9**	**55.3**	**69.9**	**18.6**	**18.6**	**−2.6**	**−12.9**	**7.7**
E, W & NI	**2,404**	**65.7**	**63.8**	**67.6**	**20.9**	**13.4**	**2.1**	**−0.6**	**4.8**

Centres missing from the table were excluded from analysis due to low patient numbers or poor data completeness
Blank cells indicate no data for 2015

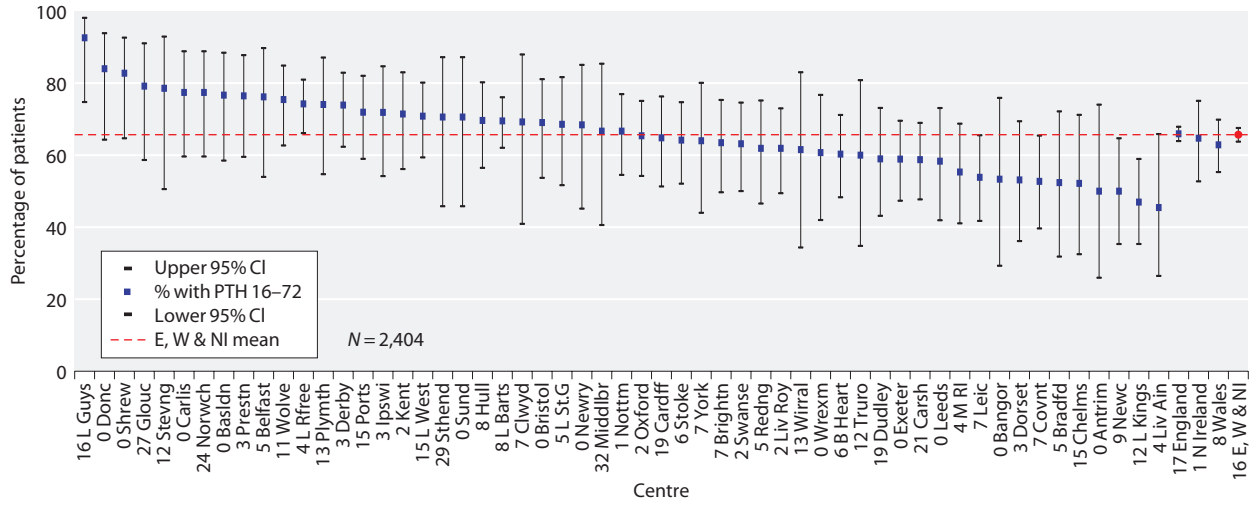

Fig. 8.29. Percentage of peritoneal dialysis patients with PTH within range (16–72 pmol/L) by centre in 2016

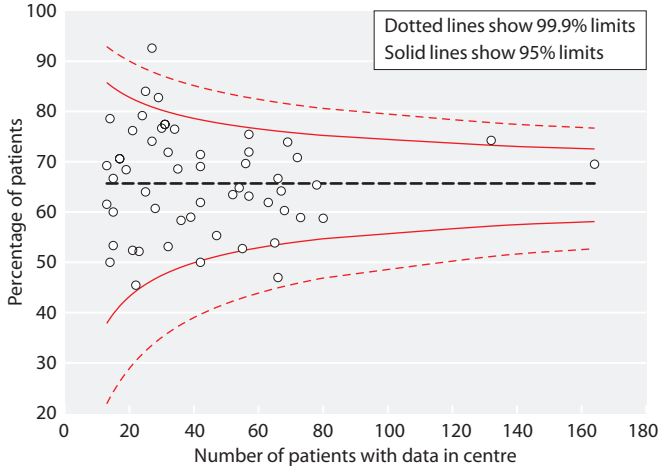

Fig. 8.30. Funnel plot of percentage of peritoneal dialysis patients with PTH within range (16–72 pmol/L) by centre in 2016

Wolverhampton, Wrexham and York. For PD patients (figure 8.30) London Guys was above average achievement of the target range and there were no outliers below the 99.9% confidence interval for the target.

Longitudinal analysis of PTH control measures at the level of the three countries noted sustained reduction in the proportion of patients with low PTH levels (<16 pmol/L) in HD and PD patients. Similarly, there has been a corresponding increase in the fraction of HD and PD patients with PTH levels being maintained within the 16–72 pmol/L range. The fraction of patients with PTH above range (>72 pmol/L) increased from 15.2% in 2006 to 17.9% in 2016 in those receiving HD but was almost unchanged in those receiving PD during the same period (figure 8.31).

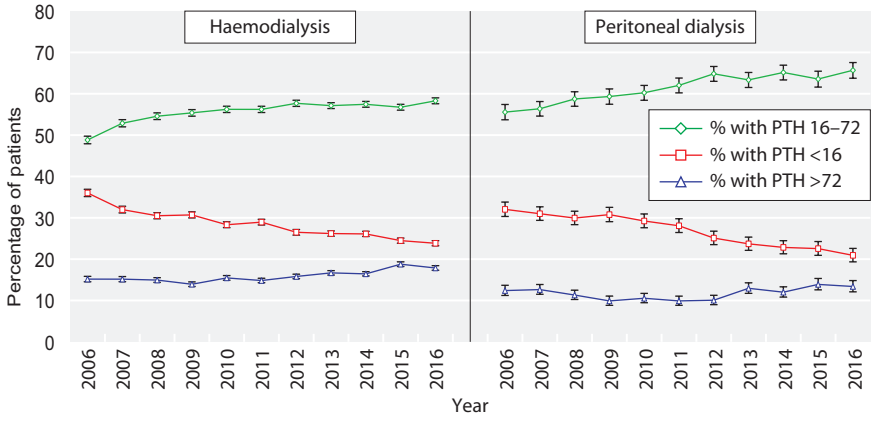

Fig. 8.31. Longitudinal change in percentage of patients with PTH within range (16–72 pmol/L) by dialysis modality 2006–2016

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UK Renal Registry 20th Annual Report: Chapter 9 Centre Variation in Access to Kidney Transplantation (2011–2013 incident cohort)

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Keywords

Centre variation · Comorbidity · Donor after brainstem death · Donor after circulatory death · Equity of access · Living kidney donor · Outcomes · Patient factors · Quality improvement · Renal transplantation · Transplant waiting list

Summary

For the 2011–2013 incident cohort:

- Patients of non-White ethnicity had an equal chance of transplant wait-listing within two years of starting renal replacement therapy (OR 1.03, 95% CI 0.93–1.14). This represents an improvement in equity of access to the kidney transplant waiting list compared to findings from 2008–2010. Once on the transplant waiting list, non-White patients had a 60% lower chance of receiving a kidney transplant of any type within two years (OR 0.40, 95% CI 0.35–0.45).
- Compared to men, women had a 17% lower chance of being activated on the kidney transplant waiting list within two years of starting renal replacement therapy (OR 0.83, 95% CI 0.76–0.90). Once on the transplant waiting list, women had a 15% lower chance of receiving a kidney transplant of any type within two years (OR 0.85, 95% CI 0.76–0.96).
- Compared to patients treated at transplanting centres, patients treated at non-transplanting centres were less likely to be wait-listed for transplantation within two years of starting dialysis (OR 0.70, 95% CI 0.65–0.77), had an equal chance of receiving a transplant from a donor after brainstem death within two years of wait-listing (OR 1.06, 95% CI 0.91–1.23), but were less likely to receive a transplant from a donor after circulatory death or living kidney donor within two years of wait-listing (OR 0.85, 95% CI 0.76–0.95). Overall, this equated to a reduced chance of receiving a transplant from any donor type for patients treated at non-transplanting renal centres (OR 0.88, 95% CI 0.78–0.98).

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Introduction

Kidney transplantation is associated with improved clinical outcomes and quality of life compared to dialysis [1–3], so is the preferred method of renal replacement therapy (RRT) for clinically suitable patients. Early transplantation minimises time on dialysis, a factor associated with reduced graft and patient survival.

Early transplant wait-listing increases the probability of transplantation from a deceased donor because the current national kidney allocation scheme [4] prioritises potential transplant recipients who have accrued more time on the waiting list. Therefore, renal centres achieving earlier transplant wait-listing provide their patients with a clinical advantage.

This analysis aims to evaluate whether access to transplant wait-listing and access to transplantation is equitable in the UK. Rates of wait-listing and rates of transplantation after wait-listing were analysed according to patient characteristics. Time from starting RRT to wait-listing was also analysed. Differences between renal centres and between transplanting versus non-transplanting renal centres were analysed, with adjustment for patient characteristics.

Methods

Study population

To identify factors which influence the likelihood of wait-listing for transplantation, an incident RRT cohort was analysed. All adult patients ($N = 20{,}675$) starting RRT between 1 January 2011 and 31 December 2013 at renal centres ($N = 71$) returning data to the UK Renal Registry (UKRR) were considered for inclusion. Patients aged 65 years and over ($N = 10{,}151$), patients listed for multi-organ transplants other than kidney and pancreas ($N = 33$) and patients who were suspended for more than 30 days within 90 days of wait-listing ($N = 593$) were excluded. The latter exclusion avoided any potential bias from centres that may activate patients on the transplant waiting list and then immediately suspend them before reactivation after medical assessment of a patient's fitness for transplantation. The remaining 9,898 patients were followed until two years after starting RRT (latest 31 December 2015), until they were registered on the waiting list for a kidney transplant alone or kidney and pancreas transplant, or until death, whichever was earliest.

To identify factors which influence the likelihood of transplantation after wait-listing, patients from the above cohort who were wait-listed before 31 December 2014 were identified. These 5,691 patients were followed until two years after wait-listing (latest 31 December 2016), until they received a kidney transplant alone or kidney and pancreas transplant, or until death, whichever was earliest.

Patients transplanted after starting dialysis were assigned to the renal centre recorded by the UKRR as having provided the dialysis. For patients transplanted pre-emptively, there may be instances where the renal centre recorded was the transplanting centre, even when work-up took place in a non-transplanting centre.

Data analysed

UKRR data included start date of RRT and patient characteristics including age group (18–29, 30–39, 40–49, 50–59, 60–64 years), sex (male, female), ethnicity (White, non-White, missing), and primary renal diagnosis (PRD, classified as: diabetes, other, missing). Date of wait-listing and date of transplantation were provided by the UK Transplant Registry, held by the Organ Donation and Transplantation Directorate of NHS Blood and Transplant.

Outcomes

Proportion of incident dialysis patients wait-listed within two years of starting RRT. In addition to patients wait-listed during the study period, patients who received a living donor transplant within two years of starting RRT were also considered to have been wait-listed.

Days from starting RRT to transplant wait-listing. For patients wait-listed after starting dialysis, time from starting dialysis to wait-listing was recorded. Patients receiving a pre-emptive transplant (living or deceased donor) were recorded as wait-listed on the day of transplantation (i.e. time from starting RRT to wait-listing: zero days). Patients who received a living donor transplant after starting dialysis who had *not* been formally wait-listed prior to transplantation were recorded as wait-listed six months before the date of their transplant (with a minimum time to wait-listing of zero days). This aimed to account for the time needed to prepare patients for a living donor transplant, assuming suitability for wait-listing six months before living donor transplantation.

Proportion of wait-listed patients receiving a transplant within two years of wait-listing. Transplants from donors after brainstem death were considered separately from transplants from donors after circulatory death or living donors, because of differences in the process of allocation. Kidneys from donors after brainstem death are allocated according to national allocation policy, while kidneys from donors after circulatory death are allocated regionally according to the 2006 donor after brainstem death kidney allocation scheme, and one kidney from each donor is offered to the local transplant centre [4]. The process of living donor transplantation is managed by the transplanting centre (and referring non-transplanting centre). The overall proportion transplanted from any donor type was also calculated.

Statistical methods

Logistic regression models were fitted to examine the relationship between patient characteristics (age group, ethnicity, sex, PRD) and transplant wait-listing within two years of starting RRT, or receipt of a transplant within two years of wait-listing. The proportion of all incident RRT patients listed for transplantation within two years of starting RRT and the proportion of wait-listed patients who were transplanted within two years were calculated for each renal centre, with adjustment for the above patient characteristics. Differences in outcome measures between transplanting and non-transplanting renal centres were assessed.

Median time from starting RRT to wait-listing at each renal centre was estimated by Kaplan-Meier (KM) analysis, censored at death or on 31 December 2015, whichever was earlier. Confidence intervals of median time to wait-listing by centre were derived using bootstrapping. In centres where the KM curve did not reach 50% (and therefore median time could not be calculated), the final event time point was used instead. The effect of renal centre on time to wait-listing was calculated by including renal centre as a covariate in a Cox regression model for time to wait-listing including patients from all centres.

Funnel plots were used to present results for each outcome variable, providing a visual comparison of the relative performance of renal centres. Where appropriate, funnel plots were adjusted for patient characteristics known to influence each outcome, based on the results of the logistic regression models described above. In each funnel plot, the solid thick line indicates the national mean. Dashed lines indicate 95% and 99.8% confidence intervals, corresponding to two and three standard deviations from the mean respectively. Each point on the plot represents one renal centre. For each outcome measure, if no significant inter-centre variation was present, three of 71 renal centres would be expected to fall between the 95% and 99.8% confidence intervals and no centre should fall outside the 99.8% confidence interval. Funnel plots showing the proportion of patients transplanted at two years after wait-listing excluded centres with fewer than ten patients wait-listed at the start of the study period ($N = 3$).

SAS 9.3 was used for all analyses. A p value below 5% was considered statistically significant. The analysis described is based on the methodology described in chapter 11 of the UKRR 17th Annual Report [5] and a previous independently peer-reviewed publication [6].

Results

Access to transplantation by patient characteristics

Table 9.1 shows results of logistic regression analysis for the relationship between patient characteristics and the odds of transplant wait-listing within two years of starting RRT. There were missing ethnicity data for 7.9% of patients and missing PRD data for 4.5%.

The results of logistic regression analyses for the relationship between patient characteristics and the likelihood of receiving a kidney transplant within two years of wait-listing are shown in table 9.2 (donor after brainstem death), table 9.3 (donor after circulatory death or living kidney donor) and table 9.4 (any donor type). Ethnicity data were missing for 7.6% of patients and PRD data for 3.6%.

Access to transplantation by individual renal centre

After adjusting for patient characteristics (age, ethnicity, sex, PRD), there were significant differences between renal centres in the proportion of patients wait-listed within two years of starting RRT (figure 9.1, table 9.5).

After adjusting for patient characteristics (age, ethnicity, sex, PRD), there were also significant differences between renal centres in the proportion of patients receiving a kidney transplant within two years of wait-listing. This was true for transplants from donors after

Table 9.1. Multivariable logistic regression model showing the relationship between patient characteristics and odds of transplant wait-listing within two years of starting RRT

Factor	Category	Patients *N* (%)	Odds ratio	95% CI	*P* value
Age	18–29	818 (8.3)	1	ref	n/a
	30–39	1,256 (12.7)	0.73	0.59–0.91	0.0046
	40–49	2,392 (24.2)	0.48	0.40–0.59	<0.0001
	50–59	3,349 (33.8)	0.28	0.23–0.34	<0.0001
	60–64	2,083 (21.0)	0.14	0.11–0.17	<0.0001
Ethnicity	White	6,613 (66.8)	1	ref	n/a
	Non-White	2,505 (25.3)	1.03	0.93–1.14	0.54
	Missing	780 (7.9)	0.97	0.83–1.14	0.70
Sex	Male	6,047 (61.1)	1	ref	n/a
	Female	3,851 (38.9)	0.83	0.76–0.90	<0.0001
PRD	Not diabetic	6,857 (69.3)	1	ref	n/a
	Diabetic	2,597 (26.2)	0.47	0.43–0.52	<0.0001
	Missing	444 (4.5)	0.57	0.47–0.70	<0.0001

ref – reference category; n/a – not applicable

Table 9.2. Multivariable logistic regression model showing the relationship between patient characteristics and odds of receiving a transplant from a donor after brainstem death within two years of wait-listing

Factor	Category	Patients *N* (%)	Odds ratio	95% CI	*P* value
Age	18–29	680 (12.0)	1	ref	n/a
	30–39	954 (16.8)	1.02	0.80–1.30	0.87
	40–49	1,578 (27.7)	0.62	0.49–0.78	<0.0001
	50–59	1,745 (30.7)	0.39	0.31–0.50	<0.0001
	60–64	734 (12.9)	0.31	0.23–0.43	<0.0001
Ethnicity	White	3,780 (66.4)	1	ref	n/a
	Non-White	1,480 (26.0)	0.72	0.60–0.85	0.0002
	Missing	431 (7.6)	1.27	0.98–1.65	0.068
Sex	Male	3,554 (62.5)	1	ref	n/a
	Female	2,137 (37.5)	0.95	0.82–1.10	0.50
PRD	Not diabetic	4,391 (77.2)	1	ref	n/a
	Diabetic	1,093 (19.2)	2.55	2.15–3.01	<0.0001
	Missing	207 (3.6)	1.32	0.90–1.95	0.16

ref – reference category; n/a – not applicable

Table 9.3. Multivariable logistic regression model showing the relationship between patient characteristics and the odds of receiving a transplant from a donor after circulatory death or living kidney donor within two years of wait-listing

Factor	Category (at baseline)	Patients *N* (%)	Odds ratio	95% CI	*P* value
Age	18–29	680 (12.0)	1	ref	n/a
	30–39	954 (16.8)	0.66	0.54–0.81	<0.0001
	40–49	1,578 (27.7)	0.51	0.42–0.61	<0.0001
	50–59	1,745 (30.7)	0.50	0.42–0.60	<0.0001
	60–64	734 (12.9)	0.43	0.34–0.53	<0.0001
Ethnicity	White	3,780 (66.4)	1	ref	n/a
	Non-White	1,480 (26.0)	0.47	0.41–0.54	<0.0001
	Missing	431 (7.6)	0.71	0.58–0.87	0.0012
Sex	Male	3,554 (62.5)	1	ref	n/a
	Female	2,137 (37.5)	0.88	0.79–0.98	0.023
PRD	Not diabetic	4,391 (77.2)	1	ref	n/a
	Diabetic	1,093 (19.2)	0.55	0.48–0.64	<0.0001
	Missing	207 (3.6)	0.66	0.49–0.89	0.0058

ref – reference category; n/a – not applicable

brainstem death (figure 9.2, table 9.6) and transplants from donors after circulatory death or living donors (figure 9.3, table 9.6). The number of centres falling on or outside the 99.8% confidence intervals was more marked in the analysis of transplants from donors after circulatory death or living kidney donors, with five falling above and ten centres below. Overall, this equated to a significant inter-centre difference in the proportion of patients receiving a transplant from any donor type within two years of wait-listing (figure 9.4, table 9.6).

Access to transplantation by transplanting vs non-transplanting renal centre

Compared to patients treated at transplanting renal centres, those treated at non-transplanting renal centres:

- Were less likely to be wait-listed within two years of starting dialysis (OR 0.70, 95% CI 0.65–0.77)
- Had an equal chance of receiving a transplant from a donor after brainstem death within two years of wait-listing (OR 1.06, 95% CI 0.91–1.23)

Table 9.4. Multivariable logistic regression model showing the relationship between patient characteristics and the odds of receiving a transplant from any donor type (DBD, DCD or living donor) within two years of wait-listing

Factor	Category (at baseline)	Patients *N* (%)	Odds ratio	95% CI	*P* value
Age	18–29	680 (12.0)	1	ref	n/a
	30–39	954 (16.8)	0.61	0.49–0.77	<0.0001
	40–49	1,578 (27.7)	0.33	0.27–0.41	<0.0001
	50–59	1,745 (30.7)	0.26	0.21–0.32	<0.0001
	60–64	734 (12.9)	0.21	0.16–0.26	<0.0001
Ethnicity	White	3,780 (66.4)	1	ref	n/a
	Non-White	1,480 (26.0)	0.40	0.35–0.45	<0.0001
	Missing	431 (7.6)	0.81	0.66–1.00	0.048
Sex	Male	3,554 (62.5)	1	ref	n/a
	Female	2,137 (37.5)	0.85	0.76–0.96	0.0063
PRD	Not diabetic	4,391 (77.2)	1	ref	n/a
	Diabetic	1,093 (19.2)	1.03	0.90–1.19	0.67
	Missing	207 (3.6)	0.77	0.57–1.03	0.079

DBD – donor after brainstem death; DCD – donor after circulatory death; ref – reference category; n/a – not applicable

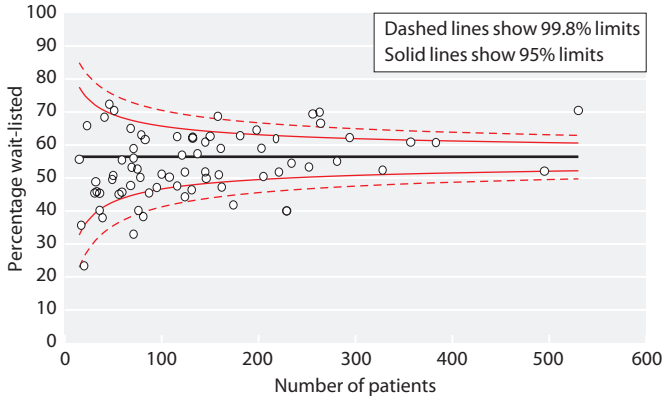

Fig. 9.1. Proportion of incident 2011–2013 RRT patients wait-listed prior to, or within two years of starting RRT, by renal centre

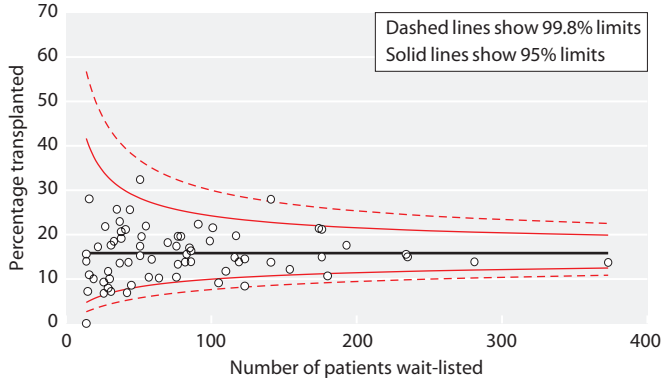

Fig. 9.2. Proportion of incident 2011–2013 RRT patients, listed by 31 December 2014, who received a transplant from a donor after brainstem death within two years of wait-listing, by renal centre

Fig. 9.3. Proportion of incident 2011–2013 RRT patients, listed by 31 December 2014, who received a transplant from a donor after circulatory death or living donor within two years of wait-listing, by renal centre

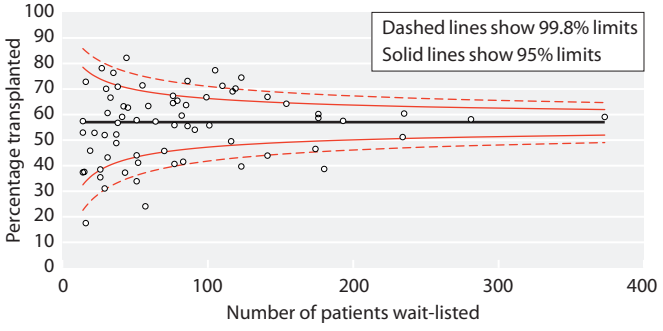

Fig. 9.4. Proportion of incident 2011–2013 RRT patients, listed by 31 December 2014, who received a transplant from any donor type (donor after brainstem death, donor after circulatory death or living donor) within two years of wait-listing, by renal centre

Table 9.5. Proportion of incident patients in each renal centre wait-listed for a kidney transplant prior to or within two years of starting RRT

Centre	RRT *N*	Wait-listed at 2 years *N*	% wait-listed	
			Unadjusted	Risk-adjusted
England				
B Heart	137	78	56.9	57.4
B QEH	328	175	53.4	52.4
Basldn	68	30	44.1	47.7
Bradfd	108	57	52.8	50.3
Brightn	162	77	47.5	47.2
Bristol	218	140	64.2	61.9
Camb	150	101	67.3	62.6
Carlis	46	34	73.9	72.4
Carsh	281	150	53.4	55.1
Chelms	59	33	55.9	55.5
Colchr	36	14	38.9	40.2
Covnt	146	77	52.7	49.9
Derby	116	54	46.6	47.6
Donc	71	41	57.7	58.9
Dorset	83	51	61.4	61.7
Dudley	71	23	32.4	33.0
Exeter	116	71	61.2	62.6
Glouc	75	39	52.0	52.7
Hull	124	62	50.0	51.8
Ipswi	56	26	46.4	45.1
Kent	161	94	58.4	59.0
L Barts	495	269	54.3	52.1
L Guys	221	114	51.6	51.8
L Kings	229	90	39.3	40.0
L Rfree	357	229	64.1	60.9
L St.G	132	81	61.4	62.4
L West	530	369	69.6	70.5
Leeds	252	139	55.2	53.3
Leic	383	230	60.1	60.8
Liv Ain	81	30	37.0	38.3
Liv Roy	174	77	44.3	41.8
M RI	294	187	63.6	62.3
Middlbr	158	108	68.4	68.7
Newc	159	83	52.2	51.0
Norwch	95	46	48.4	47.1
Nottm	145	89	61.4	60.9
Oxford	263	181	68.8	70.0
Plymth	68	43	63.2	65.0
Ports	264	173	65.5	66.6
Prestn	205	103	50.2	50.5
Redng	132	78	59.1	62.1
Salford	198	117	59.1	64.6
Sheff	203	119	58.6	59.0
Shrew	76	28	36.8	40.1
Stevng	181	118	65.2	62.8
Sthend	41	30	73.2	68.4
Stoke	100	49	49.0	51.2
Sund	87	39	44.8	45.5
Truro	51	36	70.6	70.5
Wirral	69	35	50.7	53.2
Wolve	124	56	45.2	44.3
York	71	41	57.7	56.0
N Ireland				
Antrim	32	15	46.9	48.9
Belfast	121	74	61.2	56.9
Newry	31	13	41.9	45.5
Ulster	33	14	42.4	45.8
West NI	36	18	50.0	45.4
Scotland				
Abrdn	78	37	47.4	50.2
Airdrie	79	49	62.0	63.1
D & Gall	15	9	60.0	55.7
Dundee	59	26	44.1	45.7
Edinb	145	74	51.0	51.8
Glasgw	256	175	68.4	69.4
Inverns	23	15	65.2	65.9
Klmarnk	50	24	48.0	50.8
Krkcldy	49	22	44.9	49.6
Wales				
Bangor	20	4	20.0	23.4
Cardff	234	125	53.4	54.5
Clwyd	17	6	35.3	35.7
Swanse	131	59	45.0	46.4
Wrexm	39	14	35.9	38.0

- Were less likely to receive a transplant from a donor after circulatory death or living donor within two years of wait-listing (OR 0.85, 95% CI 0.76–0.95).

Overall, this equated to a reduced chance of receiving a transplant from any donor type for patients treated at non-transplanting renal centres (OR 0.88, 95% CI 0.78–0.98).

Time to transplant wait-listing by renal centre

Table 9.7 shows the median time (days), or the final event time, from starting RRT to wait-listing for each renal centre. Figure 9.5 shows a funnel plot of time from starting RRT to wait-listing by renal centre. These values were derived from simulations based on the actual data and for six centres (those with fewer events and/or longer waiting times) median values could not be estimated, so final event times are shown.

Table 9.6. Proportion of patients receiving a transplant within two years of wait-listing, by donor type and renal centre

		Donor after brainstem death			Donor after circulatory death/ living kidney donor			Any donor type		
			Proportion transplanted within 2 years of wait-listing (%)			Proportion transplanted within 2 years of wait-listing (%)			Proportion transplanted within 2 years of wait-listing (%)	
Centre	Wait-listed *N*	Transplanted *N*	Unadjusted	Risk-adjusted	Transplanted *N*	Unadjusted	Risk-adjusted	Transplanted *N*	Unadjusted	Risk-adjusted
Transplanting centre median (IQR)				15.0 (13.8–17.6)			45.6 (37.2–53.2)			60.2 (55.5–67.4)
Non-transplanting centre median (IQR)				15.5 (10.3–19.7)			38.2 (26.2–48.6)			55.0 (41.3–63.4)
England										
B Heart	83	14	16.9	15.6	19	22.9	25.5	33	39.8	41.5
B QEH	**180**	**17**	**9.4**	**10.7**	**50**	**27.8**	**28.0**	**67**	**37.2**	**38.7**
Basldn	31	2	6.5	7.2	11	35.5	35.7	13	41.9	43.2
Bradfd	55	11	20.0	21.9	27	49.1	50.8	38	69.1	71.4
Brightn	77	14	18.2	19.6	19	24.7	22.4	33	42.9	40.7
Bristol	**141**	**19**	**13.5**	**13.8**	**47**	**33.3**	**30.4**	**66**	**46.8**	**43.9**
Camb	**105**	**9**	**8.6**	**9.1**	**77**	**73.3**	**66.6**	**86**	**81.9**	**77.3**
Carlis	33	6	18.2	18.5	18	54.5	47.4	24	72.7	66.6
Carsh	154	18	11.7	12.2	77	50.0	51.7	95	61.7	64.2
Chelms	35	9	25.7	25.7	19	54.3	51.8	28	80.0	76.3
Colchr	16	5	31.3	28.0	8	50.0	44.2	13	81.3	72.8
Covnt	**82**	**11**	**13.4**	**13.8**	**42**	**51.2**	**45.3**	**53**	**64.6**	**59.6**
Derby	52	10	19.2	19.6	12	23.1	22.2	22	42.3	41.2
Donc	43	6	14.0	13.8	11	25.6	23.8	17	39.5	37.3
Dorset	51	10	19.6	17.4	9	17.6	16.2	19	37.3	33.9
Dudley	26	2	7.7	6.8	8	30.8	28.8	10	38.5	35.4
Exeter	70	13	18.6	18.2	22	31.4	28.2	35	50.0	45.8
Glouc	38	7	18.4	19.1	15	39.5	37.9	22	57.9	56.8
Hull	64	7	10.9	10.2	33	51.6	46.8	40	62.5	57.3
Ipswi	27	6	22.2	21.8	17	63.0	56.0	23	85.2	78.2
Kent	99	21	21.2	18.6	50	50.5	48.1	71	71.7	66.8
L Barts	**281**	**36**	**12.8**	**13.9**	**107**	**38.1**	**44.6**	**143**	**50.9**	**58.1**
L Guys	**119**	**16**	**13.4**	**13.9**	**60**	**50.4**	**56.6**	**76**	**63.9**	**70.2**
L Kings	91	18	19.8	22.4	26	28.6	31.7	44	48.4	54.1
L Rfree	**235**	**33**	**14.0**	**15.0**	**93**	**39.6**	**45.6**	**126**	**53.6**	**60.4**
L St.G	**85**	**12**	**14.1**	**17.0**	**34**	**40.0**	**46.3**	**46**	**54.1**	**63.7**
L West	**373**	**47**	**12.6**	**13.7**	**142**	**38.1**	**45.6**	**189**	**50.7**	**59.1**
Leeds	**141**	**36**	**25.5**	**28.0**	**61**	**43.3**	**40.3**	**97**	**68.8**	**66.9**
Leic	**234**	**35**	**15.0**	**15.6**	**82**	**35.0**	**35.7**	**117**	**50.0**	**51.2**
Liv Ain	31	5	16.1	17.6	14	45.2	42.8	19	61.3	60.6
Liv Roy	**79**	**15**	**19.0**	**19.6**	**41**	**51.9**	**45.8**	**56**	**70.9**	**65.4**
M RI	**193**	**33**	**17.1**	**17.6**	**77**	**39.9**	**39.7**	**110**	**57.0**	**57.5**
Middlbr	110	14	12.7	11.8	70	63.6	59.4	84	76.4	71.3
Newc	**86**	**12**	**14.0**	**13.9**	**55**	**64.0**	**58.5**	**67**	**77.9**	**73.2**
Norwch	45	4	8.9	8.6	28	62.2	52.9	32	71.1	62.7
Nottm	**86**	**13**	**15.1**	**16.3**	**37**	**43.0**	**39.2**	**50**	**58.1**	**55.5**

Table 9.6. Continued

Centre	Donor after brainstem death			Donor after circulatory death/ living kidney donor			Any donor type		
			Proportion transplanted within 2 years of wait-listing (%)			Proportion transplanted within 2 years of wait-listing (%)			Proportion transplanted within 2 years of wait-listing (%)
	Wait-listed *N*	Transplanted *N*	Unadjusted	Risk-adjusted	Transplanted *N*	Unadjusted	Risk-adjusted	Transplanted *N*	Unadjusted	Risk-adjusted
Oxford	**176**	**39**	**22.2**	**21.2**	**63**	**35.8**	**37.2**	**102**	**58.0**	**58.7**
Plymth	**44**	**10**	**22.7**	**25.6**	**28**	**63.6**	**57.1**	**38**	**86.4**	**82.2**
Ports	**174**	**39**	**22.4**	**21.4**	**46**	**26.4**	**25.4**	**85**	**48.9**	**46.5**
Prestn	101	21	20.8	21.5	37	36.6	34.9	58	57.4	55.8
Redng	77	11	14.3	13.3	30	39.0	43.4	41	53.2	55.9
Salford	116	18	15.5	14.9	37	31.9	34.5	55	47.4	49.5
Sheff	**123**	**11**	**8.9**	**8.4**	**41**	**33.3**	**31.3**	**52**	**42.3**	**39.7**
Shrew	29	2	6.9	8.0	13	44.8	42.9	15	51.7	52.0
Stevng	117	22	18.8	19.7	57	48.7	49.3	79	67.5	69.1
Sthend	30	3	10.0	10.0	20	66.7	59.0	23	76.7	70.1
Stoke	51	8	15.7	15.3	16	31.4	28.6	24	47.1	44.0
Sund	42	3	7.1	6.9	26	61.9	55.6	29	69.0	63.2
Truro	38	9	23.7	20.7	21	55.3	49.7	30	78.9	70.9
Wirral	37	6	16.2	13.6	15	40.5	38.9	21	56.8	52.2
Wolve	57	5	8.8	10.4	8	14.0	14.1	13	22.8	24.1
York	41	9	22.0	21.2	19	46.3	38.5	28	68.3	59.1
N Ireland										
Antrim	15	1	6.7	7.2	5	33.3	29.8	6	40.0	37.6
Belfast	**76**	**8**	**10.5**	**10.4**	**47**	**61.8**	**53.2**	**55**	**72.4**	**64.5**
Newry	16	2	12.5	11.0	1	6.3	6.1	3	18.8	17.5
Ulster	14	0	0.0	0.0	7	50.0	46.0	8	57.1	53.0
West NI	19	2	10.5	10.0	8	42.1	35.7	10	52.6	45.9
Scotland										
Abrdn	37	12	32.4	23.0	7	18.9	20.4	19	51.4	48.8
Airdrie	51	18	35.3	32.4	13	25.5	24.7	31	60.8	57.8
D&Gall	9	1	11.1	8.2	5	55.6	56.8	6	66.7	61.5
Dundee	29	4	13.8	11.7	5	17.2	18.6	9	31.0	31.1
Edinb	**76**	**17**	**22.4**	**17.4**	**36**	**47.4**	**50.2**	**53**	**69.7**	**67.4**
Glasgw	**176**	**31**	**17.6**	**15.0**	**74**	**42.0**	**45.9**	**105**	**59.7**	**60.2**
Inverns	14	2	14.3	14.0	3	21.4	23.1	5	35.7	37.4
Klmarnk	26	3	11.5	9.3	7	26.9	29.6	10	38.5	38.5
Krkcldy	22	5	22.7	17.2	7	31.8	34.2	12	54.5	52.8
Wales										
Bangor	5	1	20.0	22.7	1	20.0	16.1	2	40.0	35.5
Cardff	**123**	**19**	**15.4**	**14.5**	**80**	**65.0**	**59.9**	**99**	**80.5**	**74.5**
Clwyd	6	1	16.7	16.5	3	50.0	42.7	4	66.7	59.0
Swanse	59	10	16.9	14.4	33	55.9	48.8	43	72.9	63.4
Wrexm	14	2	14.3	15.6	7	50.0	42.1	9	64.3	57.4

Transplanting renal centres are shown in bold

Table 9.7. Median time (days), or final event time*, from starting RRT to transplant wait-listing by renal centre

Centre	RRT *N*	Wait-listed at 2 years *N*	Median time to listing (days)	Final event time (days*)
England				
B Heart	137	84	385	
B QEH	328	187	466	
Basldn	68	32	854	
Bradfd	108	61	489	
Brightn	162	82	750	
Bristol	218	143	176	
Camb	150	107	2	
Carlis	46	34	93	
Carsh	281	170	480	
Chelms	59	36	402	
Colchr	36	16	787	
Covnt	146	86	511	
Derby	116	59	748	
Donc	71	45	250	
Dorset	83	52	266	
Dudley	71	27	n/a	1,095
Exeter	116	72	337	
Glouc	75	42	538	
Hull	124	66	623	
Ipswi	56	28	865	
Kent	161	102	349	
L Barts	495	299	509	
L Guys	221	122	512	
L Kings	229	98	n/a	1,064
L Rfree	357	251	188	
L St.G	132	91	260	
L West	530	391	223	
Leeds	252	149	308	
Leic	383	240	147	
Liv Ain	81	35	869	
Liv Roy	174	84	914	
M RI	294	196	244	
Middlbr	158	116	148	
Newc	159	95	535	
Norwch	95	48	622	
Nottm	145	93	126	
Oxford	263	191	125	
Plymth	68	46	213	
Ports	264	181	147	
Prestn	205	110	589	
Redng	132	81	372	
Salford	198	122	256	
Sheff	203	127	300	
Shrew	76	30	n/a	1,252
Stevng	181	124	198	
Sthend	41	30	107	
Stoke	100	53	387	
Sund	87	44	796	
Truro	51	39	105	
Wirral	69	38	483	
Wolve	124	61	965	
York	71	41	179	
N Ireland				
Antrim	32	16	482	
Belfast	121	78	232	
Newry	31	18	911	
Ulster	33	15	1,100	
West NI	36	19	436	
Scotland				
Abrdn	78	40	615	
Airdrie	79	51	351	
D & Gall	15	9	214	
Dundee	59	32	855	
Edinb	145	79	507	
Glasgw	256	179	162	
Inverns	23	16	231	
Klmarnk	50	26	441	
Krkcldy	49	23	633	
Wales				
Bangor	20	5	n/a	1,283
Cardff	234	132	330	
Clwyd	17	6	n/a	512
Swanse	131	60	719	
Wrexm	39	15	n/a	958

n/a – not applicable
*Final event time given for centres where median time could not be estimated

Discussion

Patient characteristics and access to transplantation

Increasing patient age was associated with reducing odds of wait-listing and of transplantation from any donor type. This is an expected finding because of the effect of age on the risks and benefits of transplantation: older age is associated with increasing comorbidity and therefore increased clinical risk of transplantation, while the potential benefit of transplantation in extending life reduces with increasing age. Older patients who are suitable for transplantation would be expected to have increased comorbidity and therefore require more screening investigations before being wait-listed, reducing the chance of wait-listing within two years of starting RRT. Reduced odds of receiving a transplant from a donor after brainstem death in older patients reflects the role of age in the national kidney allocation scheme [4].

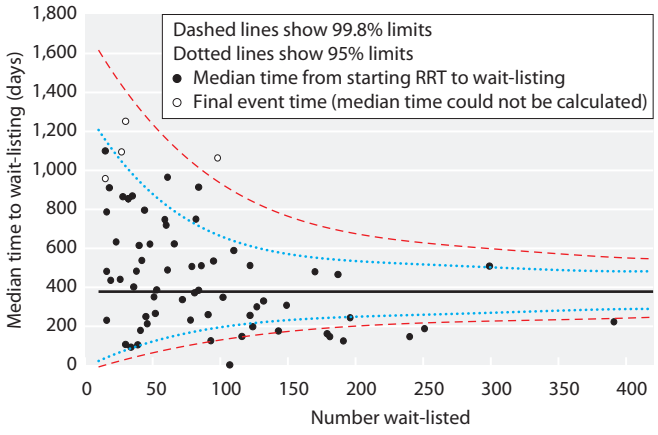

Fig. 9.5. Median time (or final event time) from starting RRT to wait-listing, by renal centre in the 2011–2013 incident cohort

In analyses adjusted for age, ethnicity and PRD, female sex was associated with a reduced chance of transplant wait-listing within two years of starting RRT (OR 0.83; 95%CI: 0.76–0.90), reduced chance of DCD/living donor transplant within two years of wait-listing (OR 0.88; 95% CI: 0.79–0.98), and reduced chance of any transplant within two years of wait-listing (OR 0.85; 95% CI: 0.76–0.96). As would be expected, there was no significant difference by sex in the odds of transplantation from a donor after brainstem death within two years of wait-listing (OR 0.95; 95% CI: 0.82–1.10). While previous reports have not always shown significant differences in wait-listing or transplantation by sex, when there have been differences, women have been shown to be at a relative disadvantage. This finding needs validating in an extended, multi-year UK cohort with data on comorbidity, but if confirmed clearly needs work to explore possible explanations.

Patients with diabetes as their PRD were less likely to be wait-listed within two years of starting RRT, and less likely to receive a transplant from a donor after circulatory death/living donor within two years of wait-listing. Higher prevalence of comorbidity amongst patients with diabetes may preclude transplantation or lengthen the medical evaluation process, explaining this finding. Patients with diabetes as their PRD were found to be more likely to receive a transplant from a donor after brainstem death once on the waiting list. This is likely to reflect the prioritisation of dual organ transplantation in organ allocation policy, in addition to the increase in the number of simultaneous kidney pancreas transplants during the study period. There was no overall difference by diabetic status in the likelihood of transplantation at two years after wait-listing when all donor types were considered.

As in the 19th Annual Report [7], non-White ethnicity did not significantly influence the likelihood of wait-listing (OR 1.03; 95% CI: 0.93–1.15). There was a persisting effect of non-White ethnicity in reducing the chance of transplantation from a donor after brainstem death within two years of wait-listing, with a similar magnitude to analysis from 2013–2015 (OR 0.72; 95% CI: 0.60–0.85 compared to OR 0.79; 95% CI: 0.65–0.95) [7]. This effect remained smaller than the one observed on the incident 2008–2010 cohort (OR 0.65; 95% CI: 0.52–0.81) [5]. This may reflect changes in the efficiency of preparation for transplant wait-listing (for instance, earlier completion of pre-transplant investigations for patients with diabetes, who were more likely to have non-White ethnicity), changes in the demographics of potential transplant recipients with non-White ethnicity, and alterations in the national kidney allocation scheme, which now has less strict criteria in relation to human leucocyte antigen (HLA) matching [4]. The latter change means that recipients with non-White ethnicity were less likely to be disadvantaged by the relative lack of organs from non-White donors. There was persisting differences by ethnicity in rates of transplantation from a donor after circulatory death/living donor. It should be noted that differences in socioeconomic status between ethnic groups have previously been found to account for some of the difference in access to transplantation by ethnicity [8, 9]. Lack of adjustment for socioeconomic status therefore limits the reliability of these results. The UKRR is collaborating with the Access to Transplant and Transplant Outcome Measures (ATTOM) study, whose forthcoming results include analyses with detailed adjustment for comorbidity and individual level socioeconomic status.

When interpreting the analyses in this chapter it is also important to consider the potential impact of missing data on the results. Data were missing either because a renal centre failed to complete relevant fields on their renal IT system or from a failure to extract this data. Missing data may not be at random: patients with increased comorbidity are likely to die sooner, 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 on the national kidney transplant waiting list were more likely to have ethnicity and PRD data reported ($p < 0.0001$)

Centre variation in access to transplantation

The analyses presented here suggest significant inter-centre variation in access to the transplant waiting list and access to transplantation, after adjustment for patient demographics and PRD. However, such results should be interpreted with caution. Adjustment for comorbidity included only diabetes as a PRD. Other comorbidities, unaccounted for in these analyses, may also preclude or delay wait-listing and transplantation. Adjustment for several other factors known to influence access to transplantation, including socioeconomic status, PRD other than diabetes, comorbidity, and HLA sensitisation was not performed. Whilst the processes of wait-listing or transplantation from a donor after circulatory death/living donor are directly influenced by individual centre practice, the allocation of transplants from donors after brainstem death is controlled by the national kidney allocation scheme. Therefore, rates of transplantation from donors after brainstem death should be relatively independent of centre practice differences (except for variation in the acceptance criteria of individual clinicians). As such, the persistence of significant inter-centre variation in rates of transplantation from donors after brainstem death is consistent with under-adjustment for patient factors.

After adjustment for patient characteristics, patients treated at transplanting renal centres had increased access to transplant wait-listing and to transplantation from a donor after circulatory death or living donor. There was no difference in access to transplants from donors after brainstem death once patients were wait-listed. These have been consistent findings in UKRR analyses since 2010, suggesting that reduced contact with clinicians directly involved in transplantation and increased geographical distance to transplanting centres reduces access to transplantation. This analysis may be subject to bias by lack of conclusive adjustment for patient characteristics as well as the allocation of patients receiving a pre-emptive transplant to their transplanting centre, even if the work-up had been initiated in a timely fashion by the non-transplanting centre. Lastly, there was competition between the two outcome variables (transplant from a donor after brainstem death versus transplant from a donor after circulatory death/living donor). As such, patients from centres with a higher rate of transplantation from a donor after circulatory death/living donor may have reduced odds of transplantation from a donor after brainstem death (and vice versa).

These issues will be addressed in future analyses, allocating patients according to their location of residence (rather than their treatment centre), and using methodology which accounts for competing risk. In addition, the results of analyses from the ATTOM study with more detailed adjustment for case mix are forthcoming.

Conflicts of interest: the authors declare no conflicts of interest

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UK Renal Registry 20th Annual Report: Chapter 10 2016 Multisite Dialysis Access Audit in England, Northern Ireland and Wales and 2015 Peritoneal Dialysis One Year Follow-up: National and Centre-specific Analyses

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Keywords
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

- In 2016, 55 of 62 centres in England, Wales and Northern Ireland returned data on first access for 4,564 incident haemodialysis (HD) and 1,246 incident PD recipients.
- Of these 5,810 incident patients, 50% started dialysis with definitive access: 21.5% started PD, 28.5% started HD with an arteriovenous fistula (AVF) or graft (AVG), 28.4% with a tunnelled line (TL) and 21.7% with a non-tunnelled line (NTL).
- Wide variation in definitive access use (defined as primary AVF, AVG or PD) was apparent between centres.
- Sixteen centres achieved the 60% target for AVF/AVG use amongst incident HD recipients.
- Seventeen centres achieved the 80% target for AVF/AVG/PD use amongst prevalent dialysis recipients.
- Timely presentation to a nephrologist and referral to a dialysis access surgeon remained key determinants of the likelihood of definitive access at dialysis initiation
- For late-presenting patients, definitive access 90 days after initiating dialysis ranged between 42.9% and 0.0% by centre, implying variation in the responsiveness of dialysis access pathways.
- For centres returning data on one-year PD access outcomes, 70.7% of patients starting PD continued to use this modality or have been transplanted one year later.
- The mean one-year PD catheter failure rate was 18.4%.
- This report demonstrates wide variation in practice between centres across several domains in the provision of dialysis access.

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Introduction

Provision of definitive dialysis access is an important measure of good clinical care for patients with established renal failure. Relevant recommendations and audit standards are presented in the Renal Association clinical practice guidelines (table 10.1). The annual multisite dialysis access audit provides centre-level information on access provision in England, Wales and Northern Ireland. Although the Renal Association undertook a national vascular access audit in 2005, published with outcomes data in 2012 by the UK Renal Registry (UKRR) [1], this is the sixth annual audit that combines peritoneal and vascular access, presenting information for patients starting dialysis between 1 January and 31 December 2016. The objective of this audit is to highlight centre-level performance variation and explore factors that may contribute to the provision of high 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'. These alternative terms are in widespread international use, but are less acceptable to patients.

Methods

In 2017, all adult renal centres in England, Wales and Northern Ireland were asked to provide vascular and peritoneal access data for incident (1 January to 31 December 2016) and prevalent dialysis patients. Access data for incident patients were collected at patient level, whereas centre-level data were submitted for prevalent patients. Table 10.2 presents a full glossary of collected variables. Data were collected using Microsoft Excel spreadsheets circulated by the UKRR.

Records 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 collected via the routine 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 1 January 2016 and 31 December 2016 were excluded. For the purposes of this audit, patients were categorised as having acute kidney injury (AKI) if their access at three months was recorded as 'recovered renal function' and were therefore excluded from analysis. Patients

Table 10.1. Summary of relevant audit standards stated in the Renal Association clinical practice guidelines

RA audit measure/guideline*		Reported	Notes
1	Proportion of planned renal replacement therapy initiations with established access or pre-emptive transplantation (no minimum audit standard)	Yes	Table 10.3 Table 10.4 Table 10.9 Table 10.10
2	60% of all incident patients with established end stage kidney disease commencing planned haemodialysis should receive dialysis via a functioning arteriovenous fistula or arteriovenous graft	Yes	Table 10.3 Table 10.4 Table 10.9 Table 10.10 Figure 10.5
3	80% of all prevalent long-term dialysis patients should receive dialysis treatment via 'definitive access': arteriovenous fistula, arteriovenous graft or peritoneal dialysis	Yes	Figure 10.7 Table 10.10
4	Peritoneal dialysis catheter patency – more than 80% of catheters should be patent at one year (censoring for death and elective modality change)	Partly	Figure 10.13 Figure 10.15
5	Complications following peritoneal dialysis catheter insertion:	Partly	Figure 10.14 Figure 10.15
5a	Bowel perforation <1%	No	Not captured by the audit
5b	Significant haemorrhage <1%	No	Not captured by the audit
5c	Exit site infection within two weeks of catheter insertion <5%	No	Not captured by the audit
5d	Peritonitis within two weeks of catheter insertion <5%	Yes	Figure 10.13

*Audit standards from the most recent Renal Association guidelines (June 2017) are presented. Current and previous guidelines are available on the Renal Association website (www.renal.org/guidelines/current-guidelines)

Table 10.2. Glossary of variables collected in the 2016 Multisite Dialysis Access Audit

Audit data item	Definition [format]	PD/HD or both
ID	Local hospital number [numerical]	Both
NHS number	NHS number (England & Wales) [numerical]	Both
Surname	[text]	Both
Forename	[text]	Both
DoB	Date of birth [DD/MM/YY]	Both
Sex	[Male/Female/Unknown]	Both
Date of death	[DD/MM/YY]	Both
Postcode	The postcode of the patient's usual address [alpha-numerical]	Both
First RRT treatment centre code	Renal treatment centre where first dialysis took place [treatment centre ID code]	Both
Primary renal diagnosis	Primary renal diagnosis [EDTA four digit diagnosis code]	Both
BMI	BMI at time of access insertion (weight in kg/height in m^2) [numerical]	Both
Date first seen by renal physician	The date the patient was first seen by a renal physician (as an outpatient or inpatient) [DD/MM/YY]	Both
Assessed by surgeon for an AVF, AVG or PD catheter at least three months before dialysis?	Was the patient assessed by a surgeon regarding dialysis access at least three months before their first dialysis date? [Yes/No]	Both
Was an AVF/AVG attempted before 1st dialysis?	Was an AVF/AVG attempted before the first ever dialysis session? [Yes/No/Unknown]	Both
Date FIRST EVER dialysis session	Date of first ever dialysis session [DD/MM/YY]	Both
First ever modality	First ever renal replacement modality [HD/PD]	Both
Access in use at first ever dialysis	Dialysis access in use at first dialysis (may not be first access created) [AVF/AVG/vein loop/TL/NTL/PD/temporary PD catheter]	Both
Access in use at three months	Dialysis access in use three months after the start of first treatment [AVF/AVG/vein loop/TL/NTL/PD/temporary PD catheter/recovered/transplant/conservative/death/lost to follow-up/transferred out]	Both
Same access in use 3 months later	Same actual access in use at first dialysis and 3 months i.e. same catheter, same AVF; same AVG) [Yes/No]	Both
Date of first ever access insertion/construction	Date of creation/insertion of first ever dialysis access (if Moncrief PD catheter, date of externalisation) [DD/MM/YY]	Both
Diabetes at time of access creation	Does the patient have diabetes mellitus (type 1 or 2) at time of dialysis access creation? [Yes/No]	Both
PD catheter insertion technique	Technique used to insert PD catheter [open /laparoscopic/ percutaneous]	PD only
Peritonitis episode	Peritonitis episode within two weeks of insertion? [Yes/No]	PD only
Access complication	Reason for access failure/discontinuation [selection from 27 item list]	Both
Date of access failure/discontinuation	Date access is no longer usable for treatment [DD/MM/YY]	Both
Comments	Any relevant comments [text]	Both

RRT – renal replacement therapy; BMI – body mass index; HD – haemodialysis; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line

with missing information for access at start, age and date of starting renal replacement therapy (RRT) were excluded from the analysis. Patients were excluded when there was no matching record in the UKRR database (patient assumed to be AKI) and when aged <18 years. If a centre reported prevalent numbers that differed by more than 10% from those in the UKRR database, it was excluded. Cross-referencing also enabled ascertainment of mortality within three months of commencing dialysis.

Patients starting haemodialysis were grouped by type of first vascular access: arteriovenous fistula, arteriovenous graft, tunnelled dialysis line, non-tunnelled dialysis line. Patients starting peritoneal dialysis were categorised by the insertion technique: open surgery, laparoscopic, peritoneoscopic or 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 (but had not recovered renal function), the reason was recorded instead, for example, 'death' or 'transplantation'. Referral time was defined as the number of days between the date of first being seen by a renal physician (as an inpatient or outpatient) and the date of commencing dialysis. A patient was classified as presenting 'late' if they had a referral time of less than 90 days.

Access failure was defined when it was no longer usable for dialysis with the date and cause of access failure reported. For the purposes of analysis, HD access failure was grouped into five causes: maturation, mechanical, infection, other and unknown. PD technique failure was grouped into six causes: infection, catheter related, solute/water clearance, leaks/hernia, other and unknown. Access failure was censored for death, transplantation, withdrawal from RRT and elective switching of access type. It was the intention to only capture access failures relating to the first access that was performed. If the reason recorded for access failure was not related to the first type of access recorded, then the data were not included in this analysis.

Centres that reported data on PD patients in the 2015 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. Analyses that use these data are titled 'PD follow-up audit'.

As in the 19th Annual Report, this chapter includes data for pre-emptive transplant (PTx) recipients. This reflects the amended (2015) Renal Association guidelines for planned RRT initiation, which include PTx in the audit standard (table 10.1). Where possible, these data have been included at centre level to aid in the interpretation of the effects of PTx upon rates of definitive and non-definitive dialysis access. Transplant and non-transplant centres work together to prepare patients for PTx, but for the purpose of these analyses, patients have been allocated to their most likely treatment centre (transplant or non-transplant) using the approach of Judge *et al.* [2]; this is based on patient postcode and the likelihood of receiving care in a centre.

Separate and combined analyses were performed for incident HD and PD patients as appropriate. Analyses have been limited to descriptive statistics of frequencies, percentages and unadjusted associations between variables. All inter-centre performance comparisons are made in the context of varying patient demography, case mix and volume. If a centre had >50% missing returns for a particular data field, then all patients from that centre were excluded from analyses involving that data field. The data were analysed using SAS 9.3.

Results

Of 62 centres contacted, 55 returned data on first dialysis access used. After individual patient exclusions, 5,810 patients were included, comprising 4,564 starting HD and 1,246 starting PD (figure 10.1, table 10.3). UKRR 2016 incident data for centres submitting data were 4,546 HD and 1,298 PD patients. The slight over-reporting represents the inability to check all patients against the UKRR dataset, because some centres did not provide patient-level data. It is also possible that a small number of patients with AKI remained in the audit data because of incomplete data at three months. Furthermore, it is possible that some patients who were excluded because they did not match to the UKRR database did not have AKI, but instead started dialysis towards the end of 2016 and the UKRR had not yet received that data from renal centres.

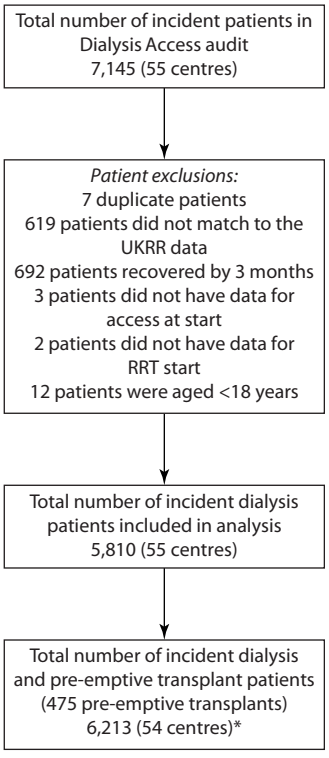

Fig. 10.1. STROBE flow diagram of patients included in the 2016 Multisite Dialysis Access Audit
*Cambridge excluded as patient level data for pre-emptive transplants in 2016 were not submitted to the UKRR

Table 10.3. Demographics and characteristics of patients in the 2016 Multisite Dialysis Access Audit, stratified by first dialysis access type

		HD patients				PD patients						
Variable		*N*	AVF/AVG	TL	NTL	*N*	Open surgery	Laparo-scopic	Peritoneo-scopic	Percuta-neous	Missing	Total
Total number		**4,564**	1,658	1,648	1,258	**1,246**	404	291	30	410	111	5,810
Percentage			36.3	36.1	27.6		32.4	23.4	2.4	32.9	8.9	
Age at first dialysis	Median (IQR)	**67 (55,76)**	68 (56,77)	66 (54,75)	69 (55,78)	**61 (47,72)**	60 (47,71)	61 (49,71)	65 (50,75)	60 (46,72)	57 (44,69)	64 (51,74)
	<45	**523**	27.2	43.6	29.3	**268**	32.8	20.1		34.3		791
	45–54	**608**	37.7	37.3	25.0	**225**	32.4	24.0	3.1	32.4	8.0	833
	55–64	**932**	38.3	37.6	24.1	**250**	33.6	24.8		29.2		1,182
	65–74	**1,204**	37.0	35.9	27.2	**297**	30.0	27.3	2.7	32.3	7.7	1,501
	75+	**1,297**	37.4	31.7	30.9	**206**	34.0	19.4	3.9	36.9	5.8	1,503
BMI	<20	**157**	31.2	43.3	25.5	**36**	44.4	25.0		16.7		193
	20–24	**541**	40.3	34.6	25.1	**207**	37.7	31.9		24.2		748
	25–29	**646**	43.5	31.1	25.4	**222**	38.7	34.7	2.3	20.7	3.6	868
	30–34	**461**	46.6	33.0	20.4	**144**	38.2	37.5		20.8		605
	35+	**382**	48.4	31.7	19.9	**65**	36.9	41.5		15.4		447
	No data	**742**	23.7	29.9	46.4	**130**	30.8	14.6		46.9		872
PRD	Diab	**1,214**	41.2	39.0	19.8	**338**	24.9	26.0	2.1	37.3	9.8	1,552
	Glom	**450**	39.6	37.6	22.9	**211**	34.1	24.6	2.8	30.3	8.1	661
	Hypert	**282**	47.9	30.9	21.3	**89**	28.1	16.9		44.9		371
	Other	**906**	16.9	34.1	49.0	**157**	34.4	24.2	3.8	29.3	8.3	1,063
	Polyc	**208**	63.0	26.4	10.6	**88**	47.7	28.4		19.3		296
	Pyelo	**245**	41.2	35.9	22.9	**60**	31.7	28.3		31.7		305
	RVD	**280**	40.7	30.0	29.3	**74**	41.9	12.2		33.8		354
	Uncert	**643**	36.4	39.2	24.4	**173**	30.1	22.5		39.3		816
	No PRD	**166**	24.7	43.4	31.9	**17**		35.3		29.4		183
Referral time (days)	<90	**1,116**	3.0	38.9	58.2	**82**	31.7	19.5		35.4		1,198
	90–180	**202**	24.3	56.9	18.8	**83**	34.9	19.3		32.5		285
	180–365	**341**	37.5	41.3	21.1	**116**	28.4	27.6		31.0		457
	365+	**2,789**	51.0	32.7	16.3	**952**	32.5	23.6	2.4	33.1	8.4	3,741
	No data	**116**	23.3	39.7	37.1	**13**	53.8					129
Assessed by surgeon	Yes	**2,010**	72.9	21.6	5.5	**514**	34.8	28.0	1.0	25.1	11.1	2,524
	No	**2,379**	6.1	48.0	45.9	**616**	30.7	20.0	4.1	43.0	2.3	2,995
	No data	**77**	26.0	35.1	39.0	**82**	36.6	26.8		19.5		159
Sex	Female	**1,647**	35.4	37.9	26.7	**461**	36.7	23.2	3.0	28.6	8.5	2,108
	Male	**2,917**	36.9	35.1	28.0	**785**	29.9	23.4	2.0	35.4	9.2	3,702
Ethnicity	Asian	**520**	33.5	43.7	22.9	**160**	21.9	19.4		48.1		680
	Black	**330**	27.3	48.2	24.5	**87**	17.2	25.3		37.9		417
	Other	**129**	31.0	43.4	25.6	**54**	37.0	18.5		29.6		183
	White	**3,265**	38.1	33.1	28.9	**893**	35.3	23.4	2.9	30.6	7.8	4,158
	No data	**251**	33.1	34.3	32.7	**49**	34.7	38.8		20.4		300
eGFR at start	Median (IQR)	**7(5,9)**	7(6,9)	7(5,9)	7(5,9)	**7(6,10)**	8(6,10)	7(6,9)	7(6,12)	7(6,9)	8(6,10)	7(6,10)
Diabetes	Yes	**1,686**	41.7	35.8	22.5	**405**	28.4	27.7	2.5	37.3	4.2	2,091
	No	**2,164**	35.7	34.1	30.3	**684**	36.4	24.1	2.9	33.3	3.2	2,848
	No data	**192**	22.4	24.0	53.6	**46**	23.9	26.1		21.7		238

Centres with >50% missing data for a variable were excluded from summary data and analyses relating to that variable, hence the total number of patients does not always sum to 5,810

Blank cells – <5 patients, percentages not shown

IQR – interquartile range; BMI – body mass index; PRD – primary renal diagnosis; DM – diabetes mellitus; GN – glomerulonephritis; HTN – hypertension; PKD – polycystic kidney disease; Pyelo – pyelonephritis; RVD – renal vascular disease; HD – haemodialysis; PD – peritoneal dialysis; eGFR – estimated glomerular filtration rate; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line

Data completeness

Data completeness varied between 100% (date of birth, sex, dialysis start date, first dialysis access, first dialysis modality and access at three months) and 28.7% (date of access failure). The data on diabetes were supplemented by triangulation with UKRR comorbidity and primary renal diagnosis (PRD), increasing completeness of diabetic status to 89.0%. Of 50 centres that reported data on PD patients in 2015 ($N = 1,075$), 38 completed the one year follow-up, returning data on 902 patients.

Variations in first dialysis access

The following observations can be made of incident dialysis access. These represent associations and do not imply causality. Data were unadjusted for patient factors.

- 50.0% of dialysis patients started therapy using definitive access: AVF/AVG or a PD catheter.
- 36.3% of HD patients started therapy using an AVF or AVG.
- AVF use increased with increasing referral time, with corresponding reductions in TL/NTL use: 48.0% of incident HD patients known to a nephrologist for over 90 days had an AVF/AVG which was below the Renal Association audit standard of 60% (table 10.1).
- AVF use increased with increasing age and BMI, with corresponding reductions in TL/NTL use.
- Percutaneous PD catheter placement was less common at extremes of BMI.
- Use of definitive access was high (74.0%) for patients with polycystic kidney disease listed as their PRD. This has been a consistent finding in the audit, likely to reflect factors associated with the disease – including early diagnosis and referral, younger age, a predictable clinical course and high health literacy.
- For patients starting haemodialysis with 'other' listed as their PRD, AVF/AVG use was particularly low (16.9%).
- Incident HD recipients who had been reviewed by a surgeon at least three months prior to starting dialysis had higher AVF/AVG use than those who had not (72.9% vs 6.1%).
- Black patients starting HD had markedly lower rates of AVF/AVG use (27.3%) compared to the average (36.3%).

Figure series 10.2 assists interpretation of table 10.3 by including annual PTx data. Transplant data were included to provide a more complete depiction of incident RRT patterns. Data remain otherwise unadjusted. For detailed analysis see chapters 3 and 9 of this annual report. Data were plotted and stratified by age (figure 10.2a), BMI (figure 10.2b), PRD (figure 10.2c), referral time (figure 10.2d), diabetic status (figure 10.2e) and surgical referral (figure 10.2f). Centres with >50% missing data for a variable were excluded, as detailed in the figure legend. BMI data on PTx recipients are not presented due to low data returns, although it is recognised that very few transplant recipients will have BMI >35. Transplant data were not presented against surgical referral data because all patients who received a PTx will have received surgical review. HD and PD data are displayed separately in figure 10.2f because the surgical

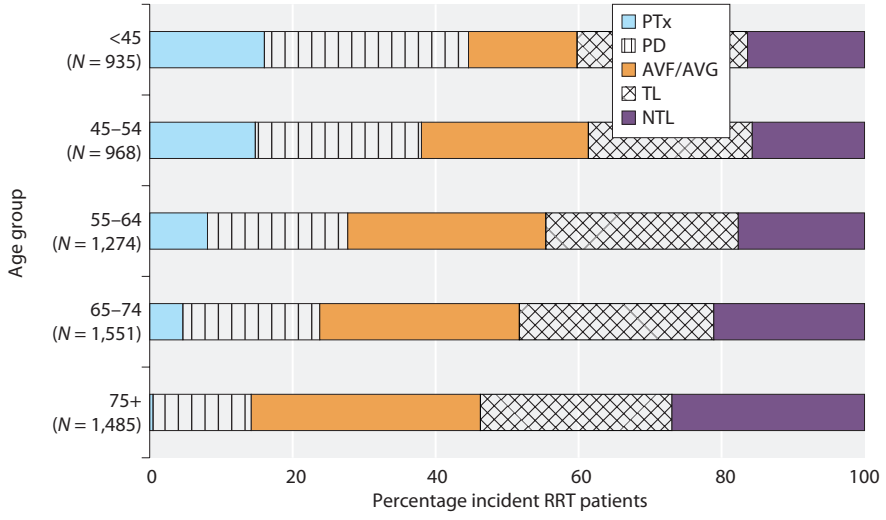

Fig. 10.2a. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by age
Number of patients in each group in brackets. PTx – pre-emptive transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

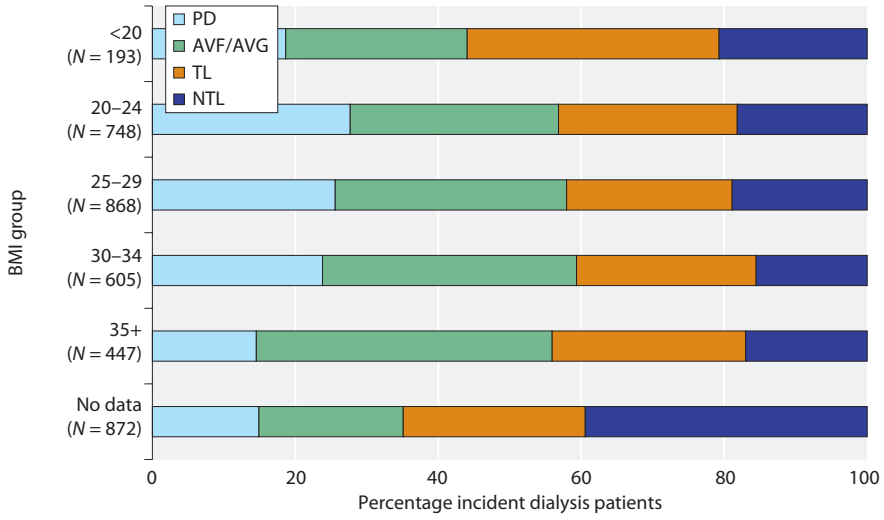

Fig. 10.2b. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by BMI

Number of patients in each group in brackets. 17 centres were excluded due to >50% missing BMI data

PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; BMI – body mass index; RRT – renal replacement therapy

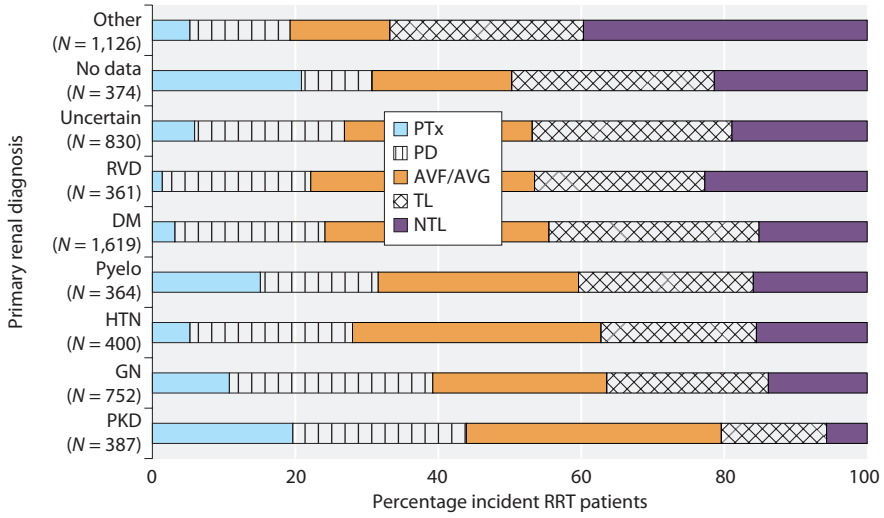

Fig. 10.2c. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by PRD

Number of patients in each group in brackets. PRD groups are sorted by decreasing proportion of patients initiating RRT with a HD catheter

PTx – pre-emptive transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RVD – reno-vascular disease; DM – diabetes mellitus; Pyelo – pyelonephritis; HTN – hypertension; GN – glomerulonephritis; PKD – polycystic kidney disease; RRT – renal replacement therapy

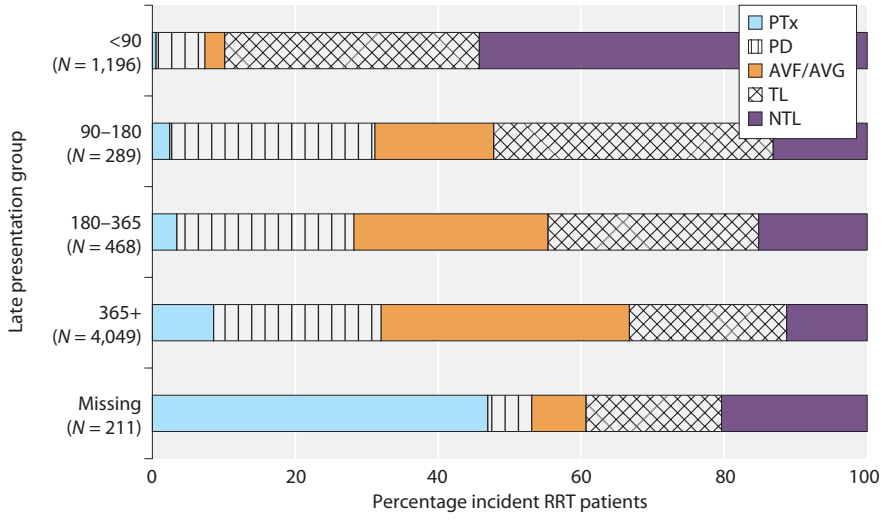

Fig. 10.2d. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by referral time

Number of patients in each group in brackets.

PTx – pre-emptive transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

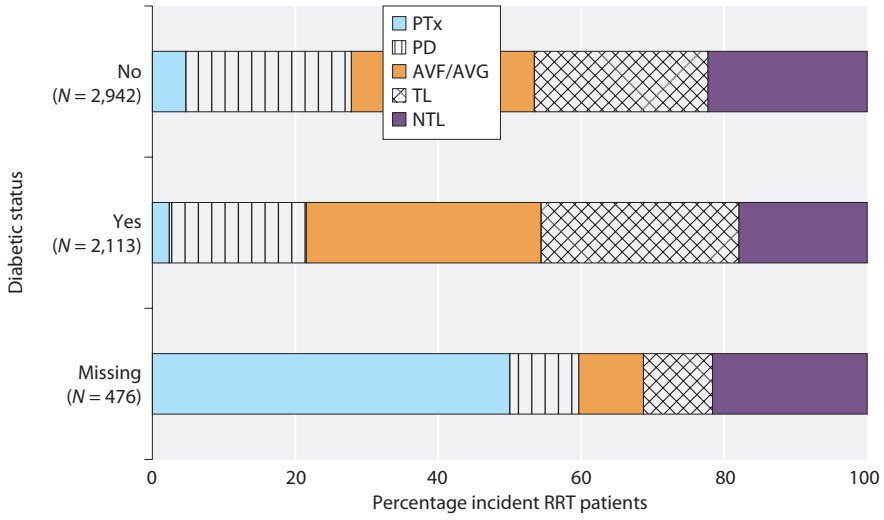

Fig. 10.2e. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by diabetic status
Number of patients in each group in brackets. Four centres were excluded due to >50% missing diabetes data after triangulation with UKRR data
PTx – pre-emptive transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

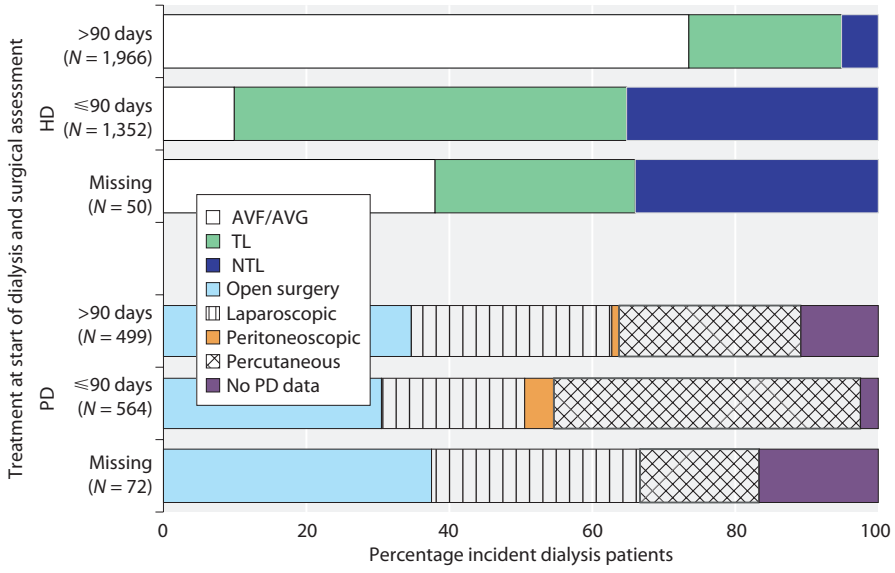

Fig. 10.2f. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by surgical referral
Number of patients in each group in brackets. Two centres were excluded due to >50% missing data for date of surgical assessment. Late presenting patients were also excluded from this analysis
AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

pathways for vascular and PD access differ. Late presenting patients were excluded from this analysis. The following observations can be made:

- Rising use of AVF/AVG with increasing age was associated with falling rates of transplant and PD.
- Amongst incident RRT patients with BMI <20, PD use was low (18.7%) and TL/NTL use was high (56.0%). Otherwise the rising use of AVF/AVG with increasing BMI was associated with falling rates of PD.
- PRD had a variable association with use of definitive dialysis access and PTx. For example, for polycystic kidney disease both definitive dialysis access (60.0%) and PTx (19.6%) were common. Where PRD was listed as 'other', definitive dialysis access (28.0%) and PTx (5.2%) were both uncommon. In renovascular disease definitive dialysis access was established in 52.1% of incident patients, whilst PTx was very rare (1.4%).
- Increasing referral time was associated with a progressive increase in PD, AVF/AVG and PTx use, with corresponding reductions in use of TL/NTL. This pattern continued as referral time increased beyond 365 days for PTx and AVF/AVG.
- 64.5% of incident RRT patients known to a nephrologist for over 90 days had definitive access or a transplant. Whilst the Renal Association presents this as an audit standard, no minimum standard is set (table 10.1).

- PD was initiated for only 6.9% of late presentations (people known to a nephrologist for less than 90 days).
- Patients with diabetes were more likely to use an AVF/AVG and less likely to receive PTx or PD than patients without diabetes, but use of TL/NTL was similar.
- AVF/AVG use was much higher amongst haemodialysis recipients referred to a surgeon >90 days before dialysis initiation (73.5%) than those who were not (9.9%).

Variations in first dialysis access by renal centre

Figure 10.3 plots incident RRT first access method stratified by centre. Practice variation was apparent. Initiating HD via an AVF/AVG ranged between <15% (Ipswich, London St Bartholomew's, London West, Ulster, Carlisle) and >40% (Chelmsford, Dorset, Middlesbrough). Initiating HD via a TL ranged between <10% (Nottingham, Derby, Basildon, Newry) and >45% (London West, Carlisle, Ipswich). Initiating with a PD catheter ranged from <10% (Truro, Sunderland, Stevenage) to >40% (Derby). There is no obvious difference in the pattern of first RRT access method used when comparing transplanting and non-transplanting centres.

Table 10.4 provides centre-level data for incident dialysis access, grouping patients by time of presentation to nephrology (early ⩾90 or late <90 days before initiating dialysis). Late presentation was associated with low rates of definitive access placement (9.6%). Peritoneal catheter placement accounted for 71.3% of definitive access placed in late presenting patients. Nineteen centres reported no late presenting patients dialysing with definitive access at initiation. Some centres were able to establish definitive vascular access for late presenting patients, although absolute numbers of patients were small. Surgical referral was made 90 days or more before dialysis initiation for 45.9% of incident patients, and ranged between >70% (Birmingham QEH, Bangor, Ipswich) and <25% (Plymouth, Swansea, Carlisle).

Table 10.5 provides centre-level data for dialysis access three months after initiation, grouping patients by time of initial presentation to nephrology (early ⩾90 or late <90 days before initiating dialysis). Late presentation remained associated with low rates of definitive access use at three months (15.1%) compared with early presentation (60.2%). TL was the mode of access for 59.6% of late presenting patients at three months. Of early presenters, 1.3% were transplanted by three months. Of late presenting patients, 0.2% were transplanted by three months. Ten centres had no late presenting patients dialysing with definitive access at three months.

Figure 10.4 plots RRT approach at three months for late presenting patients. Definitive access ranges between 42.9% and 0.0% by centre, implying variation in the responsiveness of dialysis access pathways. Some centres were able to establish definitive access in over 30% of late presenting patients by three months, the majority of whom started PD.

Table 10.6 shows dialysis access three months after initiation, stratified by first access type. The shaded cells highlight proportions of patients who continued with their initial dialysis access technique at three months. This analysis reflects RRT approach at initiation and three months, and therefore cannot identify access failure unless this results in a change in access approach. See figure 10.14 for failure of initial access. Of patients who initiated dialysis with definitive access, 87.7% continued with definitive access at three months and 89.4% had definitive access or a transplant, whilst 5.8% converted to TL/NTL. Of patients who started dialysis without definitive access, 10.4% received a transplant or were dialysing with definitive access at three months. Of patients who initiated dialysis with a TL, 78.7% continued with a TL at three months and only 11.0% had converted to definitive access or a transplant. The majority of patients who initiated dialysis with a NTL continued HD via a TL (60.3%). Death before three months was much more common in this group than any other (25.2%).

Figure 10.5 provides a funnel plot of the percentage of patients starting HD with an AVF or AVG. Late presenting patients are excluded as a surrogate for 'unplanned dialysis initiation' as per the Renal Association guidelines (table 10.1). This analysis shows that the majority of UK renal centres fell below the Renal Association audit standard of ⩾60% AVF/AVG use at 'planned' HD initiation. Sixteen centres achieved the target. Twelve centres were below the 99.9% limit.

Figure 10.6 depicts the percentage of incident HD patients by first access used, stratified by time between date of first access formation attempt and HD initiation. Data from patients incident to dialysis in 2015 and 2016 are included. Longer duration between first attempt at forming dialysis access and first HD session was associated with greater levels of AVF/AVG use at initiation. Amongst patients for whom the first attempt at forming dialysis access was made more than one year before starting HD, 86.3% initiated with AVF/AVG; whereas for

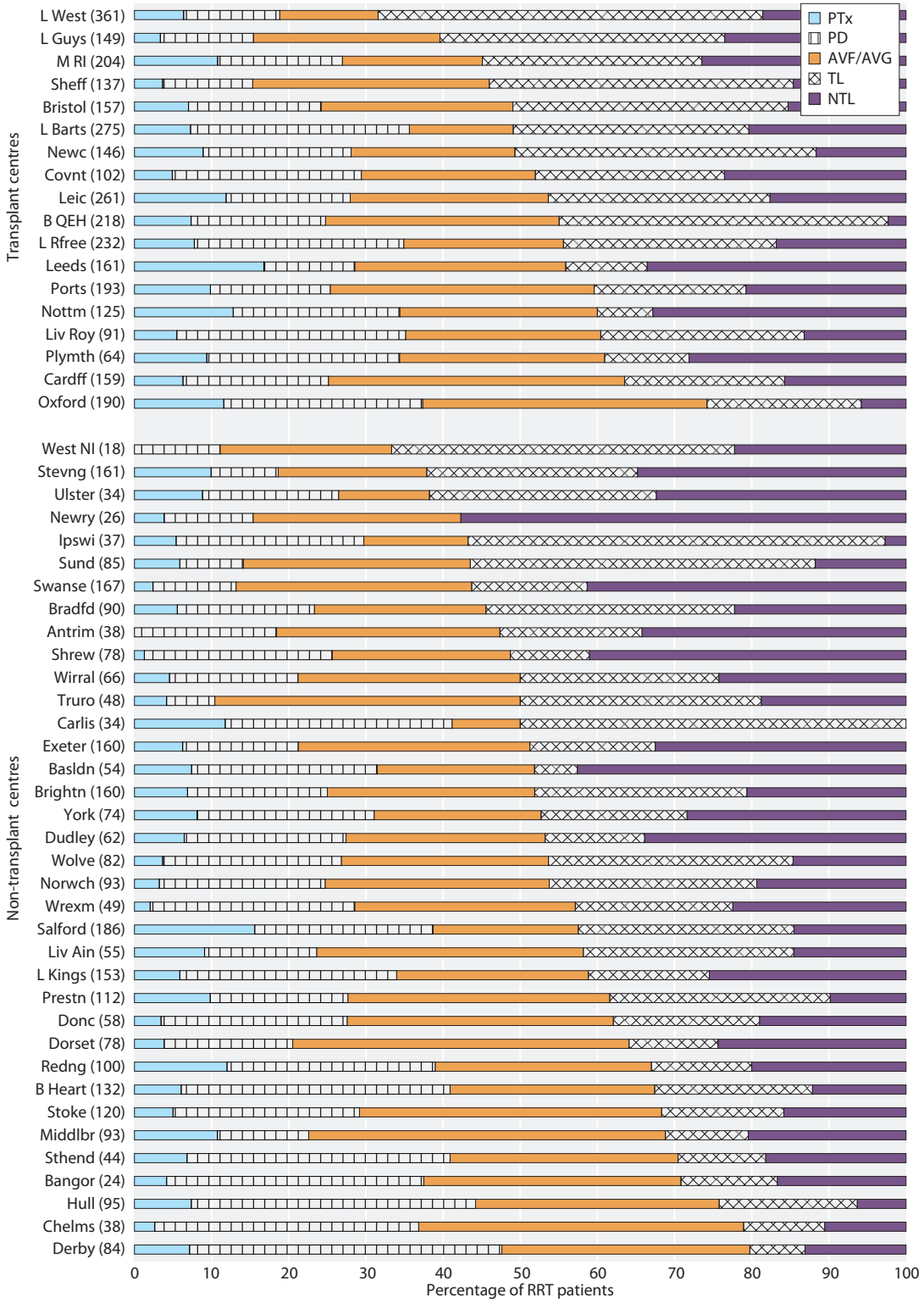

Fig. 10.3. Incident RRT first access method for patients in the 2016 Multisite Dialysis Access Audit, stratified by renal centre
Centre size in brackets. Centres are stratified by transplanting/non-transplanting centre and sorted by decreasing proportion of patients initiating RRT with a HD catheter (TL/NTL). Eight centres were excluded due to missing transplant or vascular access data.
PTx – pre-emptive transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

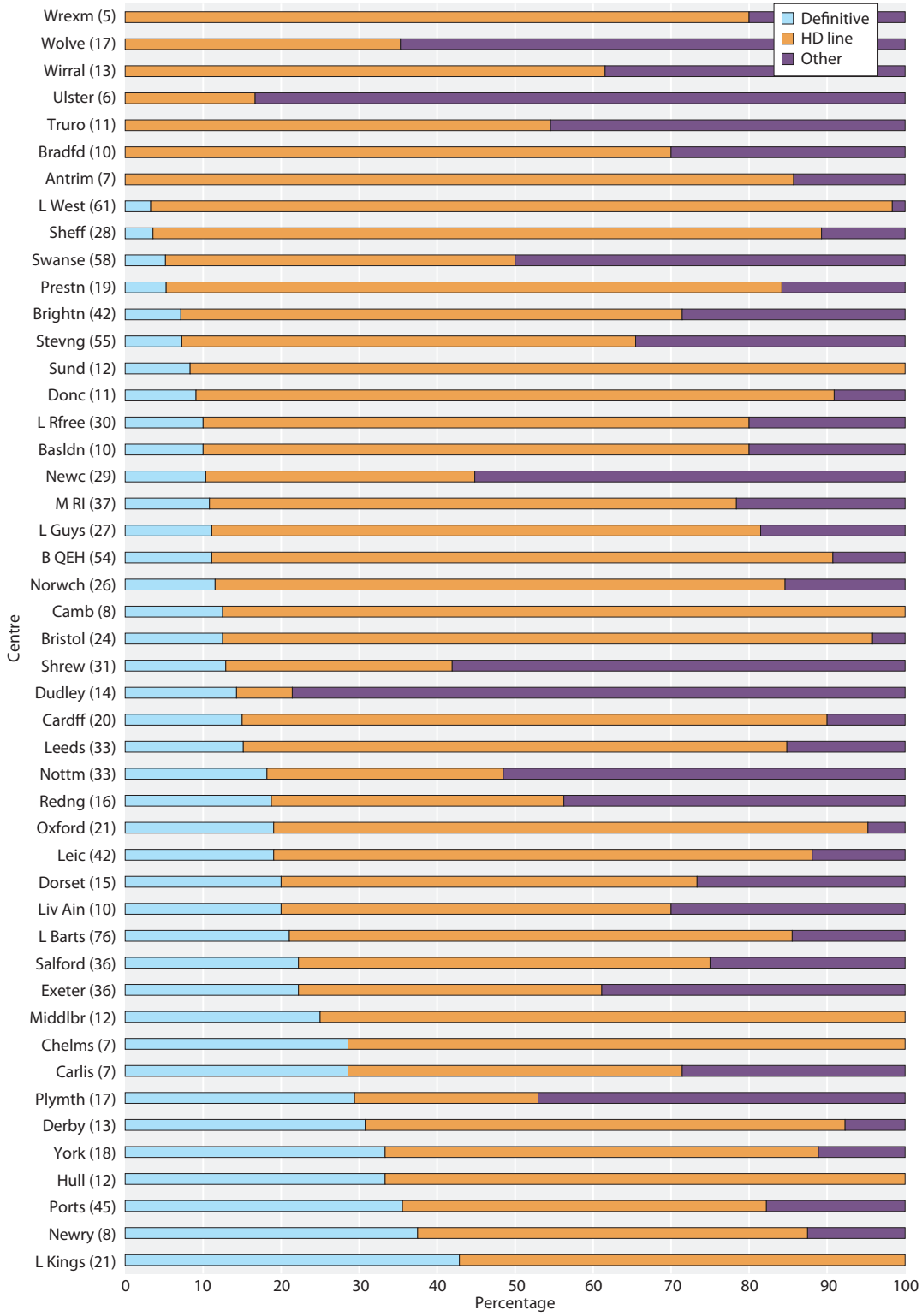

Fig. 10.4. RRT approach at three months for late-presenting patients in the 2016 Multisite Dialysis Access Audit
Centres are sorted by increasing proportion of patients with definitive access (AVF/AVG/PD). Five centres were excluded as they had <5 late presenting patients and three centres due to missing data on treatment modality at three months
PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

Table 10.4. Modality at start of dialysis and access in use for patients in the 2016 Multisite Dialysis Access Audit, by early and late presentation at dialysis initiation, by centre, including surgical referral rates within three months before start of dialysis

	Early presenters (≥90 days before start of dialysis)					Late presenters (<90 days before start of dialysis)					Surgical assessment (%)		Treatment at start (%)		
Centre	*N*	PD %	AVF/ AVG%	TL %	NTL %	*N*	PD %	AVF/ AVG%	TL %	NTL %	Yes	No	HD	PD	PTx
Antrim	31	22.6	35.5	16.1	25.8	7	0.0	0.0	28.6	71.4	68.4	31.6	81.6	18.4	0.0
B Heart	120	38.3	29.2	20.0	12.5	*	0.0	0.0	75.0	25.0	41.9	58.1	59.1	34.8	6.1
B QEH	148	22.3	43.9	31.8	2.0	54	9.3	1.9	85.2	3.7	70.8	29.2	75.2	17.4	7.3
Bangor	20	40.0	40.0	10.0	10.0	*	0.0	0.0	100.0	0.0	72.7	27.3	62.5	33.3	4.2
Basldn	37	35.1	27.0	8.1	29.7	10	0.0	0.0	0.0	100.0	46.0	54.0	68.5	24.1	7.4
Bradfd	75	21.3	26.7	32.0	20.0	10	0.0	0.0	50.0	50.0	46.4	53.6	76.7	17.8	5.6
Brightn	107	25.2	39.3	27.1	8.4	42	4.8	2.4	35.7	57.1	45.3	54.7	75.0	18.1	6.9
Bristol	120	22.5	31.7	35.0	10.8	24	0.0	0.0	54.2	45.8	46.8	53.2	75.8	17.2	7.0
Camb	47	6.4	36.2	55.3	2.1	8	0.0	0.0	100.0	0.0	54.2	45.8			
Cardff	128	22.7	47.7	18.0	11.7	20	5.0	0.0	50.0	45.0	66.4	33.6	74.8	18.9	6.3
Carlis	22	45.5	13.6	40.9	0.0	7	0.0	0.0	100.0	0.0	23.3	76.7	58.8	29.4	11.8
Chelms	30	40.0	53.3	3.3	3.3	7	14.3	0.0	42.9	42.9	70.3	29.7	63.2	34.2	2.6
Covnt	71	29.6	26.8	26.8	16.9	20	20.0	5.0	30.0	45.0	68.8	31.3	70.6	24.5	4.9
Derby	65	49.2	38.5	4.6	7.7	13	15.4	15.4	23.1	46.2	32.1	67.9	52.4	40.5	7.1
Donc	45	28.9	44.4	15.6	11.1	11	9.1	0.0	36.4	54.5	51.8	48.2	72.4	24.1	3.4
Dorset	58	22.4	55.2	10.3	12.1	15	0.0	0.0	20.0	80.0	48.0	52.0	79.5	16.7	3.8
Dudley	44	27.3	36.4	18.2	18.2	14	7.1	0.0	0.0	92.9	47.2	52.8	72.6	21.0	6.5
Exeter	113	21.2	42.5	15.9	20.4	36	0.0	0.0	22.2	77.8	36.7	63.3	78.8	15.0	6.3
Hull	76	42.1	38.2	17.1	2.6	12	25.0	8.3	33.3	33.3	60.2	39.8	55.8	36.8	7.4
Ipswi	*	25.0	25.0	50.0	0.0	*	33.3	0.0	33.3	33.3	100.0	0.0	70.3	24.3	5.4
L Barts	174	36.8	21.3	31.0	10.9	76	18.4	0.0	38.2	43.4	28.8	71.2	64.4	28.4	7.3
L Guys	117	13.7	29.9	41.0	15.4	27	7.4	3.7	25.9	63.0	46.2	53.8	84.6	12.1	3.4
L Kings	122	32.0	30.3	17.2	20.5	21	19.0	4.8	9.5	66.7	36.8	63.2	66.0	28.1	5.9
L Rfree	184	33.2	25.5	27.2	14.1	30	6.7	3.3	46.7	43.3	49.2	50.8	65.1	27.2	7.8
L West	277	15.5	16.6	53.4	14.4	61	3.3	0.0	52.5	44.3	44.7	55.3	81.2	12.5	6.4
Leeds	99	17.2	43.4	13.1	26.3	33	6.1	3.0	9.1	81.8	44.0	56.0	71.4	11.8	16.8
Leic	188	20.2	34.6	29.8	15.4	42	9.5	4.8	45.2	40.5	50.4	49.6	72.0	16.1	11.9
Liv Ain	40	20.0	42.5	25.0	12.5	10	0.0	20.0	50.0	30.0	61.2	38.8	76.4	14.5	9.1
Liv Roy	70	35.7	28.6	25.7	10.0	5	40.0	40.0	0.0	20.0	57.5	42.5	64.8	29.7	5.5
M RI	133	21.8	27.8	33.1	17.3	37	5.4	0.0	29.7	64.9	38.1	61.9	73.0	16.2	10.8
Middlbr	71	14.1	59.2	9.9	16.9	12	8.3	8.3	25.0	58.3	48.8	51.3	77.4	11.8	10.8
Newc	104	26.9	27.9	34.6	10.6	29	0.0	6.9	72.4	20.7	31.6	68.4	71.9	19.2	8.9
Newry	17	17.6	35.3	0.0	47.1	8	0.0	12.5	0.0	87.5	52.0	48.0	84.6	11.5	3.8
Norwch	64	28.1	42.2	25.0	4.7	26	7.7	0.0	34.6	57.7	31.1	68.9	75.3	21.5	3.2
Nottm	76	34.2	39.5	6.6	19.7	33	3.0	6.1	12.1	78.8	32.1	67.9	65.6	21.6	12.8
Oxford	146	32.2	47.3	15.8	4.8	21	9.5	4.8	66.7	19.0	64.2	35.8	62.6	25.8	11.6
Plymth	41	34.1	41.5	9.8	14.6	17	11.8	0.0	17.6	70.6	6.7	93.3	65.6	25.0	9.4
Ports	111	22.5	50.5	18.0	9.0	45	11.1	17.8	28.9	42.2	51.0	49.0	74.6	15.5	9.8
Prestn	81	24.7	46.9	24.7	3.7	19	0.0	0.0	57.9	42.1	60.4	39.6	72.3	17.9	9.8
Redng	72	36.1	38.9	16.7	8.3	16	6.3	0.0	6.3	87.5	30.7	69.3	61.0	27.0	12.0
Salford	117	29.1	29.9	29.1	12.0	36	13.9	0.0	50.0	36.1	39.1	60.9	61.3	23.1	15.6
Sheff	99	15.2	41.4	36.4	7.1	28	3.6	0.0	57.1	39.3	53.8	46.2	84.7	11.7	3.6
Shrew	46	34.8	39.1	6.5	19.6	31	9.7	0.0	16.1	74.2	47.4	52.6	74.4	24.4	1.3
Stevng	90	14.4	33.3	38.9	13.3	55	1.8	1.8	16.4	80.0	37.2	62.8	81.4	8.7	9.9
Sthend	37	40.5	35.1	13.5	10.8	*	0.0	0.0	0.0	100.0	31.7	68.3	59.1	34.1	6.8
Stoke	99	28.3	47.5	17.2	7.1	15	6.7	0.0	13.3	80.0	61.4	38.6	70.8	24.2	5.0
Sund	68	10.3	36.8	48.5	4.4	12	0.0	0.0	41.7	58.3	36.3	63.8	85.9	8.2	5.9
Swanse	105	16.2	47.6	13.3	22.9	58	1.7	1.7	19.0	77.6	22.7	77.3	86.8	10.8	2.4
Truro	35	8.6	54.3	28.6	8.6	11	0.0	0.0	45.5	54.5	56.5	43.5	89.6	6.3	4.2
Ulster	25	24.0	16.0	40.0	20.0	6	0.0	0.0	0.0	100.0	64.5	35.5	73.5	17.6	8.8
West NI	15	13.3	26.7	46.7	13.3	*	0.0	0.0	33.3	66.7	55.6	44.4	88.9	11.1	0.0
Wirral	49	22.4	36.7	26.5	14.3	13	0.0	0.0	30.8	69.2	46.0	54.0	78.8	16.7	4.5
Wolve	61	31.1	36.1	26.2	6.6	17	0.0	0.0	58.8	41.2	41.1	58.9	73.2	23.2	3.7
Wrexm	39	33.3	35.9	20.5	10.3	5	0.0	0.0	40.0	60.0	55.9	44.1	71.4	26.5	2.0
York	50	32.0	32.0	22.0	14.0	18	5.6	0.0	16.7	77.8	36.8	63.2	68.9	23.0	8.1
Total	**4,483**	**25.7**	**35.6**	**26.1**	**12.6**	**1,198**	**6.8**	**2.8**	**36.2**	**54.2**	**45.9**	**54.1**	**72.3**	**20.0**	**7.6**

For a small number of centres the proportion of missing data for presentation date was high, therefore the total number of patients will not be the sum of the early and late presenting patients.
Blank cells – Cambridge did not submit PTx data, therefore percentage by treatment at start not known
*fewer than five patients reported
PTx – pre-emptive transplant; HD -– haemodialysis; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line.

Table 10.5. Modality at three months after start of dialysis and access in use for patients in the 2016 Multisite Dialysis Access Audit, by early and late presentation at dialysis initiation, by centre

	Early presenters (⩾90 days before start of dialysis) %								Late presenters (<90 days before start of dialysis) %								Treatment modality at 3 months (%)						
Centre	Tx	PD	AVF/ AVG	TL	NTL	Other	Miss	Total (*N*)	Tx	PD	AVF/ AVG	TL	NTL	Other	Miss	Total (*N*)	Tx	PD	AVF/ AVG	TL	NTL	Other	Miss
Antrim	0.0	22.6	35.5	35.5	0.0	6.5	0.0	31	0.0	0.0	0.0	85.7	0.0	14.3	0.0	7	0.0	18.4	28.9	44.7	0.0	7.9	0.0
B Heart	0.8	43.3	25.8	23.3	0.8	5.8	0.0	120	0.0	0.0	25.0	75.0	0.0	0.0	0.0	*	0.8	41.9	25.8	25.0	0.8	5.6	0.0
B QEH	0.7	24.3	41.9	27.7	0.0	5.4	0.0	148	0.0	9.3	1.9	77.8	1.9	9.3	0.0	54	0.5	20.3	31.2	41.1	0.5	6.4	0.0
Bangor	0.0	40.0	40.0	20.0	0.0	0.0	0.0	20	0.0	0.0	0.0	100.0	0.0	0.0	0.0	*	0.0	34.8	34.8	30.4	0.0	0.0	0.0
Basldn	0.0	35.1	29.7	24.3	0.0	10.8	0.0	37	0.0	10.0	0.0	70.0	0.0	20.0	0.0	10	0.0	28.0	24.0	32.0	0.0	16.0	0.0
Bradfd	1.3	18.7	26.7	49.3	0.0	4.0	0.0	75	0.0	0.0	0.0	70.0	0.0	30.0	0.0	10	1.2	16.5	23.5	51.8	0.0	7.1	0.0
Brightn	0.0	24.3	31.8	33.6	0.0	10.3	0.0	107	0.0	2.4	4.8	64.3	0.0	28.6	0.0	42	0.0	18.1	24.2	42.3	0.0	15.4	0.0
Bristol	4.2	17.5	30.0	45.0	0.0	3.3	0.0	120	0.0	8.3	4.2	83.3	0.0	4.2	0.0	24	3.4	15.8	26.0	51.4	0.0	3.4	0.0
Camb	0.0	8.5	46.8	40.4	0.0	4.3	0.0	47	0.0	0.0	12.5	87.5	0.0	0.0	0.0	8	0.0	5.6	48.6	43.1	0.0	2.8	0.0
Cardff	0.8	21.9	45.3	28.1	0.0	3.9	0.0	128	0.0	5.0	10.0	75.0	0.0	10.0	0.0	20	0.7	19.5	40.3	34.9	0.0	4.7	0.0
Carlis	0.0	50.0	13.6	31.8	0.0	4.5	0.0	22	0.0	14.3	14.3	42.9	0.0	28.6	0.0	7	0.0	40.0	13.3	33.3	0.0	13.3	0.0
Chelms	0.0	40.0	46.7	13.3	0.0	0.0	0.0	30	0.0	14.3	14.3	71.4	0.0	0.0	0.0	7	0.0	35.1	40.5	24.3	0.0	0.0	0.0
Covnt	1.4	18.3	25.4	16.9	1.4	4.2	32.4	71	0.0	20.0	0.0	25.0	0.0	20.0	35.0	20	1.0	17.5	21.6	17.5	1.0	9.3	32.0
Derby	1.5	47.7	35.4	13.8	0.0	1.5	0.0	65	0.0	7.7	23.1	61.5	0.0	7.7	0.0	13	1.3	41.0	33.3	21.8	0.0	2.6	0.0
Donc	2.2	26.7	37.8	28.9	0.0	4.4	0.0	45	0.0	9.1	0.0	81.8	0.0	9.1	0.0	11	1.8	23.2	30.4	39.3	0.0	5.4	0.0
Dorset	1.7	22.4	53.4	10.3	0.0	12.1	0.0	58	0.0	13.3	6.7	53.3	0.0	26.7	0.0	15	1.3	20.0	45.3	18.7	0.0	14.7	0.0
Dudley	2.3	31.8	34.1	22.7	0.0	9.1	0.0	44	0.0	7.1	7.1	7.1	0.0	78.6	0.0	14	1.7	25.9	27.6	19.0	0.0	25.9	0.0
Exeter	0.0	21.2	44.2	23.9	0.9	9.7	0.0	113	0.0	2.8	19.4	33.3	5.6	38.9	0.0	36	0.0	16.7	38.0	26.7	2.0	16.7	0.0
Hull	3.9	32.9	27.6	30.3	0.0	5.3	0.0	76	0.0	16.7	16.7	66.7	0.0	0.0	0.0	12	3.4	30.7	26.1	35.2	0.0	4.5	0.0
Ipswi	0.0	25.0	25.0	50.0	0.0	0.0	0.0	*	0.0	33.3	0.0	66.7	0.0	0.0	0.0	*	2.9	25.7	14.3	48.6	0.0	8.6	0.0
L Barts	1.7	32.2	21.8	39.7	0.6	4.0	0.0	174	0.0	21.1	0.0	61.8	2.6	14.5	0.0	76	1.2	28.2	14.9	47.5	1.2	7.1	0.0
L Guys	5.1	12.8	31.6	50.4	0.0	0.0	0.0	117	0.0	7.4	3.7	70.4	0.0	18.5	0.0	27	4.2	11.8	26.4	54.2	0.0	3.5	0.0
L Kings	0.8	27.0	27.0	40.2	0.0	4.9	0.0	122	0.0	38.1	4.8	57.1	0.0	0.0	0.0	21	0.7	28.5	23.6	42.4	0.0	4.9	0.0
L Rfree	0.5	34.2	29.3	27.7	0.0	8.2	0.0	184	0.0	6.7	3.3	70.0	0.0	20.0	0.0	30	0.5	30.4	25.7	33.6	0.0	9.8	0.0
L West	0.7	14.8	18.4	64.3	0.0	1.8	0.0	277	0.0	3.3	0.0	95.1	0.0	1.6	0.0	61	0.6	12.7	15.1	69.8	0.0	1.8	0.0
Leeds	2.0	19.2	44.4	28.3	0.0	6.1	0.0	99	0.0	12.1	3.0	66.7	3.0	15.2	0.0	33	1.5	17.2	33.6	38.8	0.7	8.2	0.0
Leic	4.3	15.4	28.7	42.0	0.0	9.6	0.0	188	0.0	14.3	4.8	69.0	0.0	11.9	0.0	42	3.5	15.2	24.3	47.0	0.0	10.0	0.0
Liv Ain	0.0	22.5	45.0	25.0	0.0	7.5	0.0	40	0.0	0.0	20.0	50.0	0.0	30.0	0.0	10	0.0	18.0	40.0	30.0	0.0	12.0	0.0
Liv Roy	0.0	32.9	0.0	1.4	0.0	0.0	65.7	70	0.0	40.0	0.0	0.0	0.0	0.0	60.0	5	0.0	29.1	0.0	1.2	0.0	0.0	69.8
M RI	2.3	17.3	27.1	43.6	0.0	9.8	0.0	133	0.0	10.8	0.0	67.6	0.0	21.6	0.0	37	1.6	15.9	19.8	47.8	0.0	14.8	0.0
Middlbr	0.0	8.5	60.6	23.9	0.0	7.0	0.0	71	0.0	8.3	16.7	75.0	0.0	0.0	0.0	12	0.0	8.4	54.2	31.3	0.0	6.0	0.0
Newc	1.9	26.9	26.9	33.7	1.9	8.7	0.0	104	0.0	3.4	6.9	34.5	0.0	55.2	0.0	29	1.5	21.8	22.6	33.8	1.5	18.8	0.0
Newry	0.0	11.8	47.1	35.3	0.0	5.9	0.0	17	12.5	25.0	0.0	37.5	12.5	12.5	0.0	8	4.0	16.0	32.0	36.0	4.0	8.0	0.0
Norwch	1.6	29.7	40.6	23.4	0.0	4.7	0.0	64	0.0	7.7	3.8	73.1	0.0	15.4	0.0	26	1.1	23.3	30.0	37.8	0.0	7.8	0.0
Nottm	3.9	32.9	36.8	23.7	0.0	2.6	0.0	76	0.0	9.1	9.1	30.3	0.0	51.5	0.0	33	2.8	25.7	28.4	25.7	0.0	17.4	0.0
Oxford	2.1	29.5	41.1	22.6	0.0	4.8	0.0	146	0.0	9.5	9.5	76.2	0.0	4.8	0.0	21	1.8	26.8	36.9	29.8	0.0	4.8	0.0
Plymth	0.0	29.3	39.0	14.6	2.4	14.6	0.0	41	0.0	23.5	5.9	23.5	0.0	47.1	0.0	17	0.0	27.6	29.3	17.2	1.7	24.1	0.0
Ports	2.7	25.2	44.1	20.7	0.0	7.2	0.0	111	0.0	15.6	20.0	46.7	0.0	17.8	0.0	45	1.7	20.7	33.9	29.3	0.0	14.4	0.0
Prestn	1.2	19.8	42.0	32.1	0.0	4.9	0.0	81	0.0	5.3	0.0	73.7	5.3	15.8	0.0	19	1.0	16.8	33.7	40.6	1.0	6.9	0.0
Redng	5.6	31.9	33.3	22.2	0.0	6.9	0.0	72	0.0	18.8	0.0	37.5	0.0	43.8	0.0	16	4.5	29.5	27.3	25.0	0.0	13.6	0.0
Salford	3.4	29.9	33.3	29.1	0.0	4.3	0.0	117	0.0	19.4	2.8	52.8	0.0	25.0	0.0	36	3.2	28.7	25.5	33.8	0.0	8.9	0.0
Sheff	1.0	13.1	38.4	42.4	0.0	5.1	0.0	99	0.0	3.6	0.0	85.7	0.0	10.7	0.0	28	0.8	10.6	30.3	52.3	0.0	6.1	0.0
Shrew	0.0	34.8	39.1	10.9	2.2	13.0	0.0	46	0.0	12.9	0.0	29.0	0.0	58.1	0.0	31	0.0	26.0	23.4	18.2	1.3	31.2	0.0
Stevng	1.1	13.3	30.0	51.1	0.0	4.4	0.0	90	0.0	5.5	1.8	58.2	0.0	34.5	0.0	55	0.7	10.3	19.3	53.8	0.0	15.9	0.0
Sthend	0.0	40.5	37.8	18.9	0.0	2.7	0.0	37	0.0	0.0	0.0	50.0	0.0	50.0	0.0	*	0.0	36.6	34.1	22.0	0.0	7.3	0.0
Stoke	0.0	29.3	44.4	21.2	0.0	5.1	0.0	99	0.0	13.3	0.0	60.0	0.0	20.0	6.7	15	0.0	27.2	38.6	26.3	0.0	7.0	0.9
Sund	1.5	4.4	45.6	45.6	1.5	1.5	0.0	68	0.0	0.0	8.3	83.3	8.3	0.0	0.0	12	1.3	3.8	40.0	51.3	2.5	1.3	0.0
Swanse	0.0	20.0	45.7	17.1	2.9	14.3	0.0	105	0.0	3.4	1.7	44.8	0.0	50.0	0.0	58	0.0	14.1	30.1	27.0	1.8	27.0	0.0
Truro	2.9	5.7	57.1	25.7	0.0	8.6	0.0	35	0.0	0.0	0.0	54.5	0.0	45.5	0.0	11	2.2	4.3	43.5	32.6	0.0	17.4	0.0
Ulster	0.0	20.0	20.0	52.0	0.0	8.0	0.0	25	0.0	0.0	0.0	16.7	0.0	83.3	0.0	6	0.0	16.1	16.1	45.2	0.0	22.6	0.0
West NI	0.0	13.3	20.0	60.0	0.0	6.7	0.0	15	0.0	0.0	0.0	100.0	0.0	0.0	0.0	*	0.0	11.1	16.7	66.7	0.0	5.6	0.0
Wirral	0.0	16.3	34.7	38.8	0.0	10.2	0.0	49	0.0	0.0	0.0	61.5	0.0	38.5	0.0	13	0.0	12.7	28.6	42.9	0.0	15.9	0.0
Wolve	0.0	26.2	42.6	21.3	0.0	9.8	0.0	61	0.0	0.0	0.0	35.3	0.0	64.7	0.0	17	0.0	20.3	32.9	25.3	0.0	21.5	0.0
Wrexm	0.0	30.8	38.5	23.1	0.0	7.7	0.0	39	0.0	0.0	0.0	80.0	0.0	20.0	0.0	5	0.0	25.0	31.3	31.3	0.0	12.5	0.0
York	2.0	30.0	28.0	34.0	2.0	4.0	0.0	50	0.0	27.8	5.6	50.0	5.6	11.1	0.0	18	1.5	29.4	22.1	38.2	2.9	5.9	0.0
Total	**1.3**	**25.0**	**35.2**	**30.5**	**0.3**	**6.0**	**1.8**	**4,483**	**0.2**	**9.8**	**5.3**	**59.6**	**0.8**	**22.4**	**1.8**	**1,198**	**1.2**	**20.9**	**27.7**	**38.2**	**0.4**	**9.9**	**1.6**

Other is made up from the following categories: withdrew, conservative care, died, transferred out and recovered
* – fewer than five patients reported
Tx – transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; Miss – missing data

Table 10.6. Dialysis access at three months since dialysis start for patients in the 2016 Multisite Dialysis Access Audit, stratified by first access used

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/AVG (1,658)	86.9	5.5	0.1	0.2	1.1	3.5	1.1	1.6
TL (1,648)	7.5	78.7	0.2	2.5	1.0	7.0	0.9	2.2
NTL (1,258)	3.5	60.3	1.3	5.7	0.3	25.2	1.7	1.9
PD catheter (1,246)	0.2	5.9	0.2	88.3	2.6	1.8	0.5	0.4

Shaded cells highlight the percentage of patients who remained on the same modality at three months
PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; LTFU – lost to follow-up

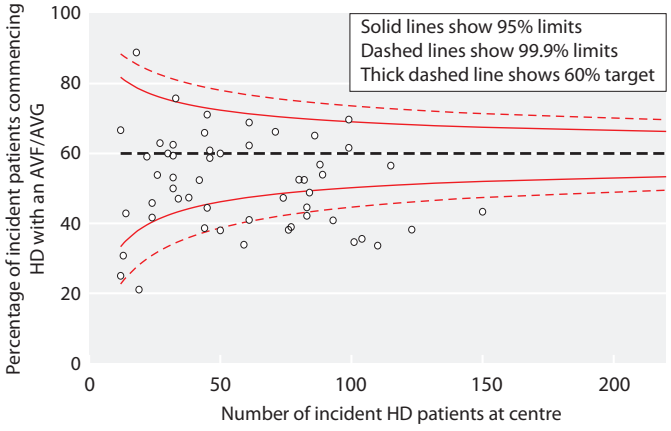

Fig. 10.5. Funnel plot of the percentage of incident HD patients in the 2016 Multisite Dialysis Access Audit who commenced dialysis with an AVF/AVG
The Renal Association audit standard (60%) is represented by the thick dotted line. Patients who were first seen by a nephrologist <90 days from initiating dialysis were excluded. One centre with <10 patients receiving HD was excluded
HD – haemodialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft

those patients for whom the first attempt at forming dialysis access was made <90 days before starting dialysis, 24.8% commenced HD with an AVF/AVG. The biggest increment in definitive dialysis access occurred between <90 and ⩾90 days. The data field used for this analysis did not specify which access was attempted, so it cannot be assumed that first access attempt and access used on first session were the same. Missing data had a similar distribution of access use to those patients for whom access was first attempted within 90 days of initiating dialysis. This pattern differs from previous years, which may be explained by much higher data completeness.

Variations in prevalent dialysis access by renal centre

Figure 10.7 provides a funnel plot of the percentage of prevalent dialysis patients receiving PD or HD via an AVF/AVG. Seventeen centres met the Renal Association audit standard of ⩾80% for definitive access use (thick dotted line). Fifteen centres were below the 99.9% limit.

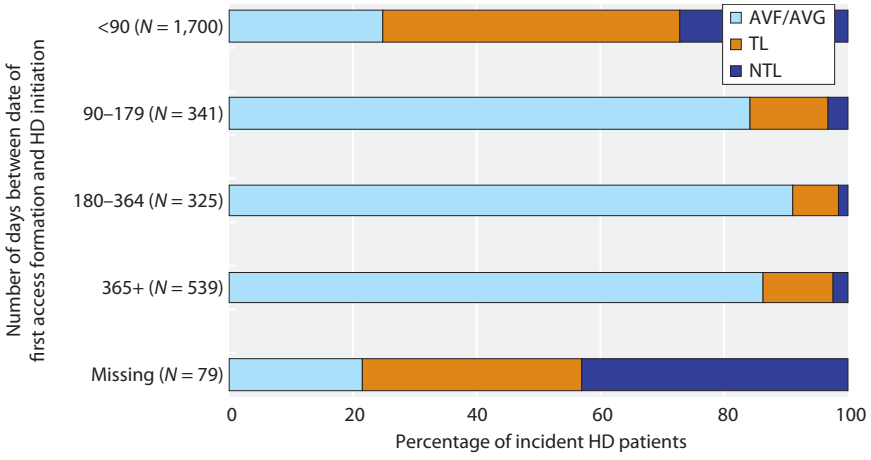

Fig. 10.6. Percentage of incident HD patients by first access used in the 2016 Multisite Dialysis Access Audit stratified categorically by days (<90; 90–179; 180–364; 365+) from first access attempt
Number of patients in each category in brackets. Late-presenting patients were excluded from this analysis. Four centres were excluded due to >50% missing data for date of first access attempt.
HD – haemodialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line

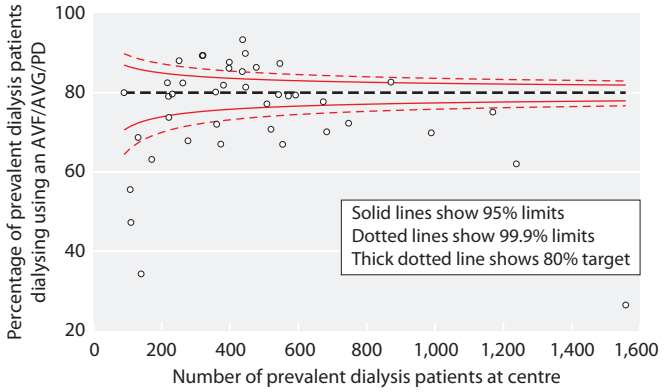

Fig. 10.7. Funnel plot of the percentage of prevalent patients in the 2016 Multisite Dialysis Access Audit receiving PD or HD via AVF/AVG

Thick dotted line = 80% Renal Association audit standard. A total of 14 centre-level exclusions were made for this analysis due to non-completion of prevalent dialysis access data and >10% differences between centre-reported and UKRR numbers of patients receiving dialysis

HD – haemodialysis; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft

Figure 10.8 depicts dialysis access for prevalent patients by centre. Wide practice variation is apparent. Rates of definitive access ranged between >90% (Liverpool Royal) and <50% (London West, Southend, Ulster). PD accounted for between >25% (Carlisle) and <5% (Stevenage) of prevalent definitive access use.

Peritoneal dialysis audit one-year follow-up by renal centre

Figure 10.9 shows RRT modality one year after commencing PD by centre. Data for this analysis came from the 2016 one-year follow-up for patients incident to dialysis in 2015. Centres with 100% missing data at one year, or fewer than five PD patients were excluded. The percentage of patients remaining on PD or who were transplanted one year after initiation ranged between 46.0% (Wolverhampton) and >90.0% (Antrim, Newry) with an overall mean of 70.7%.

Figure 10.10 depicts PD catheter insertion technique stratified by centre. Four centres reporting fewer than five patients on PD were excluded from this analysis. Surgical techniques include open and laparoscopic. Non-surgical techniques include percutaneous and peritoneoscopic insertion. There was considerable practice variation. Twenty-three centres reported use of non-surgical PD catheter placement, accounting for 35.3% of all catheters placed and 17 of these centres placed >50% of their PD catheters this way. Five placed >90% of their PD catheters percutaneously (Birmingham Heartlands, Southend, Derby, London Kings, Preston). At the 23 centres that placed non-surgical PD catheters, 22.0% of incident RRT patients started PD, compared with 20.0% overall. Twenty-seven percent of incident RRT patients started PD at the six centres that placed >90% of their catheters percutaneously.

Figure 10.11 displays PD catheter insertion technique by referral time. There does not appear to be a strong relationship between referral time and technique used for PD catheter insertion. This suggests that the PD access referral pathway may be less dependent on timely referral than the vascular access pathway.

Figure 10.12 presents the percentage of incident PD patients by catheter insertion technique and BMI group. Associations between BMI and PD catheter insertion technique do not appear to be strong and apart from peritoneoscopic insertion (which was used infrequently overall) every approach was used for people in each BMI group, with a slight tendency to less frequent use of non-surgical techniques at the extremes of BMI. Patients with missing BMI data had much higher rates of percutaneous tube insertion (56.6%) than patients with BMI data.

Figure 10.13 shows a funnel plot of the percentage of PD catheter failures within one year of initiating dialysis. Data are from the one-year PD follow-up audit of patients incident to PD in 2015. PD catheter failure was censored for transplantation, elective transfer to HD or death. Of the 31 centres for which data were available, one was above the 95% limit for PD catheter failure with a catheter failure rate of 59.3%. Seven centres were below the lower 99.9% limit, only one of which reported any failed PD catheters. The mean one-year catheter failure rate was 18.4% (13.3% in 2015). Only 13 cases of peritonitis were reported within two weeks of catheter insertion in 2016, but data completeness was too low (20.8%) to permit a reliable estimate of early peritonitis rates.

Figure 10.14 shows comparative access failures by access type within three months of initiating dialysis. Data were drawn from the 2015 and 2016 Multisite Dialysis Access Audits. 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. Failure rates appeared marginally higher for PD than for HD access. Numbers of AVGs and peritoneoscopically inserted PD tubes were very low, hence the wide confidence intervals (CIs) for these data, which overlap with the failure rates of all other access techniques.

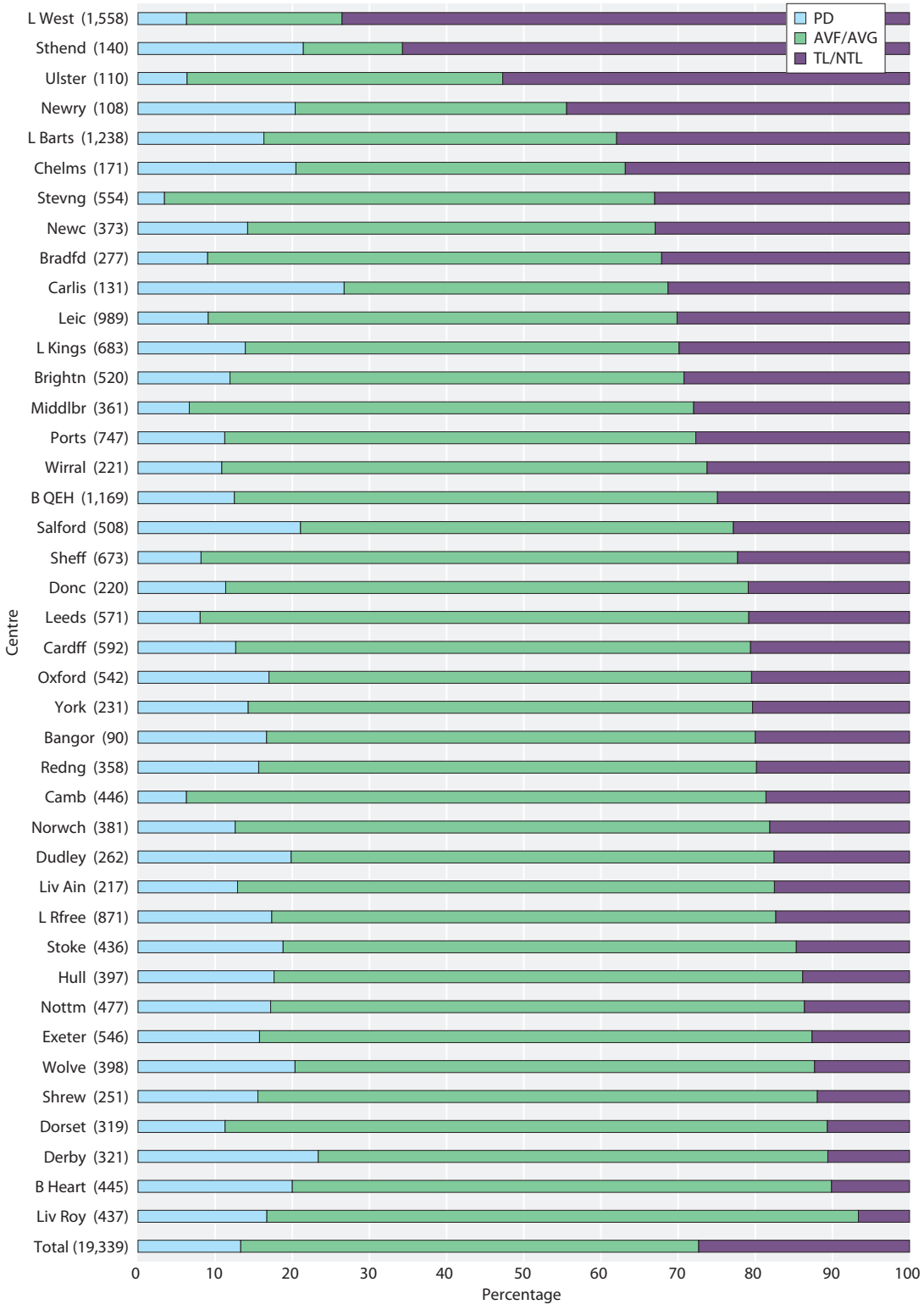

Fig. 10.8. Prevalent dialysis access by centre for patients in the 2016 Multisite Dialysis Access Audit

Centre size in brackets. Centres are sorted by decreasing proportion of patients initiating RRT with a HD catheter. Fourteen centre-level exclusions were made due to non-completion of prevalent dialysis access data and >10% differences between centre-reported and UKRR numbers of patients receiving dialysis

PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line

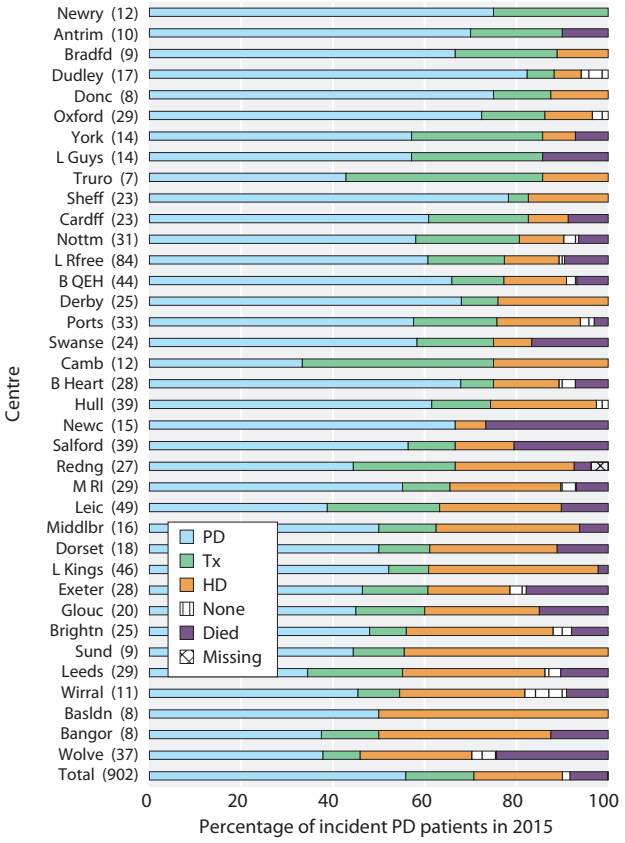

Fig. 10.9. Modality at one year after commencing PD in 2015, by centre

Number of patients receiving PD at each centre in brackets. Centres with 100% missing treatment data at one year (12 centres) or fewer than five PD patients (one centre) were excluded. Centres are sorted by decreasing proportion of patients transplanted or remaining on PD

PD – peritoneal dialysis; HD – haemodialysis; Tx – transplanted; None – not receiving RRT (e.g. conservative care, recovered)

Figure 10.15 shows cause of catheter failure within one year of initiating dialysis for the 166 failed PD catheters reported in the one-year PD follow-up audit (patients incident to dialysis in 2015). The small number of failed catheters increases the likelihood that differences in cause of failure between subgroups were due to chance. Patients undergoing surgical and non-surgical PD catheter insertion were also likely to differ in ways that influenced the likelihood of catheter failure.

Discussion

This audit shows, once again, that rates of definitive dialysis access amongst both incident and prevalent patients were below Renal Association audit standards. A small number of centres achieved high rates of definitive dialysis access for incident and prevalent dialysis recipients, demonstrating that the audit standards are attainable.

Several factors have recurrently been shown to associate with definitive dialysis access. Timely presentation to a nephrologist and referral to a dialysis access surgeon were associated with higher rates of definitive dialysis access use. Most patients who only meet a nephrologist for the first time within three months of starting dialysis commenced HD via a NTL/TL. However, a substantial proportion of patients known to a nephrologist for more than three months also commenced HD via a NTL/TL, and indeed conversion from a NTL/TL to definitive access by three months was infrequent in most centres. One in four individuals who initiated dialysis with a NTL died within three months. The contributions of acute renal pathology, comorbid illness and access complications to these deaths cannot be quantified with these data.

The need to begin access planning early is confirmed by the observation that most individuals who had access attempted more than a year before initiating HD started with an AVF/AVG. A small number of centres secured definitive access within three months for late-presenting patients, achieved for most through PD. No clinical practice guideline exists to drive rapid placement of definitive access amongst late presenting individuals, but centres achieving this have, by definition, responsive dialysis access pathways. Most commonly, responsive PD access pathways were achieved using a predominantly percutaneous rather than surgical catheter insertion approach. This is logical, since this is generally performed under local anaesthetic, avoiding the requirement for both a pre-operative assessment and operating theatre time. An increasing number of centres were performing percutaneous catheter insertion. Some centres were able to achieve surgical vascular access for a substantial proportion of late-presenting patients. Efforts to better understand practice patterns that enhance the responsiveness of vascular and PD access services are needed. Results from the UK Peritoneal Dialysis Outcomes and Practice Patterns Study (PDOPPS) Catheter Study are awaited [3]. A national survey of HD access in the UK by the British Renal Society Vascular Access Special Interest Group showed that the infrastructure to support delivery of quality vascular access is in place in most centres [4]. This would suggest that there are other factors that determine how effectively patterns of practice can achieve successful outcomes. Further work to improve

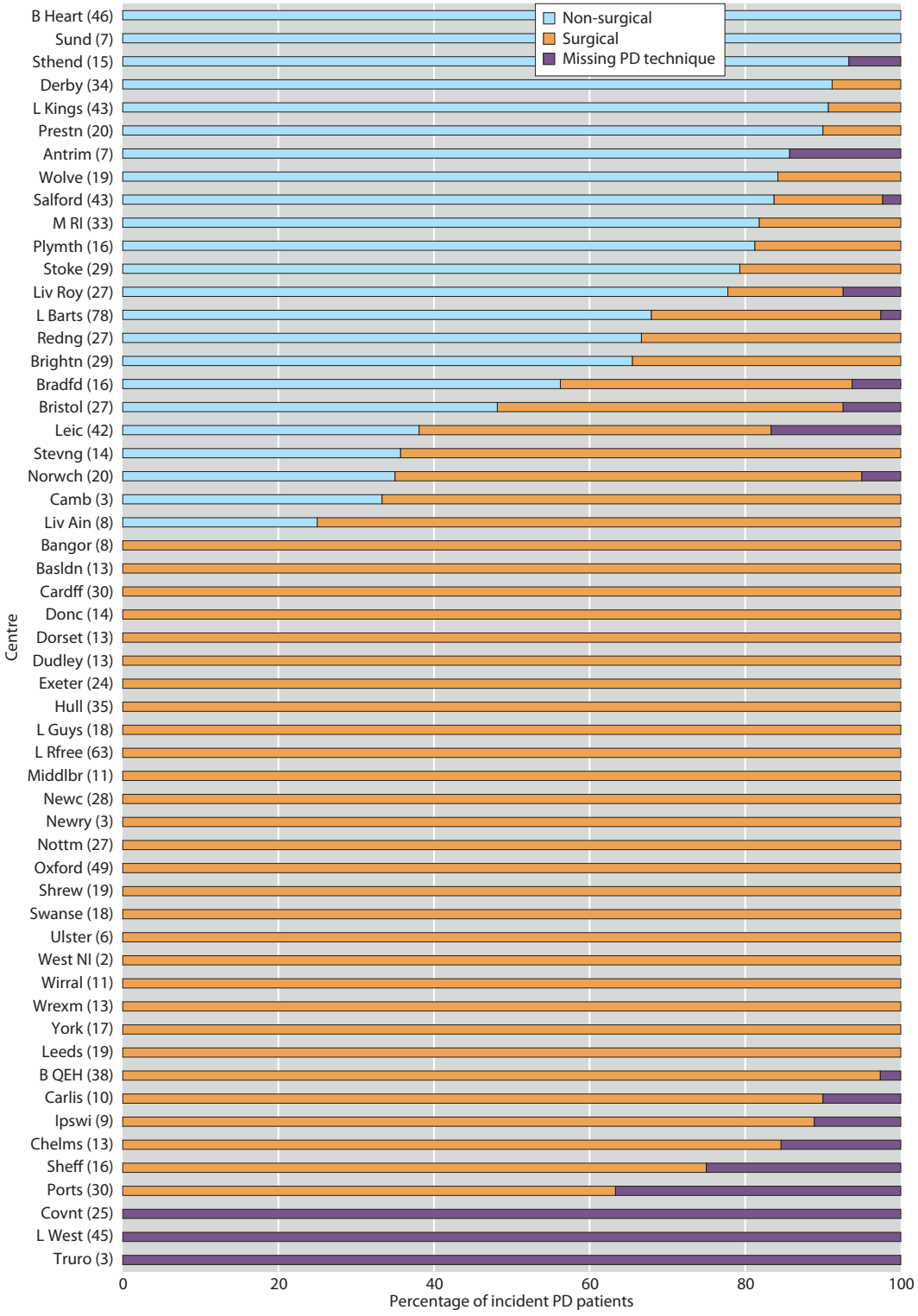

Fig. 10.10. PD catheter insertion technique (surgical vs non-surgical) stratified by centre for patients in the 2016 Multisite Dialysis Access Audit

Number of patients receiving PD at each centre in brackets. Four centres reporting fewer than five patients on PD were excluded from this analysis. Due to small numbers in the subcategories of surgical insertion techniques, open and laparoscopic insertions are grouped as 'surgical'; peritoneoscopic and percutaneous as 'non-surgical'

PD – peritoneal dialysis

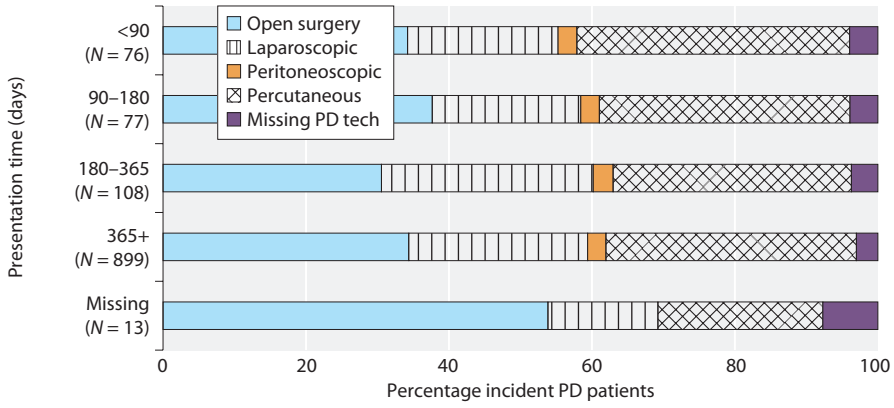

Fig. 10.11. PD catheter insertion technique by referral time (days) for patients in the 2016 Multisite Dialysis Access Audit

Number of patients in each category in brackets. Referral time was measured between first nephrology input (inpatient/outpatient) and initiating dialysis

PD – peritoneal dialysis

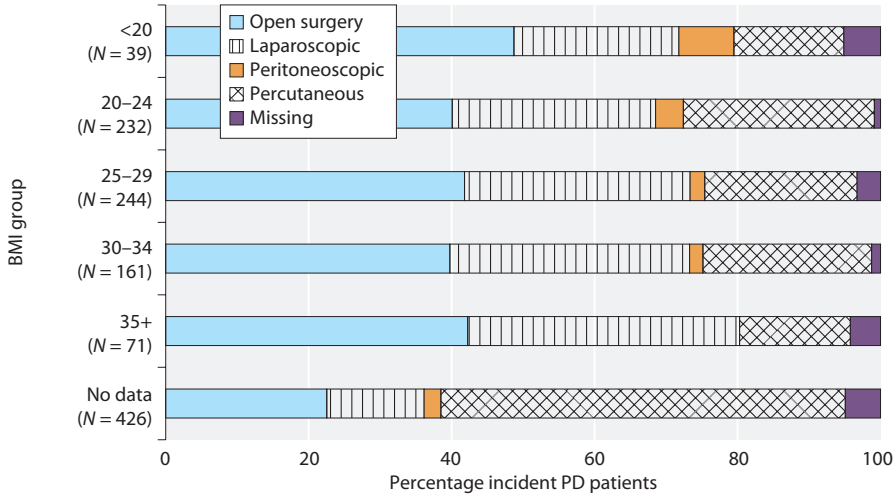

Fig. 10.12. Percentage of incident PD patients by catheter insertion technique and BMI group for patients in the 2016 Multisite Dialysis Access Audit

Number of patients in each category in brackets. 17 centres were excluded from this analysis due to >50% of missing data for BMI

PD – peritoneal dialysis; BMI – body mass index

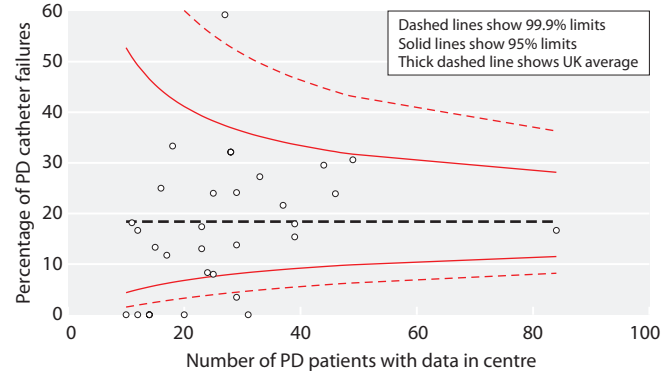

Fig. 10.13. Funnel plot of the percentage of PD catheter failures within one year of start date for patients incident to PD in 2015

Twelve centres did not return data for the one year follow-up

PD – peritoneal dialysis

compliance with Renal Association standards is highly recommended.

It has been suggested that lower rates of definitive dialysis access in some centres may be a result of higher rates of PTx because transplanted patients may otherwise have started dialysis with definitive access. This hypothesis is not supported by the data presented.

The UKRR has an important role in monitoring the quality of planned and unplanned RRT provision and informing guidance and practice improvement. Wide variation in practice reflects the absence of a cohesive approach, despite national guidance. The insights gained from the inclusion of information about all three RRT modalities in this chapter reflect the importance of a comprehensive approach in the exploration of trends in RRT access provision. Once again, this year's Multisite

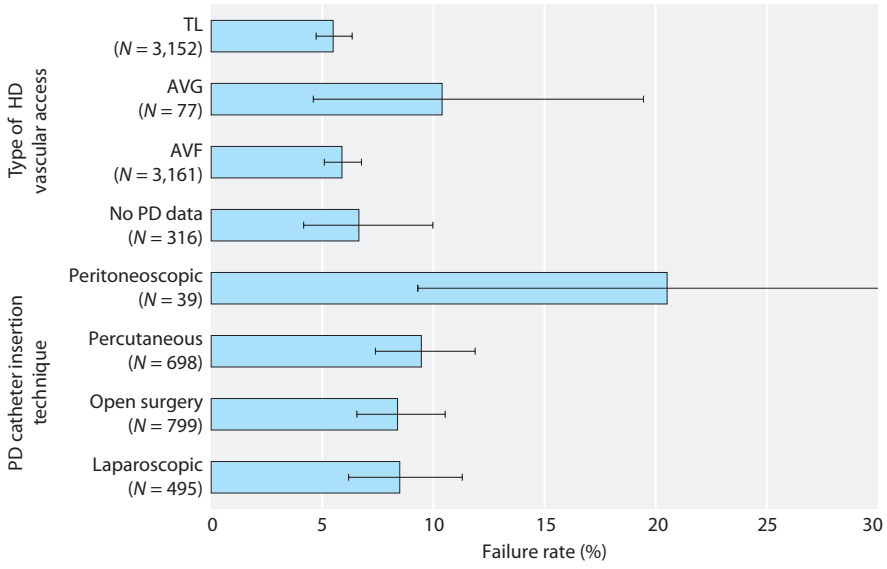

Fig. 10.14. Percentage of patients experiencing failure of first access within three months, by type of first access, for patients in the 2015 and 2016 Multisite Dialysis Access Audits
HD – haemodialysis; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line

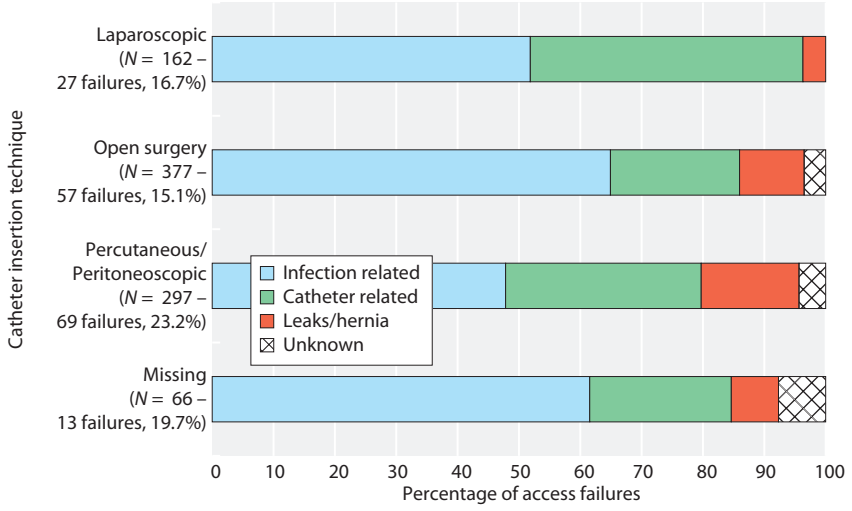

Fig. 10.15. Percentage of PD catheter access failures within one year of starting dialysis, from PD follow-up data, 2016
PD – peritoneal dialysis

Dialysis Access Audit identifies the need for an improved understanding of what drives heterogeneity in access practice along with approaches to standardise and enhance care.

Acknowledgement

Thanks are expressed to all renal centres for their assistance in providing the data.

Conflicts of interest: the authors declare no conflicts of interest

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UK Renal Registry 20th Annual Report: Chapter 11 Clinical, Haematological and Biochemical Parameters in Patients on Renal Replacement Therapy in Paediatric Centres in the UK in 2016: National and Centre-specific Analyses

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Keywords
Adolescents · Biochemical variables · Blood pressure · Body mass index · Children · Dialysis · Established renal failure · Growth · Haemoglobin · Height · Hypertension · Paediatric · Quality improvement · Renal replacement therapy · Transplant · Weight · Young adults

Summary

- In 2016, the median height z-score for prevalent paediatric patients on dialysis was −1.8 and −1.1 for those with a functioning transplant ($p < 0.0001$).
- The median weight z-score for children receiving dialysis in 2016 was −1.2 compared with −0.2 for children with a functioning transplant.
- The median systolic blood pressure (SBP) z-score for transplanted children was 0.3 compared with 0.9 for dialysis patients ($p < 0.0001$).
- Of those with complete data, 72% of the prevalent paediatric renal replacement therapy (RRT) population in 2016 had one or more risk factors for cardiovascular disease; 6% had three risk factors present.
- All centres reported quarterly laboratory data in 2016. Quarterly data for transplant patients revealed a median creatinine of 77 μmol/L. Data for dialysis patients revealed median values within the normal range for most biochemical and laboratory parameters, however wide inter-centre variation was seen for parameters such as ferritin and phosphate. Evidence of hyperparathyroidism (median parathyroid hormone (PTH) 16.5 pmol/L) was noted within this cohort.
- Most (91%) prevalent transplant patients achieved the national haemoglobin standard in 2016: 86% had a normal range bicarbonate level and 81% had a PTH within acceptable range.
- For prevalent patients on haemodialysis in 2016, 56% achieved SBP values of less than the 90th percentile. Achievement of standards was 71%,

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79%, 54% and 41% for haemoglobin, calcium, phosphate and PTH respectively.
- For prevalent patients on peritoneal dialysis in 2016, 65% achieved SBP values of less than the 90th percentile. Achievement of standards was 77%, 69%, 59% and 35% for haemoglobin, calcium, phosphate and PTH standards respectively.

Introduction

This chapter focuses on the following variables for the prevalent paediatric dialysis and transplantation cohort on 31 December 2016:

1. The completeness of data returns to the UK Renal Registry (UKRR)
2. Anthropometric characteristics and growth
3. Cardiovascular risk factors (CVRFs)
4. Laboratory, clinical and biochemical indices relevant to the management of established renal failure.

Analyses are reported for prevalent patients aged <18 years managed in paediatric centres receiving chronic RRT for the year 2016 and for the time period 2002–2016 (inclusive).

Methods

Processes for data collection for the paediatric UKRR are described in chapter 4. The data presented in this chapter relate to the annual census date of 31 December 2016.

Standards and standardisation

Standards are in bold text and are from the Renal Association's (2002) Treatment of adults and children with renal failure: standards and audit measures (third edition) [1], unless otherwise stated.

Data for height, weight, body mass index (BMI) and SBP vary with age, sex and size and are therefore 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, weight and body mass index in childhood varies with gender and age. BMI was calculated using the formula BMI = weight (kg)/height^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 in this report describe the achievement of values at or below the 90th percentile. Guidance for blood pressure in paediatric renal transplant patients was based on 2011 British Association for Paediatric Nephrology recommendations [4].

The reference range for SBP varies with gender, age and height. The data are 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 children at risk of secondary dyslipidaemias including those with chronic kidney disease (CKD) [6]. Given the potential long-term cardiovascular benefit and minimal harm associated with testing, this recommendation was endorsed by the Kidney Disease Improving Global Outcomes (KDIGO) working group. Their 2013 clinical guidance on lipid management recommends annual measurement of fasting lipid levels in children with CKD, including those on RRT [7]. Both organisations consider a high total cholesterol as $\geqslant$5.2 mmol/L [6]. This cut-off has been adopted for this report.

Haemoglobin and Ferritin

The National Institute for Health and Care Excellence (NICE) guidance on the management of anaemia in adults and children with CKD was updated in 2015 and was used to describe haemoglobin (Hb) findings for this report [8].

'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.'

New recommendations suggest that ferritin alone is insufficient for assessment of iron deficiency status. Isolated serum ferritin however may be used to guide maximum iron levels.

'Do not request transferrin saturation or serum ferritin measurement alone to assess iron deficiency status in people with anaemia of CKD.'

'In people treated with iron, serum ferritin levels should not rise above 800 micrograms/litre. In order to prevent this, review the dose of iron when serum ferritin levels reach 500 micrograms/litre.'

Table 11.1. Summary of relevant biochemical clinical audit measures

	Age (years)			
Parameter	<1	1–5	6–12	>12
Hb (g/L)	Maintain 95–115 if aged <2 years	Maintain 100–120 if aged >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
PTH (individual centre)	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			

Hb – haemoglobin; PTH – parathyroid hormone

In view of this, the reporting of ferritin in relation to the recognition of anaemia has been removed from this year's report. Quarterly ferritin data by centre is reported; this should only be interpreted in the context of maximum iron levels. Hb and ferritin were analysed using age-related laboratory reference ranges as in table 11.1.

Calcium, phosphate and parathyroid hormone

'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.'

Calcium, phosphate and PTH were analysed using age-related laboratory reference ranges as in table 11.1. Individual variable data analysis has been performed by centre and nationally. It should be noted that 'normal' growth is difficult to determine in relation to paediatric established renal failure (ERF).

Bicarbonate

'Serum bicarbonate concentrations should be between 20 and 26 mmol/L.'

Bicarbonate reference ranges varied by centre and are reported as within or outside the reference range as given in table 11.1.

Cardiovascular risk factors (CVRFs)

A cross-sectional assessment of the prevalence of risk factors for cardiovascular disease in paediatric patients with ERF was performed. Risk factors described include hypertension, overweight/obesity and hypercholesterolaemia. Evidence pertaining to childhood CVRFs and their association with long-term cardiovascular risk is available from The National Heart Lung and Blood Institute [6].

Statistical analyses

Annual and quarterly clinical and laboratory data have been analysed separately, with annual data being used unless stated otherwise. Data were analysed to calculate summary statistics (maximum, minimum, mean and median values in addition to standard deviation and interquartile 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. Centre-specific data for each UK paediatric nephrology centre is presented where completeness reaches at least 50%.

Estimated glomerular filtration rate (eGFR) was calculated using the updated 'bedside' Schwartz formula [9], using centre-specific individual correction factors submitted to the UKRR. Caution should be taken when interpreting results based on a single annual measurement per patient. Furthermore, additional factors that may impact the analysis include the assays used by centres and timing of blood results in relation to RRT. All analyses were performed using SAS 9.3.

Results

Data completeness

Annual data

Tables 11.2 and 11.3 show the completeness of annual data returns for transplant and dialysis prevalent patients in 2016.

Data returns for 2016 were lower than previous years for key variables such as height, weight and systolic blood pressure in both transplant and dialysis patients. As in previous years, transplant patients tended to have better data completeness for these variables, although this too has fallen. Haematological and biochemical parameters collected (including haemoglobin, creatinine, bicarbonate and PTH) had >90% completeness overall for both groups of patients. In 2016, completeness of erythropoietin stimulating agent (ESA) and IV iron use was extremely poor, with many sites not submitting any data. Analyses including these variables have therefore been removed from this year's report. Growth hormone use (data not shown) had 18% completeness and was also omitted from analyses.

Table 11.2. Percentage data completeness for transplant patients <18 years old by centre for each variable and total number of patients per centre on 31/12/2016, (annual data return)

	Transplant patients														
Centre	*N*	Height	Weight	BMI	SBP	Hb	Creat	Ferr	ESA	IV iron	Chol	Bicarb	PTH	Ca	Phos
Bham_P	89	82.0	82.0	82.0	84.3	93.3	97.8	49.4	0.0	0.0	65.2	96.6	93.3	97.8	97.8
Blfst_P	22	95.5	100.0	95.5	95.5	90.9	90.9	81.8	90.9	90.9	86.4	90.9	86.4	90.9	90.9
Brstl_P	40	95.0	97.5	92.5	97.5	100.0	100.0	67.5	100.0	100.0	60.0	97.5	77.5	100.0	100.0
Cardf_P	26	88.5	92.3	84.6	92.3	96.2	96.2	88.5	7.7	7.7	84.6	96.2	88.5	96.2	96.2
Glasg_P	43	100.0	100.0	100.0	100.0	86.1	86.1	62.8	100.0	100.0	44.2	86.1	83.7	86.1	86.1
L Eve_P	80	98.8	98.8	98.8	97.5	98.8	98.8	73.8	0.0	0.0	87.5	98.8	98.8	98.8	98.8
L GOSH_P	147	98.0	97.3	93.9	99.3	96.6	96.6	81.6	0.0	0.0	66.7	96.6	94.6	96.6	96.6
Leeds_P	69	89.9	95.7	89.9	95.7	98.6	98.6	87.0	98.6	98.6	53.6	98.6	91.3	98.6	97.1
Livpl_P	46	95.7	95.7	95.7	95.7	100.0	100.0	97.8	0.0	0.0	80.4	100.0	93.5	100.0	100.0
Manch_P	63	0.0	0.0	0.0	98.4	98.4	98.4	68.3	0.0	0.0	71.4	98.4	96.8	98.4	98.4
Newc_P	27	96.3	96.3	96.3	96.3	100.0	100.0	77.8	0.0	0.0	66.7	100.0	85.2	100.0	100.0
Nottm_P	77	93.5	100.0	93.5	89.6	100.0	100.0	87.0	98.7	98.7	87.0	100.0	83.1	98.7	98.7
Soton_P	26	92.3	96.2	92.3	88.5	92.3	96.2	92.3	96.2	96.2	76.9	92.3	92.3	92.3	92.3
UK	**755**	**86.0**	**87.6**	**84.9**	**94.8**	**96.7**	**97.4**	**76.6**	**36.3**	**36.3**	**70.7**	**97.0**	**91.1**	**97.1**	**97.0**

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

Table 11.3. Percentage data completeness for dialysis patients <18 years old by centre for each variable and total number of patients per centre on 31/12/2016, (annual data return)

	Dialysis patients													
Centre	*N*	Height	Weight	BMI	SBP	Hb	Ferr	ESA	IV iron	Chol	Bicarb	PTH	Ca	Phos
Bham_P	23	87.0	91.3	87.0	95.7	95.7	91.3	0.0	0.0	91.3	95.7	95.7	95.7	95.7
Blfst_P	8	100.0	100.0	100.0	100.0	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
Brstl_P	15	100.0	100.0	100.0	100.0	100.0	100.0	100.0	93.3	73.3	100.0	100.0	100.0	100.0
Cardf_P	9	88.9	100.0	88.9	88.9	100.0	100.0	0.0	0.0	66.7	100.0	100.0	100.0	100.0
Glasg_P	17	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	58.8	100.0	100.0	100.0	100.0
L Eve_P	28	64.3	78.6	60.7	57.1	92.9	89.3	0.0	0.0	14.3	89.3	92.9	92.9	92.9
L GOSH_P	37	83.8	89.2	81.1	91.9	100.0	78.4	0.0	0.0	48.7	100.0	100.0	100.0	100.0
Leeds_P	12	75.0	100.0	75.0	100.0	100.0	91.7	100.0	100.0	83.3	100.0	100.0	91.7	100.0
Livpl_P	9	88.9	88.9	88.9	88.9	88.9	88.9	0.0	0.0	33.3	88.9	88.9	88.9	88.9
Manch_P	25	0.0	0.0	0.0	100.0	100.0	100.0	0.0	0.0	64.0	100.0	100.0	100.0	100.0
Newc_P	5	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0	40.0	100.0	80.0	100.0	100.0
Nottm_P	17	52.9	82.4	52.9	58.8	100.0	94.1	100.0	100.0	64.7	100.0	94.1	100.0	100.0
Soton_P	4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	50.0	100.0	100.0	100.0	100.0
UK	**209**	**72.7**	**80.4**	**71.8**	**88.0**	**97.6**	**91.9**	**34.5**	**34.0**	**57.9**	**97.1**	**96.7**	**97.1**	**97.6**

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

Quarterly data

All thirteen centres supplied quarterly 2016 data to the UKRR. Completeness of these data is shown for transplant patients in table 11.4 and dialysis patients in table 11.5. PTH and ferritin were not used widely in transplant patients and therefore have been omitted from the table.

Growth

Height

Figures 11.1 and 11.2 demonstrate that children receiving RRT were shorter for their age and gender than the general childhood population; this was particularly pronounced for children on dialysis. The transplant median height z-score (shown by the dotted line)

Table 11.4. Percentage data completeness for transplant patients <18 years old by centre reporting quarterly laboratory data and total number of patients per centre on 31/12/2016

	Transplant patients					
Centre	*N* patients	Creatinine	Hb	Calcium	Phosphate	Bicarbonate
Bham_P	89	90.2	55.2	90.2	90.2	89.6
Blfst_P	22	89.9	87.3	89.9	89.9	89.9
Brstl_P	40	94.0	90.6	87.9	87.9	85.9
Cardf_P	26	94.8	93.8	93.8	92.7	90.6
Glasg_P	43	82.8	82.8	82.8	82.8	82.8
L Eve_P	80	98.1	97.1	98.1	98.1	98.1
L GOSH_P	147	94.5	93.7	94.3	93.7	93.0
Leeds_P	69	95.7	95.7	93.3	93.3	95.3
Livpl_P	46	100.0	98.9	100.0	100.0	100.0
Manch_P	63	98.7	99.2	98.7	98.3	98.7
Newc_P	27	95.5	92.1	95.5	95.5	94.4
Nottm_P	77	90.2	86.7	86.4	86.0	86.4
Soton_P	26	94.6	76.3	80.6	78.5	80.6
UK	**755**	**94.0**	**88.3**	**92.5**	**92.2**	**92.1**

Hb – haemoglobin

Table 11.5. Percentage data completeness for dialysis patients <18 years old by centre reporting quarterly laboratory data and total number of patients per centre on 31/12/2016

	Dialysis patients						
Centre	*N* patients	Hb	Ferritin	Calcium	Phosphate	PTH	Bicarbonate
Bham_P	23	69.8	75.0	92.7	92.7	88.5	92.7
Blfst_P	8	87.9	87.9	87.9	87.9	81.8	87.9
Brstl_P	15	89.2	78.5	89.2	89.2	87.7	89.2
Cardf_P	9	100.0	97.3	100.0	100.0	97.3	100.0
Glasg_P	17	95.1	88.5	91.8	91.8	91.8	95.1
L Eve_P	28	88.3	87.2	90.4	90.4	90.4	89.4
L GOSH_P	37	98.5	59.4	98.5	98.5	97.7	98.5
Leeds_P	12	100.0	91.8	98.0	100.0	98.0	100.0
Livpl_P	9	100.0	100.0	100.0	100.0	23.7	100.0
Manch_P	25	100.0	100.0	100.0	100.0	100.0	100.0
Newc_P	5	100.0	89.7	100.0	100.0	96.6	100.0
Nottm_P	17	98.4	93.5	98.4	98.4	93.5	98.4
Soton_P	4	95.7	95.7	100.0	100.0	100.0	100.0
UK	**209**	**93.2**	**84.5**	**95.7**	**95.9**	**90.6**	**96.1**

Hb – haemoglobin; PTH – parathyroid hormone

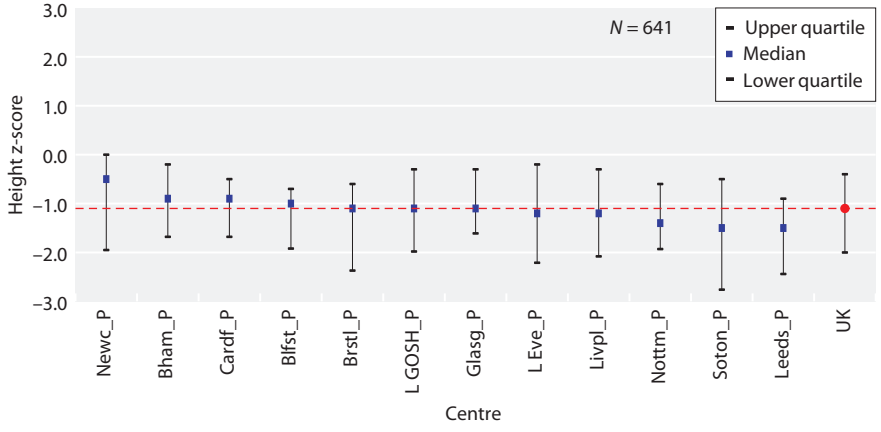

Fig. 11.1. Median height z-scores for transplant patients <18 years old on 31/12/2016, centre specific and national averages

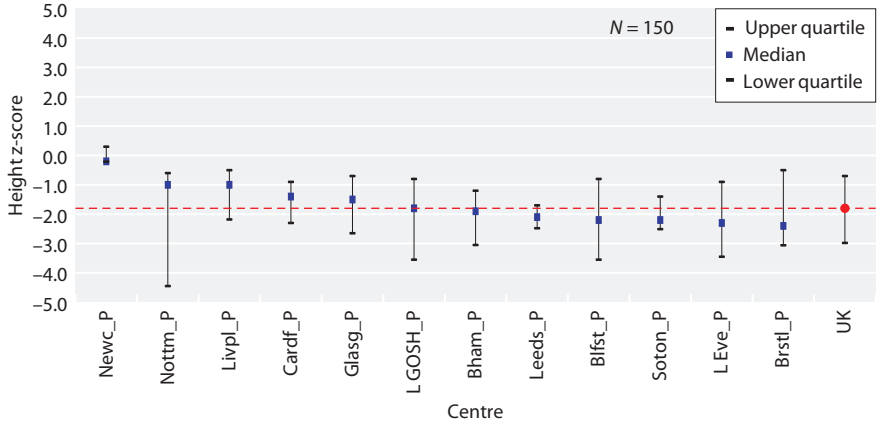

Fig. 11.2. Median height z-scores for dialysis patients <18 years old on 31/12/2016, centre specific and national averages

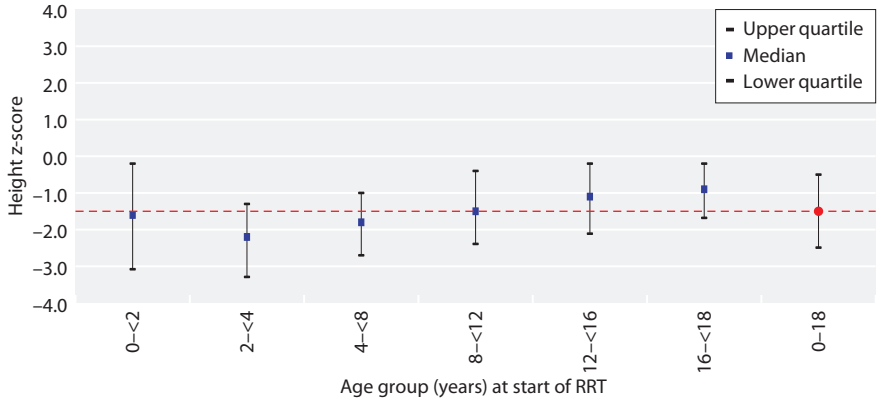

Fig. 11.3. Median height z-scores at start of RRT for patients <18 years old between 2002 and 2016, by age at start

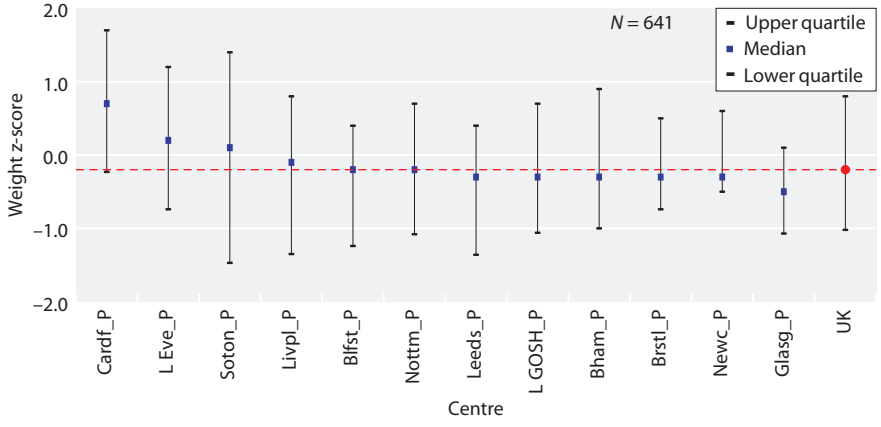

Fig. 11.4. Median weight z-scores for transplant patients <18 years old on 31/12/2016, centre specific and national averages

was −1.1 and the dialysis median z-score was −1.8 ($p < 0.0001$). Manchester was excluded from both analyses as no 2016 data were submitted to the UKRR for analysis. Examining height z-score at start of RRT (figure 11.3) suggests that children of all age groups were short for their age and height, with an overall median height z-score of −1.5. As in previous years, younger children, particularly two to less than four year olds, appeared worse off compared with older age-groups.

Weight

Figure 11.4 shows that paediatric patients with a functioning transplant had a relatively normal weight z-score for age and gender despite a shorter height: overall median z-score was −0.2. Dialysis patients however had a lower weight for age and gender with a median z-score of −1.2 (figure 11.5), although small numbers hamper further inter-centre analysis. This difference in weight was significant when compared between modality groups ($p < 0.0001$).

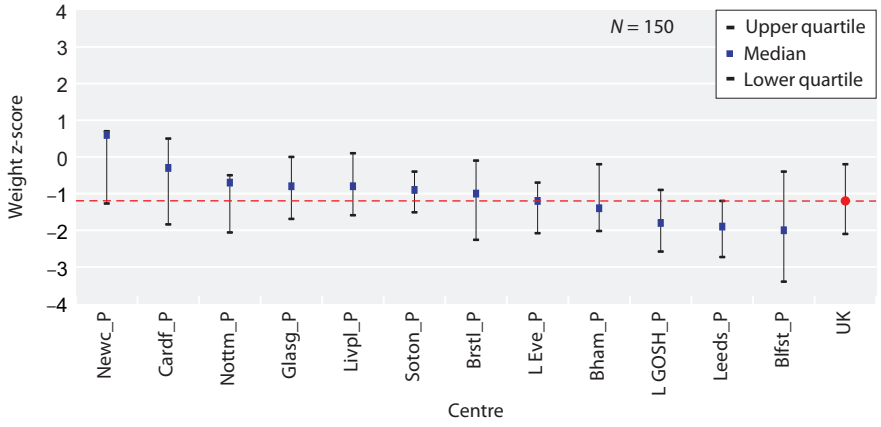

Fig. 11.5. Median weight z-scores for dialysis patients <18 years old on 31/12/2016, centre specific and national averages

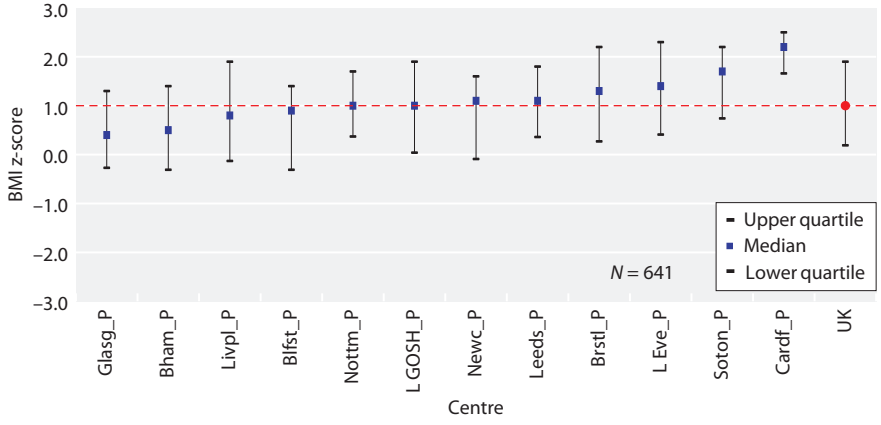

Fig. 11.6. Median BMI z-scores for transplant patients <18 years old on 31/12/2016, centre specific and national averages

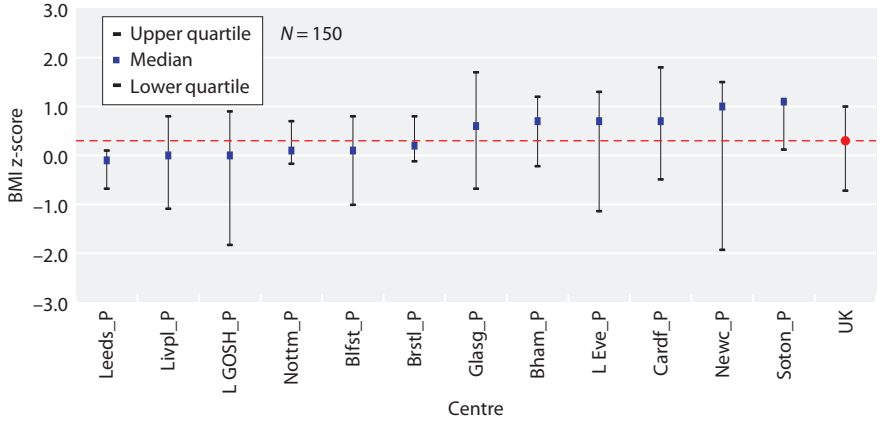

Fig. 11.7. Median BMI z-scores for dialysis patients <18 years old on 31/12/2016, centre specific and national averages

Cardiovascular risk factor evaluation

Obesity

Examination of BMI by height-age and gender revealed that children in 2016 with functioning transplants had a significantly higher BMI than those receiving dialysis. The median z-score for the respective groups was 1.0 in the transplant group (figure 11.6) and 0.3 in the dialysis group (figure 11.7; $p < 0.0001$): both median scores fall within the 'normal' BMI category. Manchester was excluded from this analysis given the lack of available height data.

Analysing BMI category by modality, over half of children with transplants (56.6%) and over three-quarters of dialysis patients (76.7%) were classified as having a normal BMI (figure 11.8). Small numbers of patients within both groups were deemed underweight (<5%). A much larger proportion of children with a functioning transplant were found to be overweight or obese,

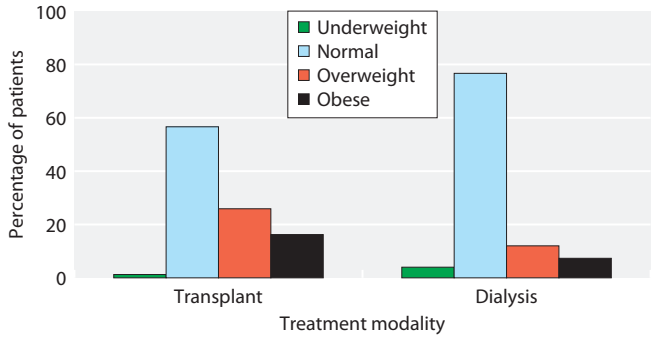

Fig. 11.8. BMI categorisation in children <18 years old by modality on 31/12/2016

compared with those on dialysis (42.2% vs 19.3% respectively, $p < 0.0001$).

Increasing age was associated with higher rates of overweight and obese BMI when analysed using the Mantel-Haenszel method ($p = 0.003$ data not shown). There were no significant differences seen by sex, ethnicity or transplant donor type when comparing proportions of underweight/normal BMI with overweight or obese categories.

Hypertension

Figures 11.9 and 11.10 display median systolic blood pressure (SBP) z-scores by centre for paediatric transplant and dialysis patients respectively, compared with the healthy population. Manchester was excluded from both analyses due to a lack of the 2016 height data needed for standardisation. London Evelina was excluded from figure 11.10 as less than 50% of patients had available data for both SBP and height variables. In 2016, transplant patients had a relatively normal SBP z-score of 0.3; interquartile ranges for only two centres crossed the 90th centile, while over half spanned zero. Compared with transplant patients, dialysis patients had a significantly higher median SBP z-score of 0.9 ($p < 0.0001$), with wide inter-centre variability seen due to the small numbers.

When auditing achievement of SBP standard by modality, a target blood pressure of less than the 90th percentile was achieved in 84.3%, 65.2% and 55.6% of patients with a functioning transplant, on peritoneal dialysis and on haemodialysis respectively. Small numbers precluded further analysis by strata. This

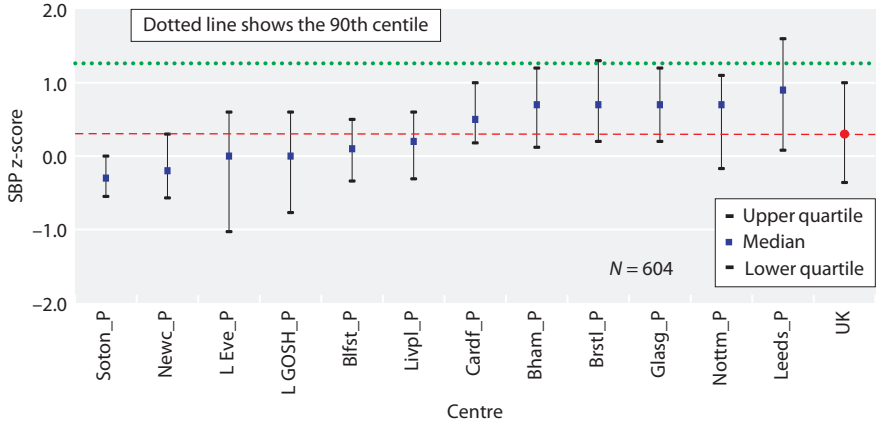

Fig. 11.9. Median SBP z-scores for transplant patients <18 years old on 31/12/2016, centre specific and national averages

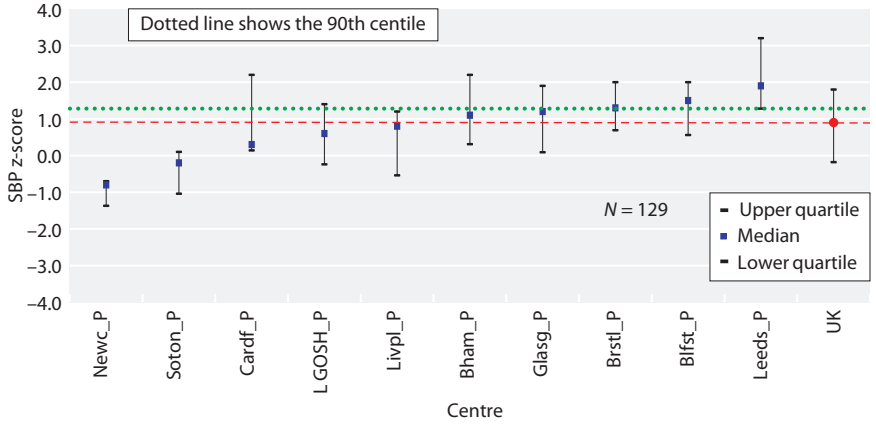

Fig. 11.10. Median SBP z-scores for dialysis patients <18 years old on 31/12/2016, centre specific and national averages

Table 11.6. Percentage of patients <18 years old achieving the standard for SBP on 31/12/2016

	N	% below 90th percentile	*p*-value
Total	733	80.1	
Age group (years)			0.04
0– <5	84	70.2	
5– <12	291	79.0	
12– <16	237	81.9	
16– <18	121	86.0	
Gender			0.7
Male	462	80.5	
Female	271	79.3	
Ethnicity			0.04
Black	33	75.8	
Other	58	77.6	
South Asian	105	71.4	
White	526	83.1	
RRT modality			<0.0001
Dialysis	129	60.5	
Transplant	604	84.3	

difference was significant between transplant and dialysis patients (table 11.6, $p = <0.0001$). Analysing SBP within the total prevalent RRT cohort, significant differences were seen by age and ethnicity. Older children were more likely to achieve the SBP standard compared with younger children, this difference persisted ($p = 0.002$) when analysing only children with a functioning transplant; small dialysis numbers prohibited a comparable analysis. Differences between ethnic groups were also seen. White patients were more likely to achieve the SBP standard (83.1%), whilst South Asian patients were least likely (71.4%). No differences were seen when SBP was analysed by dialysis modality or transplant donor type.

Prevalence of cardiovascular risk factors

Table 11.7 demonstrates the proportion of prevalent RRT patients with identified CVRFs: this analysis was restricted to the 553 of 964 (57.4%) patients with data for all three risk factors. Of those with complete data, over a quarter of patients (27.7%) had no recorded CVRF, 41.4% had one CVRF, with under a third of patients (30.9%) having two or more CVRFs. The most frequently occurring CVRF was high BMI (overweight/obese categories), affecting 40.5% of prevalent patients. There were no statistically significant differences in the number of CVRFs according to age-group, ethnicity or modality.

Laboratory and clinical indices – quarterly data

Tables 11.8 and 11.9 display the median values and interquartile ranges (IQRs) of quarterly laboratory data for prevalent 2016 paediatric transplant and dialysis patients, by centre. For transplant patients, PTH and ferritin data completeness was poor (less than 50% complete for six and 12 paediatric centres respectively), and was therefore omitted from table 11.8. Overall, transplanted paediatric patients continued to demonstrate good renal allograft function with associated satisfactory biochemistry and anaemia control as a result. For dialysis patients, overall median values for haematological parameters and bicarbonate were satisfactory. While overall median values for corrected calcium and phosphate were normal, there was evidence of hyperparathyroidism (median PTH 16.5 pmol/L). Wide variation was noted in median values for ferritin, phosphate and PTH by centre.

Table 11.7. Frequency of number of CVRFs in prevalent RRT patients <18 years on 31/12/2016

Number of CV risk factors	Hypertensive	OW/Obese	Hypercholesterolaemic	*N*	%	Total %
0	No	No	No	153	27.7	27.7
1	Yes	No	No	60	10.8	
	No	Yes	No	99	17.9	41.4
	No	No	Yes	70	12.7	
2	Yes	Yes	No	39	7.1	
	Yes	No	Yes	46	8.3	24.8
	No	Yes	Yes	52	9.4	
3	Yes	Yes	Yes	34	6.1	6.1
N	**179**	**224**	**202**	**553**		
Total %	**32.4**	**40.5**	**36.5**			

CV – cardiovascular; OW – overweight

Table 11.8. Median quarterly laboratory data by centre in prevalent transplant patients <18 years old on 31/12/2016

	Transplant patients				
Centre	Creatinine μmol/L	Haemoglobin g/L	Calcium mmol/L	Phosphate mmol/L	Bicarbonate mmol/L
Bham_P	71	117	2.44	1.34	25
Blfst_P	73	121	2.41	1.23	23
Brstl_P	73	124	2.42	1.24	23
Cardf_P	69	128	2.46	1.27	23
Glasg_P	86	122	2.44	1.24	22
L Eve_P	80	123	2.46	1.20	23
L GOSH_P	79	121	2.42	1.38	23
Leeds_P	94	116	2.51	1.30	26
Livpl_P	80	127	2.34	1.28	23
Manch_P	74	117	2.44	1.26	22
Newc_P	64	121	2.45	1.27	23
Nottm_P	72	122	2.42	1.25	24
Soton_P	91	124	2.50	1.30	24
UK median	**77**	**121**	**2.44**	**1.30**	**23**
IQR	**(59–104)**	**(110–131)**	**(2.37–2.50)**	**(1.13–1.44)**	**(21–25)**

IQR – interquartile range

Table 11.9. Median quarterly laboratory data by centre in prevalent dialysis patients <18 years old on 31/12/2016

	Dialysis patients					
Centre	Haemoglobin g/L	Ferritin μg/L	Calcium mmol/L	Phosphate mmol/L	PTH pmol/L	Bicarbonate mmol/L
Bham_P	111	281	2.55	1.62	10.2	27
Blfst_P	122	717	2.48	1.52	12.9	25
Brstl_P	111	360	2.57	1.30	10.4	25
Cardf_P	129	315	2.62	1.53	35.1	22
Glasg_P	115	249	2.48	1.26	18.1	23
L Eve_P	105	298	2.51	1.40	32.6	23
L GOSH_P	113	229	2.46	1.60	9.1	25
Leeds_P	105	332	2.53	2.10	36.9	24
Livpl_P	107	245	2.55	1.50	13.7	25
Manch_P	107	192	2.62	1.64	19.1	26
Newc_P	110	328	2.57	1.39	6.9	25
Nottm_P	106	276	2.47	1.66	29.6	26
Soton_P	114	163	2.50	1.50	10.7	25
UK median	**111**	**271**	**2.52**	**1.57**	**16.5**	**25**
IQR	**(99–123)**	**(138–484)**	**(2.41–2.63)**	**(1.25–1.90)**	**(6.5–43.4)**	**(23–28)**

PTH – parathyroid hormone; IQR – interquartile range

Table 11.10 demonstrates median eGFR rates for prevalent paediatric transplant recipients by age group and time since transplant. Analysis was performed on 635 of the 755 (84.1%) prevalent transplant patients with height and creatinine data available for 2016. Overall, satisfactory graft function is noted. Younger children tended to have better graft function at any time point post-transplantation compared with older children. By one year, the youngest age group demonstrated an improvement in function, with loss of baseline eGFR ranging between 1.6–11.3% in older age groups. Median eGFR at one year equates to CKD stage 3A for the oldest children, and CKD stage 2 for younger age groups. At five years post-transplantation, loss of baseline eGFR ranges from 5–22.5% (no data available for patients aged 0–5 years). Small numbers however have prevented in-depth statistical analysis of these trends.

Table 11.10. Median estimated glomerular filtration rate (eGFR) by age group and time since transplantation in prevalent transplant patients <18 years old on 31/12/2016

Time since transplantation	Age (years)							
	0–<5		5–<12		12–<16		16–<18	
	N	eGFR	*N*	eGFR	*N*	eGFR	*N*	eGFR
3 months	13	66	32	80	14	64	11	60
1 year	11	83	35	71	24	63	16	57
3 years	9	77	84	67	39	59	22	55
5 years	0		77	62	55	61	25	54
⩾7 years	0		39	60	87	57	42	53
Overall median IQR	**33**	**77 (51–99)**	**267**	**66 (53–84)**	**219**	**59 (45–74)**	**116**	**54 (42–70)**

IQR – interquartile range

Laboratory and clinical indices – annual data

Laboratory data described below are for the prevalent RRT patients aged less than 18 years and managed in paediatric centres in 2016. Achievement of standards was calculated using one value per patient, the most recent value for 2016 was used in each case. Interpretation of inter-centre variation is limited when stratified by RRT modality given the small numbers.

Haemoglobin and ferritin

The proportion of patients with a functioning renal transplant achieving the haemoglobin standard in 2016 was 91.1%, compared with 71% of haemodialysis and 77% of peritoneal dialysis patients. The proportions of transplant and dialysis (both modalities) patients achieving the national haemoglobin standard has been consistent over the last ten years: 72–75% of dialysis patients achieved the standard over this time compared with 92–93% of transplant patients.

Calcium

The proportion of haemodialysis patients under 18 years achieving the calcium standard was slightly higher in 2016 at 79.3% compared to the previous year. Less than 5% of patients were hypocalcaemic and 16% were reportedly hypercalcaemic. Of the peritoneal dialysis cohort, a similar proportion of patients (69.1%) achieved the calcium standard in 2016, compared with the previous year. No PD patients were hypocalcaemic.

Phosphate

Just over half of prevalent haemodialysis and peritoneal dialysis patients achieved the phosphate standard in 2016: 53.8% and 58.8% respectively. Similar proportions of each patient group were hyperphosphataemic (32.1% of HD; 35.1% of PD patients). No differences were seen in attainment of standard by age group.

Parathyroid hormone

Little change was noted in 2016 with regards to the overall attainment of satisfactory PTH values compared with the previous year. The proportion of transplant patients aged <18 years maintaining a PTH within an acceptable range was 80.7%; 19.3% demonstrated evidence of hyperparathyroidism. For HD patients, more patients had hyperparathyroidism (59.1%) than acceptable levels (41%). This trend was similar in PD patients: 64.6% of the cohort had documented hyperparathyroidism, 35.4% achieved the standard.

Bicarbonate

In 2016, 86.2% of prevalent transplant patients, 73.6% of haemodialysis patients and 68% of peritoneal dialysis patients had a bicarbonate level within the agreed standard range. Peritoneal dialysis patients had the highest proportion of patients with levels exceeding the standard (30.9%) compared to 10.4% of HD and 4.9% of transplant patients. Fewer patients were acidotic: the proportion was highest in the HD group (16.0%), followed by transplant recipients (8.9%) and PD patients (1.0%).

Discussion

This chapter offers an insight into the haematological and biochemical management of established renal failure for children aged less than 18 years undergoing RRT in

paediatric centres. Comparison of laboratory and clinical indices in most cases are made by modality type and centre, although small numbers limit in-depth analysis at this level. Furthermore, discrepancies in attainment of nationally agreed standards relevant to the management of ERF will help to identify areas for future quality improvement work. It is hoped that data from this report can continue to support the paediatric nephrology community to improve clinical care and outcomes for patients.

Quarterly data

All centres submitted quarterly data to the UKRR. This serves to strengthen future research, with more timepoints available for analyses of growth and allograft function. Median creatinine data for paediatric transplant patients suggests good overall allograft function, with associated normal range values seen for haematological and biochemistry parameters. Dialysis patients demonstrated good control of anaemia, acidosis and calcium, although wide variation in median phosphate and PTH values were seen across centres. The high median PTH value of 16.5 pmol/L suggests management of hyperparathyroidism remained an ongoing challenge for this cohort. This has improved however from 2015 data (previously 21.0 pmol/L).

Highlights from the 2016 data

Data completeness for 2016 fell, thus hampering the ability to fully report outcomes for all data items collected by the UKRR. Key variables including height, weight and systolic blood pressure were of good completeness. Lack of data was particularly problematic for ESA, IV iron and growth hormone use, as such analyses included in previous years have been removed from this report. Cholesterol was of sufficient completeness to be included in the CVRF analysis. It is difficult to be certain of the reasons for reduced data completeness, but this needs to be explored.

Growth

Height at start of RRT, as well as for prevalent children on RRT in 2016 remained lower than that of the healthy UK paediatric population. This was strongly associated with RRT modality, with dialysis patients demonstrating lower height z-scores than transplanted children.

As expected, younger children at start of RRT tended to fare worse in terms of height z-score compared with older children, although given the small numbers and associated wide interquartile ranges, this was based on the observed trend. It is interesting to note that even young people reaching ERF at the end of adolescence were shorter than their peers (median z-score −0.9), although this observation does not consider duration of kidney disease, primary renal diagnosis or associated extra-renal comorbidity and final height as adults was not known.

In terms of weight, transplant patients had similar z-scores to those seen in the healthy population. Dialysis patients by comparison were underweight, with a median weight z-score of −1.2. As in previous years, a relatively short height with near-normal weight attainment meant that a high proportion of transplanted children were in the overweight or obese BMI range (42.1% vs 19.3% dialysis). Given that being overweight or obese was the most frequently reported cardiovascular risk factor within the paediatric RRT population, further analysis of this population is warranted to understand how this risk can be modified and reduced.

Cardiovascular risk factor evaluation

As in previous years, many prevalent RRT patients have one or more modifiable cardiovascular risk factors. For transplanted children, high BMI appears particularly problematic, with 42.1% of the total cohort reportedly overweight or obese for their height-age. For children receiving dialysis, management of hypertension was a greater issue: only 56% of haemodialysis and 66% of peritoneal dialysis patients achieved a systolic blood pressure below the 90th percentile in 2016. Given that cardiac disease remained one of the most common causes of death for young UK adults with ERF [10], timely consideration and treatment of these risk factors, together with maximizing access to transplantation, is important for the long-term health of this population. It would also be of value to further investigate patient and disease characteristics of children who have no CVRF whilst on RRT.

Laboratory and clinical indices

Attainment of standards for laboratory measures were similar to previous years for both transplant and dialysis patients. The updated 2015 NICE guidance on the management of anaemia in CKD has advised that ferritin alone should not be routinely used to assess iron deficiency status. In view of this, isolated ferritin data has not been interpreted this year in the context of anaemia management, focusing only on assessment of maximum iron levels. In previous years, completeness of ferritin data has been variable by centre and therefore

difficult to interpret; this is likely to reflect alternative methods of anaemia assessment being used in lieu of ferritin. Recommendations now suggest that assessment of anaemia and responsiveness to treatment should be based on the percentage of hypochromic red blood cells (%HRC), reticulocyte haemoglobin content, or transferrin saturation in conjunction with ferritin. Serum ferritin can be used to guide maximum iron levels and IV iron therapy. Information from centres on how best to collect haematological data relating to anaemia management for future reports is welcomed.

Future work

The UKRR has approved the use of data for an analysis of risk factors implicated in the rate of eGFR function decline post-transplantation in paediatric and young adult patients. Additionally, potential quality improvement projects based on findings of previous years' reports have been discussed amongst BAPN members at their 2018 annual meeting. For the UKRR, suggestions on how to improve the process of timely accurate and complete data returns from paediatric centres are welcomed.

Conflicts of interest: the authors declare no conflicts of interest

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UK Renal Registry 20th 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, quality improvement, policy and research. The collection and analysis of sequential biochemical and haematological data is a unique feature of the UKRR.

1.3 The UK Renal Registry Database System Specification (UKRR DSS) 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 per renal patient.

1.6 As part of its core activities, the UKRR provides data to hospital 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, hospital trusts, commissioning authorities, patient groups, researchers and academics.

1.8 The UKRR 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 UKRR.

2.2 The chief executives of hospital 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

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the ERA-EDTA made it impossible to build a picture of the activity of RRT in the UK for planning and policy purposes. Subsequently, national data collections from England and Wales were solicited from renal centres in 1992, 1996, 1999, 2002 and 2004 to fill this gap. The UKRR published its first report in 1998 and through its quarterly returns has established a system to place routine data collection and analysis on a permanent basis. The next stage is in progress incorporating data from the earlier stages of chronic kidney disease and acute kidney injury.

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 publishes 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. The dataset is subject to regular review and a drive is required for more complete data returns by renal centres.

2.7 It can be seen that the need for a RRT registry 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 over 25 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 the earlier UKRR Annual Reports can now be replaced by confident assertions, built on the experience of nineteen 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. Participation is mandated in England through the recommendation in the Renal National Service Framework and the NHS Commissioning document A06 Renal Dialysis. During the earlier years of the UKRR there was a focus on RRT, including transplantation, this now extends to other areas of nephrology. The UKRR provides an independent source of data and analysis on national activity in renal disease.

A:4 Relationships of the UK Renal Registry

4.1 The UKRR 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. The UKRR maintains links

with the Department of Health, the National Kidney Federation (NKF), Kidney Care UK (formerly the British Kidney Patient Association (BKPA)), the Royal Colleges, 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, in particular for data analysis and interpretation for inclusion in the annual reports. Further specialised panels may be developed for publications and the dissemination of UKRR analyses.

4.3 The Scottish Renal Registry sends data to the UKRR for joint reporting and comparison.

4.4 The return of English, Welsh and Northern Irish data to the ERA-EDTA Registry will be through the UKRR. The Scottish Renal Registry already sends data directly to the ERA-EDTA 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 with NHS Blood and Transplant gives joint benefits. Data aggregation and integration has led to joint presentations and publications. The description of the entire patient pathway 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 Health Research Authority's Confidentiality Advisory Group (CAG). This is renewed on an annual basis along with audit of the information governance arrangements within the UKRR through completion of NHS Digital's Information Governance 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 treatment outcomes.

5.2 A patient leaflet and poster produced in collaboration with the NKF and Kidney Care UK are available on the UKRR website (www.renalreg.org), explaining how patients may opt-out of the collection of identifiable data by the UKRR if they wish. This was renewed in 2016 as part of the UKRR's CAG submission. Patient opt-out remains low.

5.3 Information from the UKRR complements the records available on 'PatientView' www.patientview.org.

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 UKRR in issues relating to information governance and patient consent.
- Use personal networks to spread awareness of the UKRR and its work with the council.
- 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 UKRR Committee was disbanded and the UKRR is now governed by the Renal Information Governance Board of the Renal Association.

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.

6.5 Reports of demographic and treatment variables are available to the participating centres for distribution to hospital trusts, strategic 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 to conduct local or national audit and research using the database, further information is available at www.renalreg.org/about-us/working-with-us/. All such projects will need the agreement of the UKRR study group concerned and any costs involved may need to be met by the applicants.

6.8 These facilities will be sustainable only through cooperation 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 hospital 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 Commissioners have confirmed the powerful role accurate data plays in their decisions.

8.2 Schedule 2 of the Renal Dialysis Service Specification states '***The provider will ensure that the required patient, activity and outcomes data are provided in accordance with the requirements of the UKRR***'.

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 incidence 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 2017 the cost of supporting the UKRR core work on RRT, AKI, CKD audit and PatientView was £30 per registered RRT patient per annum, which is less than 0.01% of the typical treatment 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 UKRR audit is listed as an audit of the Healthcare Quality Improvement Partnership national clinical audit programme.

9.2 The demographic, diagnostic and outcomes data can 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.

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UK Renal Registry 20th Annual Report: Appendix B Definitions and Analysis Criteria

B:1 Definition of the incident population

The incident population is defined as all patients aged over 18 who started renal replacement therapy (RRT) at UK renal centres, with the exclusion of patients that recovered their renal function for more than 90 days after having had only a short spell of RRT (<90days).

The treatment timeline is used to define incident patients as follows.

If a patient has timeline entries from more than one centre then these are all combined and sorted by date. The first treatment entry from any centre is then used to determine the first date 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 incident 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 patient is defined as an incident patient (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 then the program looks at the modality codes after this date to see if the patient restarted RRT. If they did, then this second (or third etc.) starting point is defined as their take-on date, providing that they do not have a recovery lasting more than 90 days within 90 days of start. Therefore a patient can appear only once in the incident cohort.

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.

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When quarterly data are 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, aluminium, 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 (unusual) then the choice is made based on the sort order of the centre codes.

In some situations (generally where timeline data is seen to be inaccurate/incomplete) then the centre used is set manually on an ad hoc basis.

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 start date (i.e. the point at which they are defined as an incident patient using the new (from 18th Annual Report) definition – see above). 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 incident 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 2.1mmol/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). A 'funnel' is plotted around the average percentage meeting the target. Any centres which fall outside the funnel 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 a 'funnel' is 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 haemodialysis filtration 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 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 RRT in UKRR analyses remains 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 <15ml/min/1.73m^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 established renal failure)

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.

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UK Renal Registry 20th 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 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.

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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 one of 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 centre 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 20 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. This work includes the management of patients opting for conservative care rather than RRT.
6. Research activities. Many nephrologists have clinical or laboratory-based research interests.

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UK Renal Registry 20th Annual Report: Appendix D Methodology for Analyses of CCG/HB Incidence and Prevalence Rates and of Standardised Ratios

This appendix describes the methods used for calculating the standardised incidence ratios for the incident UK RRT cohort, the standardised prevalence ratios for the total UK RRT cohort and the standardised ratios (SR) 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 rate 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 ratio analyses as there can be small numbers of incident patients particularly in the smaller areas.

Geography

The areas used were the 207 English Clinical Commissioning Groups (CCGs) valid from April 2017, 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 their GP's postcode). For the incidence rate analyses the patients' postcodes at start of RRT were used. For the prevalence rate analyses the postcodes at the end of the latest 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 2017 and also Ordnance Survey data © Crown copyright and database right 2017.

Areas included in the UK Renal Registry 'covered' population

One renal centre (Cambridge) was unable to submit 2015 or 2016 data to the UKRR by the closing of the database. As a consequence, coverage of the UK was complete for only four of the six years used in these analyses (2011–2014 complete, 2015–2016 not complete). CCGs affected by the lack of Cambridge's data have been highlighted in the relevant tables.

The 2011 to 2014 data were used to decide which CCG/HBs should be excluded from the calculation of age and sex standardised incidence rates due to missing patient-level data. Those CCG/HBs where greater than 15% of the incident RRT population from 2011 to 2014 were incident patients of the Cambridge renal centre were not included in the analysis for 2015 or 2016. These CCG/HBs were included for 2011–2014. CCG/HBs where less than 15% of the 2011–2014 data were from Cambridge were included in the analyses and where the percentage was between 5% and 15% are flagged in table 1.3 as their results are likely to be underestimated. Data on

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RRT and transplant prevalent patients in 2014 were used to decide which CCG/HBs should be excluded from the calculation of 2015 and 2016 age and sex standardised prevalence rates on RRT and transplant due to missing patient-level data. The same rules as for the incidence rates were applied for exclusion/inclusion criteria, with CCG/HBs excluded if more than 15% of the relevant prevalent population in 2014 were patients of Cambridge renal centre and CCG/HBs included in the analyses if less than 15% of the 2014 data were from Cambridge (with the CCGs flagged in the relevant tables if the percentage was between 5% and 15% as their results are likely to be underestimated).

Population data

Mid-2016 population estimates by CCG/HB, sex and age group were obtained from the Office for National Statistics (ONS) website (www.ons.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-2016 population estimates are projections based on the 2011 Census data. The CCG/HB populations range from 21,900 (Orkney) to 1.16 million (Greater Glasgow and Clyde).

The analysis for each year uses this mid-2016 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 * (observed number)/(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.

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. generally 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. For the incident analyses, confidence intervals have only been calculated around the overall average for

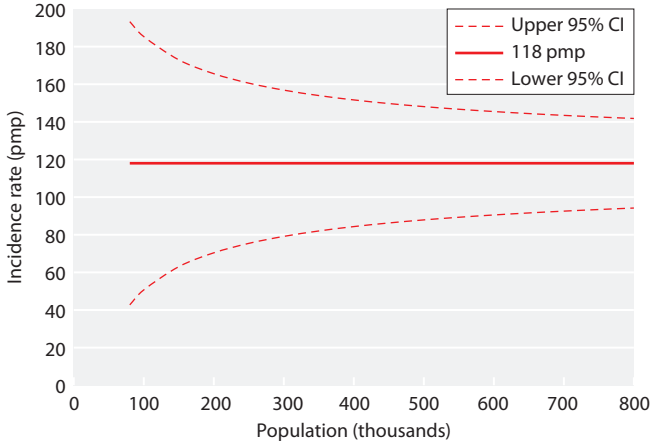

Fig. D.1. 95% confidence limits for incidence rate of 118 pmp for population size 80,000–800,000

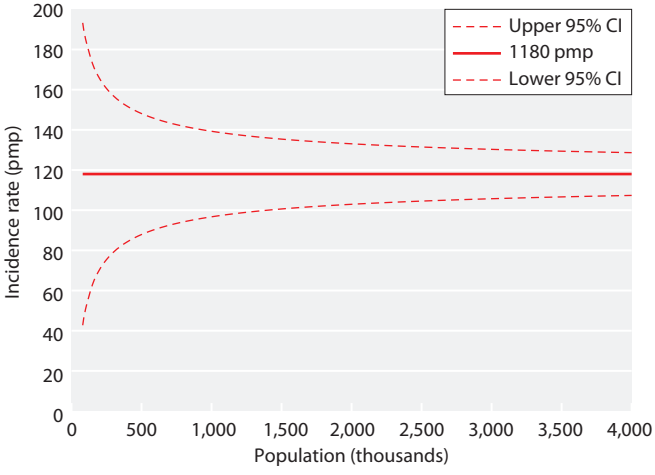

Fig. D.2. 95% confidence limits for incidence rate of 118 pmp for population size 80,000–4 million

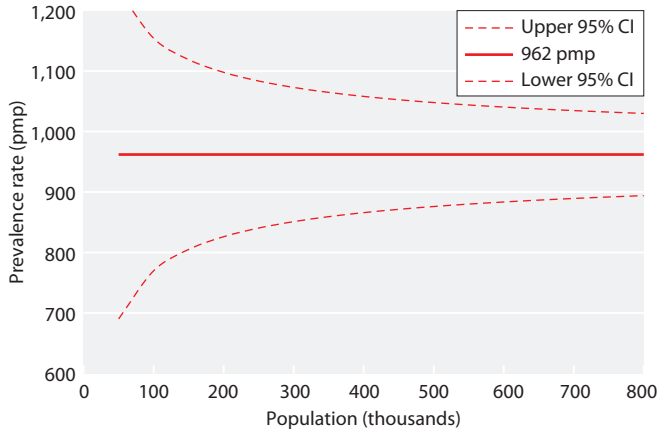

Fig. D.3. 95% confidence limits for prevalence rate of 962 pmp for catchment population size 50,000–800,000

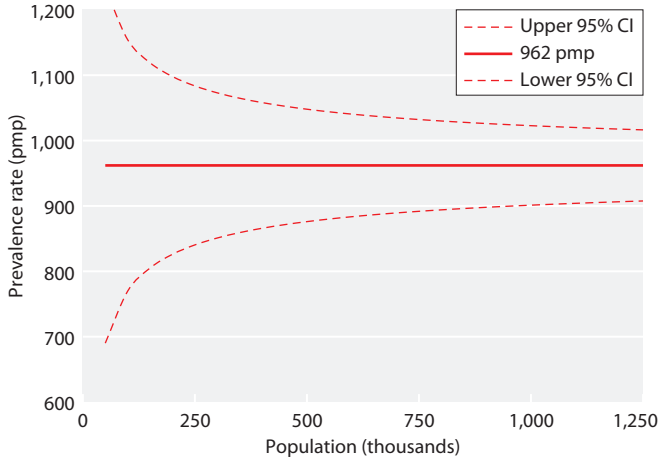

Fig. D.4. 95% confidence limits for prevalence rate of 962 pmp for catchment population size 50,000–1.25 million

populations of over 80,000. This is because below this level the number of cases you would expect per area is low – with low expected numbers the Poisson distribution is skewed and the Normal approximation to it 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 sex groups. As there are also differences in the age/sex breakdowns of the different areas it is useful to produce estimates standardised for age and sex. The method used is *indirect* standardisation.

Observed cases (O_i) were calculated by summing all cases in all age and sex 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/sex band and dividing this by the total covered population in that age/sex band. These crude rates (by age/sex 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/sex bands to give an expected total number of cases in each CCG/HB. The age/sex 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/sex breakdown. Confidence intervals (95%) were calculated for each area using an error factor (EF) as follows:

$$\text{Lower confidence limit} = \text{SR}/\text{EF}$$

$$\text{Upper confidence limit} = \text{SR}^*\text{EF}$$

Where $\text{EF} = \exp(1.96/\sqrt{(O_i)})$.

A SR of one indicates that the area's rate was as expected if the age/sex rates found in the total covered population applied to the CCG/HB area's population structure; a value above one indicates that the observed rate was greater than expected given the area's population structure, if the lower confidence limit was above one this was statistically significant at the 5% level. The converse applies to standardised ratios below 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 notably low or high standardised ratios. This is partly because these ratios have only been adjusted for age and sex and not for ethnicity or any other factors. Higher rates are expected in populations with a high percentage of patients from South Asian or Black backgrounds and so it is hoped that in the future the UKRR will also do analyses further standardised for ethnicity.

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UK Renal Registry 20th 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 Professor 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]. For the 16th Annual 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. For the 17th Annual Report, estimates for renal centres in Scotland and Northern Ireland were calculated thus completing full coverage of the UK.

Methods

The UKRR database of the incident dialysis population between 1 January 2008 and 31 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.

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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 renal centres in England 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 RI	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 renal centres in Wales 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

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UK Renal Registry 20th Annual Report: Appendix F Additional Data Tables for 2016 Incident and Prevalent Patients

F:1 Incident patients starting renal replacement therapy

Table F1.1. Number of patients on dialysis at 90 days (incident cohort 1/10/2015 to 30/09/2016)

	Aged <65		Aged ⩾65	
	HD *N*	PD *N*	HD *N*	PD *N*
England	2,000	756	2,223	534
N Ireland	64	18	96	21
Scotland	217	57	220	33
Wales	123	52	148	24
UK	**2,404**	**883**	**2,687**	**612**

Table F1.2. Number of patients per treatment modality at 90 days (incident cohort 1/10/2015 to 30/09/2016)

	HD	PD	Transplant	Recovered/ discontinued	Died
England	4,223	1,290	597	40	264
N Ireland	160	39	36	5	5
Scotland	437	90	53	0	23
Wales	271	76	22	*	*
UK	**5,091**	**1,495**	**708**	*	*

*Values suppressed due to small numbers (primary or secondary suppression)

Table F1.3. First treatment modality (incident cohort 2012 to 2016)

Centre	% HD	% PD	% transplant	Centre	% HD	% PD	% transplant
England				Prestn	75	15	10
B Heart	75	22	3	Redng	61	32	7
B QEH	74	17	9	Salford	65	26	9
Basldn	*	25	*	Sheff	79	15	6
Bradfd	79	13	8	Shrew	72	26	2
Brightn	72	23	5	Stevng	81	12	7
Bristol	73	18	9	Sthend	72	24	4
Camb	66	10	24	Stoke	74	25	2
Carlis	54	40	6	Sund	84	11	5
Carsh	75	19	5	Truro	77	16	7
Chelms	*	21	*	Wirral	78	19	3
Colchr	100			Wolve	62	37	2
Covnt	68	26	7	York	68	21	10
Derby	57	40	2	**N Ireland**			
Donc	*	23	*	Antrim	*	16	*
Dorset	70	26	4	Belfast	63	12	25
Dudley	*	32	*	Newry	*	30	*
Exeter	75	20	5	Ulster	*	13	*
Glouc	69	28	3	West NI	*	16	*
Hull	63	31	6	**Scotland**			
Ipswi	68	28	4	Abrdn	85	15	
Kent	74	18	8	Airdrie	85	15	
L Barts	67	27	5	D&Gall	63	37	

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Table F1.3. Continued

Centre	% HD	% PD	% transplant	Centre	% HD	% PD	% transplant
L Guys	76	10	15	Dundee	82	18	
L Kings	72	24	3	Edinb	71	11	18
L Rfree	63	28	9	Glasgw	77	11	12
L St.G	78	14	8	Inverns	73	27	
L West	83	8	9	Klmarnk	79	21	
Leeds	70	14	16	Krkcldy	82	18	
Leic	72	18	10	**Wales**			
Liv Ain	74	24	3	Bangor	*	26	*
Liv Roy	61	23	16	Cardff	75	17	9
M RI	65	19	16	Clwyd	*	21	*
Middlbr	80	10	11	Swanse	78	18	3
Newc	72	18	9	Wrexm	70	25	5
Norwch	81	17	3	**England**	**72**	**20**	**8**
Nottm	59	27	13	**N Ireland**	**73**	**16**	**12**
Oxford	62	23	14	**Scotland**	**78**	**15**	**7**
Plymth	67	21	11	**Wales**	**75**	**19**	**6**
Ports	73	18	9	**UK**	**72**	**20**	**8**

*Values suppressed due to small numbers (primary or secondary suppression)
Blank cells – no patients on that modality

Table F1.4. First treatment modality, patient numbers (2016 incident cohort)

	HD	PD	Transplant
England	4,652	1,339	488
N Ireland	165	36	25
Scotland	428	99	32
Wales	284	74	17
UK	**5,529**	**1,548**	**562**

Table F1.5. Gender breakdown by treatment modality at 90 days (incident cohort 1/10/2011 to 30/09/2016)

	HD			PD		
Centre	% male	% female	M : F Ratio	% male	% female	M : F Ratio
England						
B Heart	63	37	1.7	55	46	1.2
B QEH	61	39	1.6	61	39	1.6
Basldn	64	36	1.8	65	35	1.9
Bradfd	63	37	1.7	51	49	1.0
Brightn	64	36	1.8	68	32	2.1
Bristol	66	34	1.9	71	29	2.4
Camb	71	29	2.4	80	21	3.9
Carlis	70	31	2.3	65	35	1.8
Carsh	66	34	1.9	61	39	1.6
Chelms	70	31	2.3	57	43	1.3
Colchr	64	36	1.7			
Covnt	64	37	1.7	63	37	1.7
Derby	61	40	1.5	65	35	1.9
Donc	59	41	1.4	70	31	2.3
Dorset	62	38	1.6	63	37	1.7
Dudley	63	37	1.7	62	38	1.6
Exeter	66	34	1.9	65	35	1.8
Glouc	66	34	2.0	69	31	2.2
Hull	68	32	2.1	67	33	2.1
Ipswi	69	31	2.2	64	36	1.8
Kent	64	36	1.8	66	34	2.0

Table F1.5. Continued

	HD			PD		
Centre	% male	% female	M : F Ratio	% male	% female	M : F Ratio
L Barts	60	40	1.5	68	32	2.1
L Guys	62	38	1.7	53	47	1.1
L Kings	66	34	1.9	66	34	1.9
L Rfree	65	36	1.8	64	37	1.7
L St.G	60	41	1.5	54	46	1.2
L West	63	37	1.7	57	43	1.3
Leeds	65	35	1.8	66	34	2.0
Leic	64	36	1.8	61	39	1.5
Liv Ain	61	39	1.6	62	38	1.6
Liv Roy	63	37	1.7	63	37	1.7
M RI	61	39	1.5	61	39	1.6
Middlbr	67	34	2.0	56	44	1.3
Newc	63	37	1.7	67	33	2.0
Norwch	62	38	1.6	56	44	1.3
Nottm	59	41	1.4	56	44	1.3
Oxford	65	36	1.8	65	35	1.9
Plymth	71	29	2.5	63	38	1.7
Ports	63	37	1.7	67	33	2.1
Prestn	62	38	1.6	59	41	1.4
Redng	65	35	1.9	64	36	1.8
Salford	65	35	1.8	63	37	1.7
Sheff	65	35	1.9	63	37	1.7
Shrew	64	36	1.8	57	43	1.3
Stevng	65	35	1.9	60	40	1.5
Sthend	67	33	2.0	66	34	1.9
Stoke	64	37	1.7	64	36	1.7
Sund	62	38	1.6	56	44	1.3
Truro	58	42	1.4	56	44	1.3
Wirral	56	44	1.3	62	38	1.6
Wolve	65	35	1.8	66	34	1.9
York	60	40	1.5	70	30	2.3
N Ireland						
Antrim	72	28	2.6	64	36	1.8
Belfast	60	40	1.5	51	49	1.0
Newry	49	51	0.9	64	36	1.8
Ulster	57	43	1.3	47	53	0.9
West NI	61	39	1.5	58	42	1.4
Scotland						
Abrdn	65	35	1.9	55	45	1.2
Airdrie	56	44	1.3	62	38	1.6
D&Gall	68	33	2.1	44	56	0.8
Dundee	58	42	1.4	60	41	1.5
Edinb	60	40	1.5	61	40	1.5
Glasgw	59	41	1.5	55	45	1.2
Inverns	50	50	1.0	50	50	1.0
Klmarnk	62	38	1.6	60	41	1.5
Krkcldy	58	42	1.4	46	54	0.9
Wales						
Bangor	74	27	2.8	74	26	2.8
Cardff	62	38	1.6	65	35	1.9
Clwyd	68	32	2.1	61	39	1.6
Swanse	66	34	1.9	61	39	1.5
Wrexm	57	44	1.3	63	37	1.7
England	**64**	**36**	**1.7**	**63**	**37**	**1.7**
N Ireland	**61**	**39**	**1.6**	**57**	**43**	**1.3**
Scotland	**59**	**41**	**1.5**	**56**	**44**	**1.3**
Wales	**64**	**36**	**1.8**	**64**	**36**	**1.7**
UK	**63**	**37**	**1.7**	**63**	**37**	**1.7**

Blank cells – no patients on that modality

F:2 Prevalent patients on 31/12/2016

Table F2.1. Treatment modalities for 2016 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	49	13	38	3.9	72	14	14	5.0
B QEH	32	5	62	6.0	62	7	31	8.7
Basldn	47	12	40	3.8	72	12	16	5.8
Bradfd	30	3	67	8.9	61	5	34	11.7
Brightn	35	4	61	9.0	61	10	29	6.0
Bristol	21	3	75	6.6	57	4	39	13.6
Carlis	24	10	66	2.5	49	17	35	2.9
Carsh	38	6	56	6.3	69	8	23	8.6
Chelms	38	8	53	4.7	58	16	26	3.7
Colchr	100	0	0	0.0	100	0	0	0.0
Covnt	27	6	67	4.6	59	8	32	7.1
Derby	33	12	55	2.8	61	17	22	3.5
Donc	45	7	48	6.5	73	9	17	7.7
Dorset	26	5	69	5.5	57	6	37	9.4
Dudley	50	15	35	3.4	67	14	19	4.7
Exeter	25	7	68	3.7	66	10	24	6.7
Glouc	33	8	59	4.0	72	10	19	7.5
Hull	26	7	67	3.8	60	11	29	5.3
Ipswi	25	4	71	5.7	49	14	37	3.4
Kent	27	4	69	6.5	59	7	35	8.7
L Barts	35	7	58	5.1	65	13	22	5.1
L Guys	26	1	73	18.1	53	3	44	17.4
L Kings	44	8	48	5.5	68	9	24	7.7
L Rfree	22	6	72	3.4	55	9	36	6.1
L St.G	31	4	65	8.4	56	7	37	7.5
L West	32	2	66	13.6	63	4	33	15.5
Leeds	27	3	70	8.6	50	3	47	16.7
Leic	30	3	67	9.5	60	5	35	12.2
Liv Ain	73	15	13	5.0	89	9	*	9.7
Liv Roy	24	5	71	4.9	46	8	46	5.4
M RI	19	3	78	7.5	44	4	52	10.0
Middlbr	26	3	71	7.5	57	2	41	23.6
Newc	23	5	72	5.0	45	6	49	7.7
Norwch	26	6	68	4.4	64	7	29	9.4
Nottm	22	6	72	3.7	57	9	34	6.1
Oxford	16	4	79	3.7	45	7	48	6.0
Plymth	17	5	77	3.1	45	11	44	4.0
Ports	27	4	69	6.9	56	5	39	10.5
Prestn	35	2	63	14.9	65	5	30	13.5
Redng	26	7	67	3.8	55	7	38	7.4
Salford	33	8	59	4.0	52	15	33	3.5
Sheff	31	3	66	9.5	65	5	30	13.1
Shrew	39	12	49	3.3	71	9	20	8.1
Stevng	45	2	52	19.1	80	3	18	31.6
Sthend	40	11	50	3.8	59	15	26	3.8
Stoke	26	6	67	4.1	63	14	23	4.6
Sund	41	3	56	12.7	64	4	33	17.7
Truro	26	2	72	12.8	58	7	35	8.2
Wirral	50	6	43	7.7	70	7	0	10.6
Wolve	44	11	45	4.2	71	15	14	4.8
York	25	5	70	5.0	56	8	36	6.9

Table F2.1. Continued

	Patients aged <65				Patients aged ⩾65			
Centre	% HD	% PD	% transplant	HD : PD	% HD	% PD	% transplant	HD : PD
N Ireland								
Antrim	25	8	67	3.3	82	5	13	15.0
Belfast	13	2	85	7.8	47	6	47	8.3
Newry	*	*	74	*	55	20	25	2.7
Ulster	*	*	59	*	78	5	16	14.6
West NI	*	*	71	*	62	5	34	13.5
Scotland								
Abrdn	28	4	68	6.2	*	*	27	*
Airdrie	32	5	63	6.3	64	6	30	10.1
D&Gall	24	7	69	3.6	56	9	35	6.4
Dundee	29	4	66	6.5	62	6	32	10.7
Edinb	34	5	62	7.4	71	8	21	8.5
Glasgw	32	4	64	8.1	50	7	43	7.3
Inverns	23	3	74	8.3	58	4	39	15.6
Klmarnk	19	3	78	6.4	68	7	26	10.2
Krkcldy	34	10	56	3.4	66	11	24	6.1
Wales								
Bangor	*	*	66	*	55	14	31	3.9
Cardff	22	4	74	6.2	50	7	44	7.6
Clwyd	35	5	60	7.0	49	13	38	3.8
Swanse	35	9	56	3.7	64	8	28	7.8
Wrexm	25	11	64	2.3	61	10	29	6.1
England	**30**	**5**	**66**	**6.0**	**60**	**8**	**32**	**7.8**
N Ireland	**20**	**2**	**77**	**8.3**	**61**	**7**	**31**	**8.2**
Scotland	**27**	**4**	**68**	**6.6**	**61**	**6**	**33**	**11.0**
Wales	**26**	**6**	**68**	**4.6**	**55**	**8**	**36**	**6.7**
UK	**29**	**5**	**66**	**6.0**	**60**	**8**	**33**	**7.9**

*Values suppressed due to small numbers (primary or secondary suppression)

Table F2.2. Number of 2016 prevalent patients under and over 65 per treatment modality

	Patients aged <65			Patients aged ⩾65		
	HD	PD	Transplant	HD	PD	Transplant
England	9,630	1,612	21,402	11,501	1,468	6,197
N Ireland	223	27	858	411	50	211
Scotland	915	139	2,279	990	90	542
Wales	483	104	1,255	679	102	443
UK	**11,251**	**1,882**	**25,794**	**13,581**	**1,710**	**7,393**

Table F2.3. Dialysis modalities for 2016 prevalent patients aged under 65

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	8	68	4	7	0	13
B QEH	8	13	65	5	0	9
Basldn	*	68	10	*	0	18
Bradfd	5	77	8	*	*	8
Brightn	12	42	36	7	0	3
Bristol	6	21	60	5	0	8
Carlis	0	49	22	*	*	24
Carsh	6	21	59	3	0	11
Chelms	*	81	0	*	*	12
Colchr	0	100	0	0	0	0
Covnt	4	78	0	17	*	*
Derby	18	56	0	18	0	9
Donc	6	47	34	*	*	10
Dorset	*	17	65	6	*	9
Dudley	1	22	*	15	*	6
Exeter	4	10	65	8	0	13
Glouc	*	57	21	5	*	15
Hull	*	45	32	14	*	7
Ipswi	0	78	7	*	*	10
Kent	10	38	39	12	*	*
L Barts	3	40	41	*	*	16
L Guys	10	16	69	1	0	4
L Kings	4	19	61	5	0	10
L Rfree	3	4	70	4	0	18
L St.G	*	18	70	*	*	8
L West	1	21	71	3	0	4
Leeds	5	21	63	3	0	7
Leic	11	20	59	3	0	7
Liv Ain	14	8	61	0	0	17
Liv Roy	11	42	30	9	0	8
M RI	15	32	41	4	0	8
Middlbr	5	28	55	12	0	0
Newc	11	66	7	*	*	16
Norwch	5	49	28	18	0	0
Nottm	12	38	28	8	0	14
Oxford	7	30	*	5	*	16
Plymth	9	59	9	9	0	16
Ports	18	17	52	13	0	0
Prestn	10	23	61	*	*	5
Redng	5	35	40	13	0	8
Salford	9	21	50	7	0	13
Sheff	14	34	42	10	0	0
Shrew	12	40	24	5	0	18
Stevng	7	43	45	5	*	*
Sthend	*	75	0	21	*	0
Stoke	16	44	20	3	4	12
Sund	4	59	29	4	*	*
Truro	9	43	41	*	0	*
Wirral	7	46	36	*	*	10
Wolve	12	*	17	3	*	14
York	14	33	36	14	*	*
N Ireland						
Antrim	*	74	0	*	0	23
Belfast	9	80	0	0	0	11
Newry	*	89	0	0	0	*

Table F2.3. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
Ulster	*	93	0	0	0	*
West NI	*	88	0	*	*	*
Scotland**						
Abrdn	*	84	0	6	0	8
Airdrie	0	86	0	6	0	8
D&Gall	*	70	0	*	0	*
Dundee	*	84	0	13	*	0
Edinb	3	86	0	*	*	10
Glasgw	6	83	0	3	0	8
Inverns	11	76	0	*	0	*
Klmarnk	*	73	0	*	0	21
Krkcldy	0	88	0	0	0	12
Wales						
Bangor	22	59	*	*	0	*
Cardff	9	11	66	7	0	7
Clwyd	*	80	0	*	0	*
Swanse	16	40	23	9	0	13
Wrexm	8	54	8	*	*	29
England	**7**	**33**	**45**	**6**	**0**	**9**
N Ireland	**6**	**84**	**0**	*	*	**10**
Scotland**	**4**	**83**	**0**	**4**	**0**	**9**
Wales	**12**	**32**	**39**	**6**	**0**	**11**
UK	**7**	**38**	**41**	**5**	**0**	**9**

*Values suppressed due to small numbers (primary or secondary suppression)
**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 F2.4. Dialysis modalities for 2016 prevalent patients aged over 65

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	*	77	6	5	*	12
B QEH	2	8	80	3	0	8
Basldn	0	61	24	10	0	5
Bradfd	*	72	20	*	0	7
Brightn	3	35	48	8	0	6
Bristol	2	13	78	3	0	4
Carlis	0	54	20	*	*	24
Carsh	1	17	72	3	0	8
Chelms	*	78	0	11	*	10
Colchr	0	100	0	0	0	0
Covnt	*	86	0	12	*	0
Derby	9	68	0	16	0	6
Donc	*	44	42	*	0	9
Dorset	3	20	68	*	*	7
Dudley	*	36	44	13	*	5
Exeter	*	8	78	5	*	8
Glouc	4	60	24	3	0	9
Hull	0	41	44	10	0	6
Ipswi	0	63	14	10	0	12
Kent	*	30	59	6	*	4
L Barts	*	31	52	3	*	14
L Guys	2	21	71	3	0	3
L Kings	*	15	73	6	*	6

Table F2.4. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
L Rfree	2	3	81	7	0	8
L St.G	*	16	71	5	*	6
L West	1	20	73	3	0	3
Leeds	0	14	80	2	0	4
Leic	3	17	72	2	0	5
Liv Ain	*	7	83	0	*	9
Liv Roy	5	31	48	8	0	8
M RI	4	21	66	*	*	8
Middlbr	*	23	71	4	*	0
Newc	*	76	11	*	0	11
Norwch	4	51	35	10	0	0
Nottm	*	33	52	7	*	7
Oxford	*	32	53	7	*	7
Plymth	*	69	9	7	*	13
Ports	4	18	70	9	0	0
Prestn	4	18	71	2	0	5
Redng	*	42	46	8	*	4
Salford	*	19	57	11	*	11
Sheff	2	41	50	7	0	0
Shrew	5	44	40	*	*	9
Stevng	3	41	53	3	0	0
Sthend	0	79	0	21	0	0
Stoke	*	49	30	*	9	7
Sund	0	64	31	*	0	*
Truro	*	53	34	7	*	4
Wirral	*	37	52	*	0	5
Wolve	4	49	30	5	3	10
York	*	26	61	7	*	5
N Ireland						
Antrim	0	94	0	0	0	6
Belfast	*	88	0	*	0	11
Newry	*	71	0	*	0	26
Ulster	0	94	0	0	0	6
West NI	*	92	0	*	0	7
Scotland**						
Abrdn	*	95	0	*	0	*
Airdrie	0	91	0	*	0	*
D&Gall	*	84	0	*	0	*
Dundee	*	91	0	6	0	*
Edinb	*	88	0	*	0	10
Glasgw	*	93	0	*	0	5
Inverns	*	87	0	7	0	*
Klmarnk	*	81	0	*	0	13
Krkcldy	0	89	0	*	*	9
Wales						
Bangor	*	46	29	*	0	15
Cardff	2	8	78	7	0	5
Clwyd	*	77	0	13	0	*
Swanse	5	49	35	5	0	7
Wrexm	*	65	17	0	*	14
England	**2**	**32**	**55**	**5**	**0**	**6**
N Ireland	*	**89**	**0**	*	**0**	**11**
Scotland**	**1**	**90**	**0**	**3**	**0**	**6**
Wales	**3**	**36**	**48**	**6**	**0**	**8**
UK	**2**	**38**	**49**	**5**	**0**	**6**

*Values suppressed due to small numbers (primary or secondary suppression)
**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 F2.5. Prevalent patients 2016, age ranges by centre (%)

Centre	18–24	25–34	35–44	45–54	55–64	65–74	75–84	85+
England								
B Heart	1	5	8	19	18	22	24	5
B QEH	4	7	12	21	23	19	11	3
Basldn	*	4	11	16	20	*	17	5
Bradfd	4	10	14	20	22	16	13	1
Brightn	1	6	9	20	21	23	16	4
Bristol	3	7	12	19	23	21	13	3
Carlis	3	7	8	20	24	19	17	2
Carsh	0	4	9	20	21	23	17	6
Chelms	*	6	8	15	23	*	17	5
Colchr	*	6	*	11	12	27	31	10
Covnt	1	7	12	23	21	18	14	3
Derby	1	5	10	21	22	23	14	3
Donc	2	7	8	15	20	25	18	5
Dorset	1	6	6	18	21	26	18	4
Dudley	*	6	6	17	20	*	18	6
Exeter	2	5	7	18	20	25	17	6
Glouc	*	4	8	17	22	*	21	5
Hull	2	7	12	19	23	21	13	2
Ipswi	*	5	10	19	21	*	15	6
Kent	1	6	10	21	21	24	14	3
L Barts	2	7	15	23	26	18	10	1
L Guys	4	8	14	23	24	17	8	2
L Kings	*	4	11	24	*	19	13	4
L Rfree	2	8	12	20	23	18	13	3
L St.G	1	5	12	20	22	24	14	3
L West	1	5	11	20	26	23	13	2
Leeds	3	8	13	22	24	18	11	1
Leic	2	7	11	21	22	22	13	3
Liv Ain	*	4	7	14	17	26	*	7
Liv Roy	1	8	12	25	28	17	7	1
M RI	4	8	13	24	23	18	9	1
Middlbr	1	8	10	19	23	22	12	2
Newc	3	6	13	20	25	21	10	2
Norwch	1	6	9	18	22	25	15	5
Nottm	4	7	12	20	23	18	13	4
Oxford	2	8	13	23	22	20	10	3
Plymth	1	5	10	19	26	24	12	4
Ports	1	6	11	22	23	21	13	2
Prestn	1	6	10	20	23	25	13	1
Redng	*	3	12	20	22	*	15	5
Salford	2	6	13	23	23	20	11	2
Sheff	2	7	11	20	23	21	13	3
Shrew	*	5	9	16	21	*	21	3
Stevng	2	6	9	21	22	19	17	3
Sthend	*	5	11	18	*	21	17	6
Stoke	1	6	12	18	21	22	15	5
Sund	*	6	11	21	23	*	12	1
Truro	3	4	11	17	21	23	17	3
Wirral	1	4	10	18	21	24	17	4
Wolve	1	5	11	19	23	20	17	3
York	2	6	12	19	21	21	15	3
N Ireland								
Antrim	*	4	8	20	21	*	20	4
Belfast	2	8	14	23	23	17	11	2
Newry	3	4	14	17	*	19	19	*
Ulster	*	*	10	13	17	22	25	10
West NI	*	7	13	21	15	*	17	3

Table F2.5. Continued

Centre	18–24	25–34	35–44	45–54	55–64	65–74	75–84	85+
Scotland								
Abrdn	3	9	13	20	23	21	8	2
Airdrie	2	8	12	24	23	18	13	1
D&Gall	*	5	11	22	18	27	15	*
Dundee	*	4	10	23	21	*	15	4
Edinb	2	5	13	24	28	19	8	1
Glasgw	2	8	12	22	26	19	10	2
Inverns	*	6	*	23	22	22	11	2
Klmarnk	*	4	12	*	28	19	11	2
Krkcldy	*	5	11	*	25	24	15	2
Wales								
Bangor	*	6	9	18	17	*	17	3
Cardff	2	7	12	22	23	21	12	1
Clwyd	*	9	5	21	19	*	15	4
Swanse	2	5	9	17	20	23	20	5
Wrexm	2	6	11	19	19	19	16	6
England	**2**	**6**	**11**	**21**	**23**	**21**	**13**	**3**
N Ireland	**2**	**6**	**13**	**21**	**21**	**19**	**15**	**3**
Scotland	**2**	**7**	**12**	**22**	**25**	**20**	**11**	**2**
Wales	**2**	**6**	**10**	**20**	**21**	**22**	**15**	**3**
UK	**2**	**6**	**11**	**21**	**23**	**21**	**13**	**3**

*Values suppressed due to small numbers (primary or secondary suppression)

Table F2.6. Dialysis modalities for 2016 prevalent patients without diabetes (all ages)

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	3	72	5	5	0	14
B QEH	5	11	70	5	0	9
Basldn	1	64	18	7	0	10
Bradfd	4	71	16	2	0	8
Brightn	7	35	44	8	0	5
Bristol	5	13	70	5	0	7
Carlis	0	55	21	4	0	20
Carsh	5	15	71	2	0	7
Chelms	1	78	0	8	1	12
Covnt	3	84	0	13	0	0
Derby	17	60	0	16	0	7
Donc	5	45	40	3	0	7
Dorset	3	19	65	4	0	9
Dudley	5	27	47	16	0	5
Exeter	2	8	74	7	0	8
Glouc	3	60	21	4	0	12
Hull	1	41	40	11	0	7
Ipswi	0	70	11	8	0	11
Kent	6	33	51	8	0	3
L Barts	3	35	46	2	0	14
L Guys	9	15	71	2	0	4
L Kings	4	15	66	6	0	9
L Rfree	3	4	76	6	0	12
L St.G	1	12	71	4	1	10
L West	1	19	72	4	0	4
Leeds	4	18	70	3	0	6
Leic	8	19	65	3	0	6

Table F2.6. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
Liv Ain	6	6	77	0	0	10
Liv Roy	11	34	40	7	0	8
M RI	13	23	53	2	0	8
Middlbr	4	22	65	8	0	0
Newc	8	70	9	1	0	13
Norwch	5	52	31	12	0	0
Nottm	7	32	42	8	0	11
Oxford	4	29	49	6	0	11
Plymth	5	64	9	8	0	14
Ports	11	16	62	11	0	0
Prestn	7	17	69	1	0	6
Redng	2	40	44	9	0	5
Salford	7	18	51	9	0	14
Sheff	9	37	45	9	0	0
Shrew	9	46	31	3	0	11
Stevng	5	42	49	4	0	0
Sthend	3	78	0	19	0	0
Stoke	9	48	26	3	6	8
Sund	2	61	31	4	0	2
Truro	4	44	40	7	0	5
Wirral	4	39	46	3	0	8
Wolve	9	48	25	4	2	12
York	7	24	54	10	0	5
N Ireland						
Antrim	1	89	0	0	0	10
Belfast	5	84	0	0	0	11
Newry	4	74	0	1	0	21
Ulster	1	94	0	0	0	5
West NI	3	91	0	1	1	5
Scotland*						
Abrdn	2	89	0	6	0	3
Airdrie	0	87	0	5	0	8
D&Gall	3	89	0	6	0	3
Dundee	1	88	0	9	0	2
Edinb	2	87	0	1	0	10
Glasgw	4	88	0	2	0	6
Inverns	7	83	0	7	0	3
Klmarnk	4	78	0	2	0	17
Krkcldy	0	89	0	1	0	10
Wales						
Bangor	12	51	18	5	0	14
Cardff	5	10	72	7	0	6
Clwyd	6	81	0	8	0	5
Swanse	10	46	31	6	0	8
Wrexham	5	58	14	1	0	22
England	**5**	**32**	**50**	**6**	**0**	**7**
N Ireland	**3**	**86**	**0**	**0**	**0**	**10**
Scotland*	**3**	**87**	**0**	**3**	**0**	**7**
Wales	**7**	**34**	**44**	**6**	**0**	**9**
UK	**5**	**37**	**44**	**5**	**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 F2.7. Number of 2016 prevalent patients without diabetes by treatment modality

	HD	PD	Transplant
England	14,736	2,209	24,087
N Ireland	464	55	960
Scotland	1,423	168	2,529
Wales	893	158	1,495
UK	**17,516**	**2,590**	**29,071**

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 F2.8. Dialysis modalities for 2016 prevalent patients without diabetes aged under 65

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	7	69	4	5	0	15
B QEH	9	14	63	5	0	10
Basldn	2	67	10	2	0	19
Bradfd	6	75	8	3	0	8
Brightn	13	39	39	6	0	3
Bristol	8	18	58	7	0	9
Carlis	0	56	20	7	0	17
Carsh	11	20	59	2	0	8
Chelms	0	78	0	4	2	15
Covnt	5	78	0	16	1	0
Derby	22	53	0	16	0	8
Donc	7	45	38	3	0	7
Dorset	3	19	59	8	0	10
Dudley	10	20	45	18	0	6
Exeter	5	10	66	10	0	10
Glouc	3	57	18	6	0	16
Hull	3	45	33	14	0	6
Ipswi	0	81	6	2	0	11
Kent	14	37	37	12	0	1
L Barts	4	40	40	1	0	15
L Guys	13	14	68	1	0	4
L Kings	6	16	60	5	0	12
L Rfree	3	4	72	4	0	16
L St.G	2	16	69	2	2	10
L West	2	19	72	4	0	4
Leeds	6	20	63	4	0	7
Leic	13	21	55	3	0	7
Liv Ain	16	5	65	0	0	13
Liv Roy	14	41	30	8	0	8
M RI	19	31	38	3	0	9
Middlbr	7	28	53	13	0	0
Newc	13	69	5	1	0	12
Norwch	7	49	26	18	0	0
Nottm	14	35	29	7	0	15
Oxford	8	27	44	5	1	15
Plymth	10	55	10	10	0	16

Table F2.8. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
Ports	21	15	51	12	0	0
Prestn	11	19	63	1	0	6
Redng	4	33	38	14	0	10
Salford	11	19	51	5	0	14
Sheff	16	33	41	10	0	0
Shrew	16	44	20	4	0	16
Stevng	8	45	41	5	0	1
Sthend	6	75	0	20	0	0
Stoke	19	42	22	4	3	11
Sund	5	57	31	5	0	3
Truro	6	36	47	4	0	6
Wirral	5	44	40	0	0	11
Wolve	15	48	19	4	1	14
York	16	29	38	14	0	3
N Ireland						
Antrim	4	79	0	0	0	17
Belfast	12	78	0	0	0	9
Newry	7	85	0	0	0	7
Ulster	6	94	0	0	0	0
West NI	5	87	0	3	3	3
Scotland*						
Abrdn	2	83	0	8	0	7
Airdrie	0	84	0	8	0	8
D&Gall	8	83	0	0	0	8
Dundee	3	85	0	12	0	0
Edinb	4	84	0	0	0	12
Glasgw	7	83	0	4	0	7
Inverns	10	76	0	7	0	7
Klmarnk	3	72	0	3	0	22
Krkcldy	0	88	0	0	0	12
Wales						
Bangor	29	50	4	8	0	8
Cardff	9	11	65	8	0	7
Clwyd	12	85	0	0	0	4
Swanse	19	41	23	8	0	9
Wrexm	8	53	9	2	0	28
England	**9**	**32**	**45**	**6**	**0**	**8**
N Ireland	**8**	**83**	**0**	**1**	**1**	**8**
Scotland*	**4**	**83**	**0**	**4**	**0**	**9**
Wales	**13**	**31**	**39**	**7**	**0**	**10**
UK	**9**	**37**	**40**	**6**	**0**	**9**

Excluded one centre with $\geqslant$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 F2.9. Number of 2016 prevalent patients without diabetes aged under 65 by treatment modality

	HD	PD	Transplant
England	6,771	1,141	18,529
N Ireland	157	15	760
Scotland	653	99	2,020
Wales	376	76	1,093
UK	**7,957**	**1,331**	**22,402**

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 F2.10. Dialysis modalities for 2016 prevalent patients without diabetes aged over 65

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	1	75	6	5	0	14
B QEH	1	7	79	4	0	8
Basldn	0	62	23	11	0	4
Bradfd	0	67	25	1	0	7
Brightn	3	33	48	10	0	7
Bristol	2	9	79	4	0	5
Carlis	0	54	22	2	0	22
Carsh	2	12	78	2	0	6
Chelms	1	78	0	10	0	10
Covnt	1	89	0	10	0	0
Derby	12	66	0	16	0	6
Donc	4	45	42	3	0	7
Dorset	2	19	68	2	0	8
Dudley	2	33	48	14	0	4
Exeter	1	8	78	6	0	7
Glouc	3	62	22	3	0	10
Hull	0	37	46	9	0	7
Ipswi	0	65	13	11	0	12
Kent	0	30	60	5	0	4
L Barts	0	27	56	3	0	13
L Guys	2	18	75	3	0	3
L Kings	1	13	75	7	0	5
L Rfree	3	4	79	7	0	8
L St.G	1	8	74	7	0	10
L West	1	19	73	4	0	3
Leeds	0	15	79	3	0	4
Leic	4	16	73	3	0	4
Liv Ain	1	7	83	0	0	9
Liv Roy	6	23	56	7	0	8
M RI	5	14	72	1	0	8
Middlbr	2	18	76	4	0	0
Newc	2	72	12	1	0	13
Norwch	4	54	34	9	0	0
Nottm	2	30	52	9	0	8
Oxford	1	30	53	7	0	8

Table F2.10. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
Plymth	2	68	9	8	0	13
Ports	4	16	70	9	0	0
Prestn	4	15	74	2	0	6
Redng	0	44	47	6	0	3
Salford	3	18	51	14	0	15
Sheff	3	40	49	7	0	0
Shrew	4	47	39	2	0	8
Stevng	3	40	54	2	0	0
Sthend	0	81	0	19	0	0
Stoke	4	52	28	2	8	7
Sund	0	65	32	3	0	1
Truro	2	48	37	9	0	4
Wirral	2	34	52	5	0	6
Wolve	4	48	30	4	3	11
York	1	22	63	8	0	6
N Ireland						
Antrim	0	93	0	0	0	7
Belfast	0	88	0	0	0	13
Newry	2	69	0	2	0	27
Ulster	0	94	0	0	0	6
West NI	1	93	0	0	0	6
Scotland*						
Abrdn	2	95	0	3	0	0
Airdrie	0	89	0	2	0	9
D&Gall	0	92	0	8	0	0
Dundee	0	90	0	7	0	3
Edinb	0	91	0	2	0	7
Glasgw	1	93	0	1	0	5
Inverns	5	87	0	7	0	2
Klmarnk	5	83	0	0	0	12
Krkcldy	0	89	0	1	0	10
Wales						
Bangor	4	51	24	4	0	16
Cardff	2	8	78	7	0	5
Clwyd	3	79	0	13	0	5
Swanse	5	48	36	5	0	7
Wrexm	3	63	17	0	0	18
England	**2**	**31**	**55**	**6**	**0**	**6**
N Ireland	**1**	**88**	**0**	**0**	**0**	**11**
Scotland*	**1**	**90**	**0**	**3**	**0**	**5**
Wales	**3**	**36**	**47**	**5**	**0**	**8**
UK	**2**	**38**	**48**	**5**	**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 F2.11. Number of 2016 prevalent patients without diabetes aged over 65 by treatment modality

	HD	PD	Transplant
England	7,965	1,068	5,558
N Ireland	307	40	200
Scotland	770	69	509
Wales	517	82	402
UK	**9,559**	**1,259**	**6,669**

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 F2.12. Dialysis modalities for 2016 prevalent patients with diabetes

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
England						
B Heart	5	75	4	7	0	9
B QEH	3	10	77	2	0	7
Basldn	0	64	19	5	0	12
Bradfd	0	83	9	0	0	8
Brightn	6	48	38	4	0	4
Bristol	0	24	73	1	0	2
Carlis	0	48	28	0	0	24
Carsh	1	22	65	3	0	8
Chelms	3	80	0	10	0	8
Covnt	2	81	0	17	0	0
Derby	4	69	0	19	0	8
Donc	0	45	33	2	0	19
Dorset	3	18	72	2	2	3
Dudley	7	41	36	5	2	9
Exeter	0	7	76	3	0	14
Glouc	4	55	33	0	0	9
Hull	0	49	32	14	0	5
Ipswi	0	69	16	3	0	13
Kent	1	33	51	11	0	4
L Barts	1	36	45	1	0	17
L Guys	3	29	63	3	0	3
L Kings	1	22	67	4	0	6
L Rfree	0	3	78	5	0	14
L St.G	1	12	77	4	0	7
L West	0	23	72	2	0	2
Leeds	1	18	75	1	0	6
Leic	3	24	65	3	0	5
Liv Ain	7	12	61	0	0	20
Liv Roy	7	30	48	9	0	6
M RI	4	36	53	2	0	5
Middlbr	0	35	59	5	0	0
Newc	0	73	9	0	0	18
Norwch	1	44	37	17	0	0
Nottm	3	46	39	5	0	7

Table F2.12. Continued

Centre	% home HD	% hospital HD	% satellite HD	% CAPD	% unknown type of PD	% APD
Oxford	1	34	50	4	0	10
Plymth	0	70	10	7	0	13
Ports	6	17	73	3	0	0
Prestn	6	31	59	1	0	3
Redng	4	37	42	12	0	6
Salford	3	22	57	8	0	9
Sheff	4	38	51	7	0	0
Shrew	4	31	42	5	0	18
Stevng	3	39	54	4	0	0
Sthend	0	72	0	28	0	0
Stoke	6	51	21	1	9	11
Sund	2	65	23	4	0	6
Truro	8	65	25	0	0	2
Wirral	5	52	34	2	0	7
Wolve	3	61	18	3	4	10
York	2	49	37	9	0	2
N Ireland						
Antrim	0	85	0	0	0	15
Belfast	2	98	0	0	0	0
Newry	0	87	0	0	0	13
Ulster	0	93	0	0	0	7
West NI	0	91	0	0	0	9
Scotland*						
Abrdn	0	93	0	0	0	7
Airdrie	0	94	0	0	0	6
D&Gall	8	63	0	13	0	17
Dundee	0	90	0	10	0	0
Edinb	0	87	0	2	0	11
Glasgw	3	88	0	2	0	7
Inverns	7	80	0	13	0	0
Klmarnk	7	73	0	2	0	18
Krkcldy	0	92	0	0	0	8
Wales						
Bangor	6	47	35	6	0	6
Cardff	5	9	76	5	0	5
Clwyd	0	78	0	0	0	22
Swanse	6	46	28	7	0	12
Wrexm	7	68	11	0	0	14
England	**2**	**34**	**52**	**4**	**0**	**7**
N Ireland	**1**	**91**	**0**	**0**	**0**	**9**
Scotland*	**2**	**87**	**0**	**3**	**0**	**8**
Wales	**5**	**34**	**46**	**5**	**0**	**9**
UK	**2**	**40**	**46**	**4**	**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 F2.13. Number of 2016 prevalent patients with diabetes by treatment modality

	HD	PD	Transplant
England	5,119	679	2,969
N Ireland	164	16	100
Scotland	472	59	292
Wales	261	45	199
UK	**6,016**	**799**	**3,560**

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 F2.14. Demography of 2016 prevalent patients with diabetes

Centre	M : F ratio	Median age on 31/12/2016	Median age at start of treatment	Median time on RRT in days	Median time on RRT in years
England					
B Heart	1.5	66	62	1,107	3.0
B QEH	1.5	63	56	1,429	3.9
Basldn	2.0	64	59	1,369	3.7
Bradfd	1.9	63	60	922	2.5
Brightn	1.5	60	55	1,114	3.0
Bristol	1.8	63	55	1,408	3.9
Carlis	1.9	58	55	1,021	2.8
Carsh	1.7	63	56	1,900	5.2
Chelms	5.5	63	61	972	2.7
Covnt	1.8	60	56	1,487	4.1
Derby	1.7	63	58	1,166	3.2
Donc	1.9	63	58	1,050	2.9
Dorset	1.8	62	55	1,365	3.7
Dudley	2.3	63	59	907	2.5
Exeter	1.8	63	59	1,187	3.2
Glouc	2.7	64	59	863	2.4
Hull	1.7	61	56	1,270	3.5
Ipswi	1.3	62	56	1,393	3.8
Kent	1.8	59	54	1,199	3.3
L Barts	1.6	63	58	1,180	3.2
L Guys	1.3	58	50	2,183	6.0
L Kings	1.5	64	60	1,193	3.3
L Rfree	1.5	65	60	1,432	3.9
L St.G	1.1	68	62	1,796	4.9
L West	1.7	65	59	1,443	4.0
Leeds	1.8	61	56	1,180	3.2
Leic	1.8	62	55	1,374	3.8
Liv Ain	1.4	58	55	764	2.1
Liv Roy	1.1	56	48	1,757	4.8
M RI	1.7	59	54	1,265	3.5
Middlbr	1.8	59	56	1,357	3.7
Newc	1.6	58	51	1,312	3.6
Norwch	1.7	60	56	1,628	4.5
Nottm	1.4	59	55	1,712	4.7
Oxford	1.9	57	52	1,383	3.8
Plymth	2.4	60	54	1,740	4.8
Ports	1.7	60	55	1,445	4.0

Table F2.14. Continued

Centre	M : F ratio	Median age on 31/12/2016	Median age at start of treatment	Median time on RRT in days	Median time on RRT in years
Prestn	1.6	63	58	1,166	3.2
Redng	2.2	63	59	1,697	4.6
Salford	2.0	61	56	794	2.2
Sheff	2.1	63	59	1,516	4.2
Shrew	1.7	65	62	1,035	2.8
Stevng	2.5	62	57	1,230	3.4
Sthend	1.8	62	54	1,679	4.6
Stoke	1.4	64	59	1,083	3.0
Sund	1.9	60	56	977	2.7
Truro	1.0	58	55	1,075	2.9
Wirral	1.4	62	60	843	2.3
Wolve	1.8	60	53	1,741	4.8
York	1.3	60	53	1,454	4.0
N Ireland					
Antrim	1.0	64	61	1,317	3.6
Belfast	1.3	60	55	1,433	3.9
Newry	1.0	64	59	1,513	4.1
Ulster	1.7	62	57	922	2.5
West NI	1.3	61	58	744	2.0
Scotland					
Abrdn	1.2	61	57	1,132	3.1
Airdrie	2.0	57	51	1,216	3.3
D&Gall	2.3	60	54	924	2.5
Dundee	1.3	55	49	1,675	4.6
Edinb	1.4	57	51	1,256	3.4
Glasgw	1.4	59	55	1,027	2.8
Inverns	2.0	53	43	1,754	4.8
Klmarnk	1.3	56	51	1,299	3.6
Krkcldy	1.4	63	61	1,466	4.0
Wales					
Bangor	2.0	65	60	1,209	3.3
Cardff	2.1	60	53	1,656	4.5
Clwyd	1.0	56	50	1,247	3.4
Swanse	2.4	65	61	1,078	3.0
Wrexm	2.4	61	50	1,739	4.8
England	**1.7**	**62**	**57**	**1,348**	**3.7**
N Ireland	**1.2**	**62**	**57**	**1,258**	**3.4**
Scotland	**1.4**	**58**	**52**	**1,153**	**3.2**
Wales	**2.1**	**62**	**56**	**1,421**	**3.9**
UK	**1.7**	**62**	**56**	**1,332**	**3.6**

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 F2.15. Transplant gender ratios in 2016 prevalent patients

	% male	% female	Male *N*	Female *N*	M : F ratio
England	60.5	39.5	16,703	10,896	1.5
N Ireland	60.0	40.0	641	428	1.5
Scotland	59.5	40.5	1,679	1,142	1.5
Wales	63.5	36.5	1,079	619	1.7
UK	**60.6**	**39.4**	**20,102**	**13,085**	**1.5**

F:3 Trends by CCG/HB between 2011 and 2016

Table F3.1. Number of incident patients by year of RRT start and CCG/HB

UK area	CCG/HB name	Code	Incident numbers					
			2011	2012	2013	2014	2015	2016
Cheshire, Warrington and Wirral	NHS Eastern Cheshire	E38000056	18	17	16	19	25	14
	NHS South Cheshire	E38000151	15	12	24	24	20	16
	NHS Vale Royal	E38000189	10	9	15		6	
	NHS Warrington	E38000194	10	19	16	24	19	16
	NHS West Cheshire	E38000196	28	23	27	24	24	30
	NHS Wirral	E38000208	33	23	37	27	45	39
Durham, Darlington and Tees	NHS Darlington	E38000042	10	15	10	7	15	8
	NHS Durham Dales, Easington and Sedgefield	E38000047	35	27	33	32	36	34
	NHS Hartlepool and Stockton-on-Tees	E38000075	28	32	27	32	25	25
	NHS North Durham	E38000116	15	34	18	16	22	27
	NHS South Tees	E38000162	28	29	37	26	53	33
Greater Manchester	NHS Bolton	E38000016	27	26	27	21	35	37
	NHS Bury	E38000024	14	27	16	25	27	25
	NHS Heywood, Middleton & Rochdale	E38000080	26	27	27	32	25	33
	NHS Manchester	E38000217	50	57	66	64	79	72
	NHS Oldham	E38000135	23	16	22	31	28	36
	NHS Salford	E38000143	17	20	26	21	22	32
	NHS Stockport	E38000174	28	21	17	31	30	37
	NHS Tameside and Glossop	E38000182	26	16	30	24	31	37
	NHS Trafford	E38000187	12	28	28	22	24	28
	NHS Wigan Borough	E38000205	35	27	27	35	37	41
Lancashire	NHS Blackburn with Darwen	E38000014	19	17	13	12	25	15
	NHS Blackpool	E38000015	14	24	19	20	16	10
	NHS Chorley and South Ribble	E38000034	18	14	25	18	24	14
	NHS East Lancashire	E38000050	37	22	36	47	30	39
	NHS Fylde & Wyre	E38000060	12	17	18	23	22	21
	NHS Greater Preston	E38000065	11	21	18	21	24	16
	NHS Morecombe Bay	E38000216	29	34	30	29	26	23
	NHS West Lancashire	E38000200	11	10	9	9	18	9
Merseyside	NHS Halton	E38000068	20	13	13	15	20	15
	NHS Knowsley	E38000091	17	20	10	28	15	14
	NHS Liverpool	E38000101	50	55	47	59	60	46
	NHS South Sefton	E38000161	25	19	24	25	21	25
	NHS Southport and Formby	E38000170	14	11	21	13	9	12
	NHS St Helens	E38000172	15	18	12	21	22	22
Cumbria, Northumberland, Tyne and Wear	NHS Cumbria North	E38000215	25	17	40	37	46	39
	NHS Newcastle Gateshead	E38000212	40	41	31	45	58	51
	NHS North Tyneside	E38000127	15	20	22	16	20	25
	NHS Northumberland	E38000130	32	30	25	40	28	38
	NHS South Tyneside	E38000163	18	9	13	11	18	27
	NHS Sunderland	E38000176	23	27	19	30	34	43

Table F3.1. Continued

UK area	CCG/HB name	Code	Incident numbers					
			2011	2012	2013	2014	2015	2016
North Yorkshire and Humber	NHS East Riding of Yorkshire	E38000052	29	28	19	32	37	33
	NHS Hambleton, Richmondshire and Whitby	E38000069	13	23	17	17	13	14
	NHS Harrogate and Rural District	E38000073	18	18	10	22	23	23
	NHS Hull	E38000085	19	19	24	27	37	27
	NHS North East Lincolnshire	E38000119	23	12	15	19	20	11
	NHS North Lincolnshire	E38000122	29	22	20	10	22	18
	NHS Scarborough and Ryedale	E38000145	8	13	10	12	10	13
	NHS Vale of York	E38000188	42	36	31	35	28	40
South Yorkshire and Bassetlaw	NHS Barnsley	E38000006	21	27	28	40	24	36
	NHS Bassetlaw	E38000008	11	14	18	13	8	12
	NHS Doncaster	E38000044	35	27	39	49	31	44
	NHS Rotherham	E38000141	19	24	22	28	34	25
	NHS Sheffield	E38000146	55	68	54	61	58	58
West Yorkshire	NHS Airedale, Wharfedale and Craven	E38000001	9	12	16	23	19	13
	NHS Bradford City	E38000018	10	14	14	18	14	16
	NHS Bradford Districts	E38000019	34	44	34	39	56	56
	NHS Calderdale	E38000025	13	17	24	15	18	23
	NHS Greater Huddersfield	E38000064	23	28	24	28	22	18
	NHS Leeds North	E38000094	18	17	19	21	16	24
	NHS Leeds South and East	E38000095	21	17	22	24	16	24
	NHS Leeds West	E38000096	17	21	34	22	29	21
	NHS North Kirklees	E38000121	23	9	28	17	17	21
	NHS Wakefield	E38000190	33	39	32	39	25	36
Arden, Herefordshire and Worcestershire	NHS Coventry and Rugby	E38000038	61	74	55	52	50	70
	NHS Herefordshire	E38000078	19	21	19	23	33	26
	NHS Redditch and Bromsgrove	E38000139	16	24	15	18	18	16
	NHS South Warwickshire	E38000164	30	20	18	28	28	30
	NHS South Worcestershire	E38000166	25	28	28	37	29	26
	NHS Warwickshire North	E38000195	23	17	16	36	26	30
	NHS Wyre Forest	E38000211	13	10	8	18	6	12
Birmingham and the Black Country	NHS Birmingham CrossCity	E38000012	106	97	98	108	120	127
	NHS Birmingham South and Central	E38000013	32	26	29	33	27	35
	NHS Dudley	E38000046	30	43	45	35	34	35
	NHS Sandwell and West Birmingham	E38000144	72	63	68	79	90	94
	NHS Solihull	E38000149	16	24	22	23	30	29
	NHS Walsall	E38000191	35	40	47	30	41	28
	NHS Wolverhampton	E38000210	31	39	30	38	36	30
Derbyshire and Nottinghamshire	NHS Erewash	E38000058	12	14	14	7	13	11
	NHS Hardwick	E38000071	9	11	10	12	12	8
	NHS Mansfield & Ashfield	E38000103	16	18	18	24	20	16
	NHS Newark & Sherwood	E38000109	18	13	7	11	10	12
	NHS North Derbyshire	E38000115	31	26	26	24	23	28
	NHS Nottingham City	E38000132	29	32	36	37	48	41
	NHS Nottingham North & East	E38000133	14	12	12	10	15	18
	NHS Nottingham West	E38000134	7	14	17	12	12	13
	NHS Rushcliffe	E38000142	15	5	14	6		12
	NHS Southern Derbyshire	E38000169	57	63	50	60	50	66

Table F3.1. Continued

UK area	CCG/HB name	Code	Incident numbers					
			2011	2012	2013	2014	2015	2016
East Anglia	NHS Cambridgeshire and Peterborough[b]	E38000026	81	60	98	77		
	NHS Great Yarmouth & Waveney	E38000063	31	26	26	23	36	32
	NHS Ipswich and East Suffolk[a]	E38000086	29	42	44	37	57	41
	NHS North Norfolk[a]	E38000124	13	18	20	23	26	20
	NHS Norwich[a]	E38000218	24	21	18	20	23	17
	NHS South Norfolk[b]	E38000219	28	21	28	19		
	NHS West Norfolk[b]	E38000203	14	15	14	21		
	NHS West Suffolk[b]	E38000204	18	23	22	17		
Essex	NHS Basildon and Brentwood	E38000007	28	34	26	29	33	34
	NHS Castle Point, Rayleigh and Rochford	E38000030	16	15	26	17	22	21
	NHS Mid Essex[a]	E38000106	42	35	32	41	34	36
	NHS North East Essex[a]	E38000117	47	36	33	46	32	34
	NHS Southend	E38000168	16	18	21	15	22	28
	NHS Thurrock	E38000185	18	12	15	19	19	11
	NHS West Essex[a]	E38000197	23	38	34	38	34	32
Hertfordshire and the South Midlands	NHS Bedfordshire	E38000010	33	44	47	47	43	54
	NHS Corby	E38000037	7	5		7	12	10
	NHS East and North Hertfordshire	E38000049	59	40	64	64	68	63
	NHS Herts Valleys	E38000079	46	52	55	71	56	67
	NHS Luton	E38000102	25	22	37	30	27	38
	NHS Milton Keynes	E38000107	22	27	22	31	34	37
	NHS Nene	E38000108	59	72	67	66	62	64
Leicestershire and Lincolnshire	NHS East Leicestershire and Rutland	E38000051	27	37	35	32	39	33
	NHS Leicester City	E38000097	51	46	49	37	48	68
	NHS Lincolnshire East	E38000099	27	23	34	19	26	29
	NHS Lincolnshire West	E38000100	19	11	21	17	19	17
	NHS South Lincolnshire	E38000157	17	16	12	13	18	17
	NHS South West Lincolnshire	E38000165	14	10	13	8	9	8
	NHS West Leicestershire	E38000201	38	22	35	45	30	41
Shropshire and Staffordshire	NHS Cannock Chase	E38000028	17	12	18	13	15	18
	NHS East Staffordshire	E38000053	12	10	16	13	9	9
	NHS North Staffordshire	E38000126	28	15	25	28	30	32
	NHS Shropshire	E38000147	37	29	41	38	38	35
	NHS South East Staffs and Seisdon and Peninsular	E38000153	26	19	17	22	22	25
	NHS Stafford and Surrounds	E38000173	15	17	16	17	27	24
	NHS Stoke on Trent	E38000175	28	23	30	42	34	34
	NHS Telford & Wrekin	E38000183	19	21	22	24	27	19
London	NHS Barking & Dagenham	E38000004	25	31	25	32	33	29
	NHS Barnet	E38000005	49	51	44	49	56	50
	NHS Camden	E38000027	23	22	28	26	30	23
	NHS City and Hackney	E38000035	34	41	38	46	26	42
	NHS Enfield	E38000057	57	46	47	48	51	52
	NHS Haringey	E38000072	37	50	50	39	39	48
	NHS Havering	E38000077	31	27	22	26	32	23
	NHS Islington	E38000088	27	36	26	21	32	21
	NHS Newham	E38000113	50	44	52	57	62	65
	NHS Redbridge	E38000138	35	55	52	40	42	50
	NHS Tower Hamlets	E38000186	32	36	41	48	52	41
	NHS Waltham Forest	E38000192	40	28	37	50	43	38

Table F3.1. Continued

UK area	CCG/HB name	Code	Incident numbers					
			2011	2012	2013	2014	2015	2016
London (cont.)	NHS Brent	E38000020	58	68	56	76	71	64
	NHS Central London (Westminster)	E38000031	21	19	23	19	18	20
	NHS Ealing	E38000048	57	68	52	58	77	60
	NHS Hammersmith and Fulham	E38000070	21	22	15	23	19	30
	NHS Harrow	E38000074	53	38	26	40	39	46
	NHS Hillingdon	E38000082	39	40	39	29	33	35
	NHS Hounslow	E38000084	42	40	48	32	34	43
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	E38000202	25	19	21	34	16	29
	NHS Bexley	E38000011	28	21	25	29	34	45
	NHS Bromley	E38000023	23	24	29	36	57	31
	NHS Croydon	E38000040	43	69	69	67	76	64
	NHS Greenwich	E38000066	23	26	55	30	43	41
	NHS Kingston	E38000090	15	17	18	19	14	17
	NHS Lambeth	E38000092	43	41	35	49	54	38
	NHS Lewisham	E38000098	42	44	36	39	40	35
	NHS Merton	E38000105	28	32	24	28	33	35
	NHS Richmond	E38000140	13	15	19	16	13	14
	NHS Southwark	E38000171	46	41	54	46	49	45
	NHS Sutton	E38000179	25	30	16	35	31	31
	NHS Wandsworth	E38000193	30	34	24	41	49	38
Bath, Gloucestershire, Swindon and Wiltshire	NHS Bath and North East Somerset	E38000009	11	18	19	14	13	16
	NHS Gloucestershire	E38000062	62	83	51	71	70	69
	NHS Swindon	E38000181	25	27	21	28	29	27
	NHS Wiltshire	E38000206	35	26	44	49	44	52
Bristol, North Somerset, Somerset and South Gloucestershire	NHS Bristol	E38000022	56	49	55	49	53	57
	NHS North Somerset	E38000125	22	26	27	28	23	22
	NHS Somerset	E38000150	56	45	38	64	50	65
	NHS South Gloucestershire	E38000155	18	24	35	22	25	27
Devon, Cornwall and Isles of Scilly	NHS Kernow	E38000089	55	65	62	59	79	70
	NHS North, East, West Devon	E38000129	96	104	90	105	107	103
	NHS South Devon and Torbay	E38000152	32	39	37	34	36	40
Kent and Medway	NHS Ashford	E38000002	11	17	15	14	13	15
	NHS Canterbury and Coastal	E38000029	19	13	22	29	23	26
	NHS Dartford, Gravesham and Swanley	E38000043	23	26	40	27	29	34
	NHS Medway	E38000104	24	22	30	27	36	18
	NHS South Kent Coast	E38000156	25	14	19	27	25	30
	NHS Swale	E38000180	7	16	10	15	12	16
	NHS Thanet	E38000184	14	17	26	18	13	16
	NHS West Kent	E38000199	42	32	37	51	47	47
Surrey and Sussex	NHS Brighton & Hove	E38000021	24	30	21	30	31	41
	NHS Coastal West Sussex	E38000213	40	50	50	70	63	68
	NHS Crawley	E38000039	5	8	11	14	8	18
	NHS East Surrey	E38000054	14	24	18	17	32	18
	NHS Eastbourne, Hailsham and Seaford	E38000055	20	25	29	19	29	23
	NHS Guildford and Waverley	E38000214	16	25	12	18	23	14
	NHS Hastings & Rother	E38000076	22	17	29	16	26	19
	NHS High Weald Lewes Havens	E38000081	14	19	13	22	20	21
	NHS Horsham and Mid Sussex	E38000083	20	13	20	23	15	22

Table F3.1. Continued

UK area	CCG/HB name	Code	Incident numbers					
			2011	2012	2013	2014	2015	2016
Surrey and Sussex (cont.)	NHS North West Surrey	E38000128	47	33	35	48	36	49
	NHS Surrey Downs	E38000177	31	29	34	33	31	30
	NHS Surrey Heath	E38000178	8	8	5	5	11	6
Thames Valley	NHS Aylesbury Vale	E38000003	22	16	15	19	18	30
	NHS Bracknell and Ascot	E38000017	10	5	17	14	12	15
	NHS Chiltern	E38000033	24	26	36	30	31	29
	NHS Newbury and District	E38000110	7	7	12	11	9	13
	NHS North & West Reading	E38000114	10	10	7	11	11	11
	NHS Oxfordshire	E38000136	69	67	62	62	63	58
	NHS Slough	E38000148	25	20	21	21	25	21
	NHS South Reading	E38000160	10	10	21	14	7	13
	NHS Windsor, Ascot and Maidenhead	E38000207	18	9	20	19	11	16
	NHS Wokingham	E38000209	22	8	14	14	11	14
Wessex	NHS Dorset	E38000045	68	67	70	73	65	61
	NHS Fareham and Gosport	E38000059	18	18	23	27	23	23
	NHS Isle of Wight	E38000087	14	16	23	17	14	12
	NHS North East Hampshire and Farnham	E38000118	18	25	26	20	24	21
	NHS North Hampshire	E38000120	16	11	17	26	20	14
	NHS Portsmouth	E38000137	25	21	22	20	23	23
	NHS South Eastern Hampshire	E38000154	19	16	25	30	20	18
	NHS Southampton	E38000167	25	19	14	23	23	23
	NHS West Hampshire	E38000198	44	41	45	55	43	41
Wales	Betsi Cadwaladr University	W11000023	68	83	74	96	99	91
	Powys Teaching	W11000024	22	22	13	11	19	18
	Hywel Dda	W11000025	58	43	52	60	56	41
	Abertawe Bro Morgannwg University	W11000026	68	84	62	59	79	76
	Cwm Taf	W11000027	46	29	37	39	35	35
	Aneurin Bevan	W11000028	77	76	69	81	71	66
	Cardiff and Vale University	W11000029	47	46	53	47	49	60
Scotland	Ayrshire and Arran	S08000015	36	42	45	38	45	60
	Borders	S08000016	8	8	7	9	11	5
	Dumfries and Galloway	S08000017	11	20	8	25	14	11
	Fife	S08000018	48	36	43	41	49	33
	Forth Valley	S08000019	27	29	34	33	38	23
	Grampian	S08000020	51	53	58	51	62	56
	Greater Glasgow and Clyde	S08000021	129	133	112	114	152	144
	Highland	S08000022	20	24	27	22	41	26
	Lanarkshire	S08000023	58	76	67	68	75	77
	Lothian	S08000024	62	65	54	71	70	71
	Orkney	S08000025		5			5	
	Shetland	S08000026						
	Tayside	S08000027	56	32	42	49	51	46
	Western Isles	S08000028				6	7	
Northern Ireland	Belfast	ZC010	36	57	40	32	47	55
	Northern	ZC020	59	54	51	53	51	59
	Southern	ZC030	44	30	30	29	35	31
	South Eastern	ZC040	34	30	35	31	54	43
	Western	ZC050	28	17	29	33	38	36

[a]CCGs where between 5% and 15% of the incident RRT population from 2011–2014 were incident patients of the Cambridge renal centre. In these CCGs the numbers for 2015 and 2016 are likely to be underestimated

[b]CCGs where >15% of the incident RRT population from 2011–2014 were incident patients of the Cambridge renal centre. These have not been included in the analysis for 2015 or 2016

Blank cells – values of <5 have been suppressed

Table F3.2. Number of prevalent patients on HD in-centre by year and CCG/HB

UK area	CCG/HB name	Code	Prevalent numbers on HD in-centre					
			2011	2012	2013	2014	2015	2016
Cheshire, Warrington and Wirral	NHS Eastern Cheshire	E38000056	43	51	48	50	57	43
	NHS South Cheshire	E38000151	60	54	53	59	62	53
	NHS Vale Royal	E38000189	26	23	29	28	25	19
	NHS Warrington	E38000194	46	50	49	60	60	50
	NHS West Cheshire	E38000196	88	83	84	86	76	80
	NHS Wirral	E38000208	96	107	113	104	96	102
Durham, Darlington and Tees	NHS Darlington	E38000042	24	32	29	27	33	31
	NHS Durham Dales, Easington and Sedgefield	E38000047	101	99	104	101	116	111
	NHS Hartlepool and Stockton-on-Tees	E38000075	84	91	89	94	81	69
	NHS North Durham	E38000116	47	63	66	66	71	76
	NHS South Tees	E38000162	90	91	98	93	106	106
Greater Manchester	NHS Bolton	E38000016	80	74	74	70	76	74
	NHS Bury	E38000024	44	43	49	52	54	56
	NHS Heywood, Middleton & Rochdale	E38000080	51	55	65	73	77	72
	NHS Manchester	E38000217	172	184	189	196	199	193
	NHS Oldham	E38000135	52	56	61	66	66	67
	NHS Salford	E38000143	52	52	55	52	42	48
	NHS Stockport	E38000174	66	69	57	69	67	76
	NHS Tameside and Glossop	E38000182	52	60	60	59	59	60
	NHS Trafford	E38000187	55	56	64	67	60	56
	NHS Wigan Borough	E38000205	76	82	86	96	91	85
Lancashire	NHS Blackburn with Darwen	E38000014	71	73	79	73	79	77
	NHS Blackpool	E38000015	40	48	53	62	60	55
	NHS Chorley and South Ribble	E38000034	40	52	61	58	55	52
	NHS East Lancashire	E38000050	118	115	121	129	127	124
	NHS Fylde & Wyre	E38000060	64	67	63	68	69	69
	NHS Greater Preston	E38000065	63	64	64	58	60	68
	NHS Morecombe Bay	E38000216	80	80	74	82	86	79
	NHS West Lancashire	E38000200	35	32	28	29	33	35
Merseyside	NHS Halton	E38000068	47	40	41	42	42	48
	NHS Knowsley	E38000091	51	51	46	47	47	51
	NHS Liverpool	E38000101	176	168	158	159	163	159
	NHS South Sefton	E38000161	57	51	52	59	60	63
	NHS Southport and Formby	E38000170	43	43	41	45	39	42
	NHS St Helens	E38000172	60	58	49	48	52	49
Cumbria, Northumberland, Tyne and Wear	NHS Cumbria North	E38000215	59	57	65	70	77	93
	NHS Newcastle Gateshead	E38000212	115	122	115	116	131	130
	NHS North Tyneside	E38000127	33	37	50	50	49	54
	NHS Northumberland	E38000130	69	68	61	75	86	79
	NHS South Tyneside	E38000163	48	45	42	38	45	56
	NHS Sunderland	E38000176	89	95	85	96	96	113

Table F3.2. Continued

UK area	CCG/HB name	Code	Prevalent numbers on HD in-centre					
			2011	2012	2013	2014	2015	2016
North Yorkshire and Humber	NHS East Riding of Yorkshire	E38000052	86	86	79	79	82	90
	NHS Hambleton, Richmondshire and Whitby	E38000069	29	40	44	41	39	37
	NHS Harrogate and Rural District	E38000073	34	34	34	39	46	44
	NHS Hull	E38000085	76	67	70	81	92	97
	NHS North East Lincolnshire	E38000119	60	54	58	60	62	55
	NHS North Lincolnshire	E38000122	56	63	72	65	71	65
	NHS Scarborough and Ryedale	E38000145	29	34	35	36	34	39
	NHS Vale of York	E38000188	92	90	94	93	95	103
South Yorkshire and Bassetlaw	NHS Barnsley	E38000006	114	107	98	100	98	107
	NHS Bassetlaw	E38000008	35	46	41	41	41	40
	NHS Doncaster	E38000044	116	111	106	110	107	116
	NHS Rotherham	E38000141	106	102	105	102	106	110
	NHS Sheffield	E38000146	225	236	238	245	251	244
West Yorkshire	NHS Airedale, Wharfedale and Craven	E38000001	37	36	36	47	48	47
	NHS Bradford City	E38000018	42	43	45	56	51	54
	NHS Bradford Districts	E38000019	115	121	110	111	125	140
	NHS Calderdale	E38000025	59	45	42	44	48	50
	NHS Greater Huddersfield	E38000064	59	74	72	78	74	73
	NHS Leeds North	E38000094	71	66	65	59	62	58
	NHS Leeds South and East	E38000095	70	73	68	82	77	81
	NHS Leeds West	E38000096	65	58	67	69	78	74
	NHS North Kirklees	E38000121	68	69	75	71	62	75
	NHS Wakefield	E38000190	105	105	108	106	103	108
Arden, Herefordshire and Worcestershire	NHS Coventry and Rugby	E38000038	181	188	198	189	173	179
	NHS Herefordshire	E38000078	61	64	63	63	76	71
	NHS Redditch and Bromsgrove	E38000139	56	58	55	60	69	69
	NHS South Warwickshire	E38000164	86	77	79	76	87	95
	NHS South Worcestershire	E38000166	86	97	98	98	109	105
	NHS Warwickshire North	E38000195	71	61	69	81	78	79
	NHS Wyre Forest	E38000211	30	30	31	39	39	40
Birmingham and the Black Country	NHS Birmingham CrossCity	E38000012	414	419	418	426	439	429
	NHS Birmingham South and Central	E38000013	136	149	146	145	148	150
	NHS Dudley	E38000046	96	112	116	110	113	115
	NHS Sandwell and West Birmingham	E38000144	361	351	347	346	364	387
	NHS Solihull	E38000149	84	85	85	79	80	80
	NHS Walsall	E38000191	134	131	134	141	141	131
	NHS Wolverhampton	E38000210	117	108	109	115	118	118
Derbyshire and Nottinghamshire	NHS Erewash	E38000058	44	41	35	30	39	36
	NHS Hardwick	E38000071	41	41	42	37	39	40
	NHS Mansfield & Ashfield	E38000103	59	52	57	54	57	59
	NHS Newark & Sherwood	E38000109	39	32	30	27	29	30
	NHS North Derbyshire	E38000115	83	78	79	78	84	84
	NHS Nottingham City	E38000132	115	106	104	112	123	130
	NHS Nottingham North & East	E38000133	41	43	42	43	41	41
	NHS Nottingham West	E38000134	39	39	40	41	41	44
	NHS Rushcliffe	E38000142	30	27	31	29	30	32
	NHS Southern Derbyshire	E38000169	148	144	144	153	164	158

Table F3.2. Continued

UK area	CCG/HB name	Code	Prevalent numbers on HD in-centre					
			2011	2012	2013	2014	2015	2016
East Anglia	NHS Cambridgeshire and Peterborough[b]	E38000026	278	267	295	282		
	NHS Great Yarmouth & Waveney[a]	E38000063	106	103	96	88	96	105
	NHS Ipswich and East Suffolk[a]	E38000086	123	130	133	131	145	144
	NHS North Norfolk	E38000124	70	69	76	82	77	76
	NHS Norwich	E38000218	63	69	65	62	68	65
	NHS South Norfolk[b]	E38000219	59	65	67	65		
	NHS West Norfolk[b]	E38000203	55	53	55	51		
	NHS West Suffolk[b]	E38000204	64	50	57	58		
Essex	NHS Basildon and Brentwood	E38000007	90	90	97	105	93	96
	NHS Castle Point, Rayleigh and Rochford	E38000030	52	53	55	56	59	53
	NHS Mid Essex[b]	E38000106	96	98	103	109		
	NHS North East Essex[b]	E38000117	122	119	113	117		
	NHS Southend	E38000168	67	67	68	66	71	63
	NHS Thurrock	E38000185	55	57	55	59	60	60
	NHS West Essex[b]	E38000197	69	82	102	108		
Hertfordshire and the South Midlands	NHS Bedfordshire[b]	E38000010	106	100	111	122		
	NHS Corby	E38000037	17	21	19	21	18	18
	NHS East and North Hertfordshire[a]	E38000049	166	157	156	169	176	158
	NHS Herts Valleys	E38000079	199	187	177	186	188	200
	NHS Luton[a]	E38000102	95	95	95	94	101	116
	NHS Milton Keynes	E38000107	58	55	63	77	75	84
	NHS Nene	E38000108	176	173	179	185	183	199
Leicestershire and Lincolnshire	NHS East Leicestershire and Rutland	E38000051	79	80	80	81	82	79
	NHS Leicester City	E38000097	186	186	193	182	191	211
	NHS Lincolnshire East	E38000099	80	83	82	81	85	81
	NHS Lincolnshire West	E38000100	68	63	72	67	75	78
	NHS South Lincolnshire[a]	E38000157	45	48	43	41	36	32
	NHS South West Lincolnshire	E38000165	30	31	30	27	29	24
	NHS West Leicestershire	E38000201	99	98	98	102	102	101
Shropshire and Staffordshire	NHS Cannock Chase	E38000028	46	38	45	42	51	48
	NHS East Staffordshire	E38000053	26	34	31	35	28	27
	NHS North Staffordshire	E38000126	68	61	65	62	67	75
	NHS Shropshire	E38000147	98	106	100	103	103	108
	NHS South East Staffs and Seisdon and Peninsular	E38000153	81	74	73	73	74	67
	NHS Stafford and Surrounds	E38000173	51	46	40	47	55	63
	NHS Stoke on Trent	E38000175	103	97	98	111	99	103
	NHS Telford & Wrekin	E38000183	79	70	73	77	75	81
London	NHS Barking & Dagenham	E38000004	80	84	86	86	93	93
	NHS Barnet	E38000005	168	167	168	174	184	190
	NHS Camden	E38000027	84	82	88	93	96	93
	NHS City and Hackney	E38000035	138	143	136	136	127	135
	NHS Enfield	E38000057	153	146	151	146	135	143
	NHS Haringey	E38000072	135	141	148	153	148	149
	NHS Havering	E38000077	80	79	70	77	81	78
	NHS Islington	E38000088	72	83	86	82	87	81
	NHS Newham	E38000113	188	188	208	214	222	234
	NHS Redbridge	E38000138	124	122	133	124	134	135
	NHS Tower Hamlets	E38000186	115	123	137	141	163	162
	NHS Waltham Forest	E38000192	133	125	138	135	140	152
	NHS Brent	E38000020	271	279	269	286	299	308

Table F3.2. Continued

UK area	CCG/HB name	Code	Prevalent numbers on HD in-centre					
			2011	2012	2013	2014	2015	2016
London (cont.)	NHS Central London (Westminster)	E38000031	63	62	69	64	61	61
	NHS Ealing	E38000048	243	258	255	255	275	269
	NHS Hammersmith and Fulham	E38000070	84	87	81	87	90	99
	NHS Harrow	E38000074	178	176	166	162	165	166
	NHS Hillingdon	E38000082	137	142	154	145	146	138
	NHS Hounslow	E38000084	138	145	150	151	154	166
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	E38000202	97	94	97	105	105	111
	NHS Bexley	E38000011	95	99	101	111	109	126
	NHS Bromley	E38000023	89	81	82	86	113	111
	NHS Croydon	E38000040	212	236	244	252	257	270
	NHS Greenwich	E38000066	112	108	122	118	117	123
	NHS Kingston	E38000090	65	61	56	56	56	60
	NHS Lambeth	E38000092	201	203	204	226	231	225
	NHS Lewisham	E38000098	180	188	184	177	180	185
	NHS Merton	E38000105	85	91	85	95	108	119
	NHS Richmond	E38000140	44	41	45	41	41	47
	NHS Southwark	E38000171	185	186	189	200	221	218
	NHS Sutton	E38000179	90	92	85	93	99	102
	NHS Wandsworth	E38000193	134	123	116	129	141	147
Bath, Gloucestershire, Swindon and Wiltshire	NHS Bath and North East Somerset	E38000009	62	64	60	58	63	55
	NHS Gloucestershire	E38000062	186	216	206	209	216	226
	NHS Swindon	E38000181	46	56	58	63	58	56
	NHS Wiltshire	E38000206	109	102	108	106	109	112
Bristol, North Somerset, Somerset and South Gloucestershire	NHS Bristol	E38000022	149	163	176	181	179	181
	NHS North Somerset	E38000125	60	69	69	79	76	74
	NHS Somerset	E38000150	163	165	163	172	179	193
	NHS South Gloucestershire	E38000155	74	73	83	86	87	82
Devon, Cornwall and Isles of Scilly	NHS Kernow	E38000089	181	172	175	179	186	194
	NHS North, East, West Devon	E38000129	274	289	287	297	300	291
	NHS South Devon and Torbay	E38000152	107	113	120	118	125	137
Kent and Medway	NHS Ashford	E38000002	39	37	36	37	39	37
	NHS Canterbury and Coastal	E38000029	54	50	60	71	79	76
	NHS Dartford, Gravesham and Swanley	E38000043	73	80	85	90	86	95
	NHS Medway	E38000104	66	73	78	80	86	75
	NHS South Kent Coast	E38000156	62	68	57	59	64	71
	NHS Swale	E38000180	33	35	31	28	30	33
	NHS Thanet	E38000184	45	43	53	53	49	49
	NHS West Kent	E38000199	127	141	130	147	144	143
Surrey and Sussex	NHS Brighton & Hove	E38000021	61	67	67	78	77	88
	NHS Coastal West Sussex	E38000213	127	143	142	144	163	164
	NHS Crawley	E38000039	46	42	40	40	39	50
	NHS East Surrey	E38000054	43	50	58	57	60	61
	NHS Eastbourne, Hailsham and Seaford	E38000055	49	58	60	69	69	71
	NHS Guildford and Waverley	E38000214	39	45	42	46	51	59
	NHS Hastings & Rother	E38000076	50	50	57	57	60	67
	NHS High Weald Lewes Havens	E38000081	32	35	40	48	54	57
	NHS Horsham and Mid Sussex	E38000083	53	53	54	45	46	47
	NHS North West Surrey	E38000128	110	106	104	112	115	125
	NHS Surrey Downs	E38000177	86	84	92	86	86	87
	NHS Surrey Heath	E38000178	25	23	21	21	24	22

Table F3.2. Continued

UK area	CCG/HB name	Code	Prevalent numbers on HD in-centre					
			2011	2012	2013	2014	2015	2016
Thames Valley	NHS Aylesbury Vale	E38000003	41	49	46	51	50	51
	NHS Bracknell and Ascot	E38000017	24	25	32	37	39	39
	NHS Chiltern	E38000033	75	70	78	84	72	74
	NHS Newbury and District	E38000110	21	15	23	29	29	33
	NHS North & West Reading	E38000114	19	19	19	21	25	29
	NHS Oxfordshire	E38000136	162	159	158	157	138	139
	NHS Slough	E38000148	76	72	66	71	73	68
	NHS South Reading	E38000160	31	30	36	37	36	35
	NHS Windsor, Ascot and Maidenhead	E38000207	33	34	33	33	40	45
	NHS Wokingham	E38000209	48	45	47	44	45	46
Wessex	NHS Dorset	E38000045	204	227	229	238	247	239
	NHS Fareham and Gosport	E38000059	48	48	57	58	65	65
	NHS Isle of Wight	E38000087	30	38	56	56	48	38
	NHS North East Hampshire and Farnham	E38000118	59	62	67	63	75	57
	NHS North Hampshire	E38000120	41	40	36	46	48	49
	NHS Portsmouth	E38000137	56	60	63	64	74	65
	NHS South Eastern Hampshire	E38000154	72	63	71	76	77	67
	NHS Southampton	E38000167	68	74	65	57	66	65
	NHS West Hampshire	E38000198	125	136	140	145	143	120
Wales	Betsi Cadwaladr University	W11000023	219	245	233	258	239	235
	Powys Teaching	W11000024	43	53	53	46	54	55
	Hywel Dda	W11000025	131	123	128	133	142	136
	Abertawe Bro Morgannwg University	W11000026	220	204	200	179	212	215
	Cwm Taf	W11000027	102	97	93	94	104	109
	Aneurin Bevan	W11000028	193	178	181	204	201	198
	Cardiff and Vale University	W11000029	131	131	137	131	135	143
Scotland	Ayrshire and Arran	S08000015	146	145	134	127	130	138
	Borders	S08000016	47	38	37	37	41	34
	Dumfries and Galloway	S08000017	52	51	46	45	50	47
	Fife	S08000018	155	162	160	152	158	149
	Forth Valley	S08000019	110	101	102	94	98	89
	Grampian	S08000020	203	222	212	190	206	219
	Greater Glasgow and Clyde	S08000021	419	419	407	387	425	425
	Highland	S08000022	82	74	74	69	88	94
	Lanarkshire	S08000023	213	235	227	217	228	219
	Lothian	S08000024	201	218	230	227	235	248
	Orkney	S08000025	7	6	8	6	8	6
	Shetland	S08000026					7	7
	Tayside	S08000027	179	167	161	157	177	172
	Western Isles	S08000028	8	6	6	9	13	9
Northern Ireland	Belfast	ZC010	146	141	139	137	127	139
	Northern	ZC020	184	185	181	182	166	164
	Southern	ZC030	131	105	104	105	98	98
	South Eastern	ZC040	99	102	98	90	105	101
	Western	ZC050	119	104	87	90	97	105

[a]CCGs where between 5% and 15% of the prevalent dialysis population from 2014 were prevalent patients of the Cambridge renal centre. In these CCGs the numbers for 2015 and 2016 are likely to be underestimated
[b]CCGs where >15% of the prevalent dialysis population from 2014 were prevalent patients of the Cambridge renal centre. These have not been included in the analysis for 2015 or 2016
Blank cells – values of <5 have been suppressed

Table F3.3. Number of prevalent patients on home-therapies by year and CCG/HB

UK Area	CCG/HB Name	Code	Prevalent numbers on home-therapies					
			2011	2012	2013	2014	2015	2016
Cheshire, Warrington and Wirral	NHS Eastern Cheshire	E38000056	20	21	19	19	13	12
	NHS South Cheshire	E38000151	12	16	18	17	16	18
	NHS Vale Royal	E38000189	12	10	8	6	8	9
	NHS Warrington	E38000194	17	15	14	18	19	21
	NHS West Cheshire	E38000196	19	20	22	18	13	14
	NHS Wirral	E38000208	22	15	19	11	18	14
Durham, Darlington and Tees	NHS Darlington	E38000042						
	NHS Durham Dales, Easington and Sedgefield	E38000047	12	10	11	10	8	8
	NHS Hartlepool and Stockton-on-Tees	E38000075	8	8	7	9	13	17
	NHS North Durham	E38000116	13	17	8	12	10	12
	NHS South Tees	E38000162		6	7	5	12	8
Greater Manchester	NHS Bolton	E38000016	25	26	24	22	18	28
	NHS Bury	E38000024	20	21	19	19	20	17
	NHS Heywood, Middleton & Rochdale	E38000080	21	20	16	23	19	23
	NHS Manchester	E38000217	36	36	38	36	34	47
	NHS Oldham	E38000135	20	18	13	13	18	23
	NHS Salford	E38000143	14	13	18	14	15	20
	NHS Stockport	E38000174	35	33	28	23	27	19
	NHS Tameside and Glossop	E38000182	28	24	25	20	20	21
	NHS Trafford	E38000187	22	20	15	12	11	13
	NHS Wigan Borough	E38000205	26	29	25	25	21	27
Lancashire	NHS Blackburn with Darwen	E38000014	14	10				
	NHS Blackpool	E38000015	7	5		7	9	9
	NHS Chorley and South Ribble	E38000034	11	11	10	11	11	10
	NHS East Lancashire	E38000050	32	30	29	28	21	23
	NHS Fylde & Wyre	E38000060	12	11	16	15	14	12
	NHS Greater Preston	E38000065	5	12	11	17	18	12
	NHS Morecombe Bay	E38000216	24	28	28	22	24	16
	NHS West Lancashire	E38000200	7	5	7	6	7	
Merseyside	NHS Halton	E38000068	11	13	13	11	14	11
	NHS Knowsley	E38000091	7	14	12	17	23	14
	NHS Liverpool	E38000101	30	32	32	36	36	41
	NHS South Sefton	E38000161	12	18	19	21	23	22
	NHS Southport and Formby	E38000170	10	8	10	10	13	12
	NHS St Helens	E38000172	14	22	21	18	14	24
Cumbria, Northumberland, Tyne and Wear	NHS Cumbria North	E38000215	22	25	24	26	38	35
	NHS Newcastle Gateshead	E38000212	24	26	24	27	25	28
	NHS North Tyneside	E38000127	11	13	11	11	12	16
	NHS Northumberland	E38000130	15	21	21	25	23	22
	NHS South Tyneside	E38000163	9	8		6		6
	NHS Sunderland	E38000176	8	7	8	6	13	11

Table F3.3. Continued

UK Area	CCG/HB Name	Code	Prevalent numbers on home-therapies					
			2011	2012	2013	2014	2015	2016
North Yorkshire and Humber	NHS East Riding of Yorkshire	E38000052	36	30	20	23	27	24
	NHS Hambleton, Richmondshire and Whitby	E38000069	11	6	7		5	6
	NHS Harrogate and Rural District	E38000073	8	10	11	14	15	17
	NHS Hull	E38000085	17	16	15	17	15	15
	NHS North East Lincolnshire	E38000119	19	21	14	12	14	14
	NHS North Lincolnshire	E38000122	19	23	26	24	20	22
	NHS Scarborough and Ryedale	E38000145	7	8	10	7	7	6
	NHS Vale of York	E38000188	25	34	27	23	21	24
South Yorkshire and Bassetlaw	NHS Barnsley	E38000006	14	14	22	19	17	16
	NHS Bassetlaw	E38000008	13	12	13	11	9	9
	NHS Doncaster	E38000044	20	22	25	27	27	27
	NHS Rotherham	E38000141	17	21	15	15	19	22
	NHS Sheffield	E38000146	37	40	40	33	34	37
West Yorkshire	NHS Airedale, Wharfedale and Craven	E38000001	5	6	7	6	8	7
	NHS Bradford City	E38000018	5					
	NHS Bradford Districts	E38000019	18	23	27	22	20	22
	NHS Calderdale	E38000025	14	15	15	14	14	11
	NHS Greater Huddersfield	E38000064	20	15	14	12	13	8
	NHS Leeds North	E38000094	7	8	5			6
	NHS Leeds South and East	E38000095	10	5	6	5	8	9
	NHS Leeds West	E38000096	16	9	7	8	6	8
	NHS North Kirklees	E38000121	12	11	12	10	10	10
	NHS Wakefield	E38000190	19	25	22	23	18	13
Arden, Herefordshire and Worcestershire	NHS Coventry and Rugby	E38000038	56	70	60	48	43	42
	NHS Herefordshire	E38000078	17	17	18	19	21	26
	NHS Redditch and Bromsgrove	E38000139	22	24	24	18	15	11
	NHS South Warwickshire	E38000164	23	20	18	28	22	18
	NHS South Worcestershire	E38000166	30	30	20	26	22	25
	NHS Warwickshire North	E38000195	26	29	25	26	28	22
	NHS Wyre Forest	E38000211	19	18	16	23	19	16
Birmingham and the Black Country	NHS Birmingham CrossCity	E38000012	62	65	65	54	61	92
	NHS Birmingham South and Central	E38000013	20	24	23	19	14	17
	NHS Dudley	E38000046	48	61	60	64	60	61
	NHS Sandwell and West Birmingham	E38000144	67	70	58	69	73	75
	NHS Solihull	E38000149	16	10	11	11	17	20
	NHS Walsall	E38000191	45	45	45	40	46	44
	NHS Wolverhampton	E38000210	31	44	37	37	38	37
Derbyshire and Nottinghamshire	NHS Erewash	E38000058	11	15	8	9	11	13
	NHS Hardwick	E38000071	7	7	8	11	10	9
	NHS Mansfield & Ashfield	E38000103	20	16	13	20	23	22
	NHS Newark & Sherwood	E38000109	26	26	23	21	16	14
	NHS North Derbyshire	E38000115	24	20	25	27	23	23
	NHS Nottingham City	E38000132	28	31	33	26	31	32
	NHS Nottingham North & East	E38000133	18	17	13	16	14	17
	NHS Nottingham West	E38000134	8	14	17	16	15	11
	NHS Rushcliffe	E38000142	13	7	5	7	7	8
	NHS Southern Derbyshire	E38000169	89	81	77	83	76	76

Table F3.3. Continued

UK Area	CCG/HB Name	Code	Prevalent numbers on home-therapies					
			2011	2012	2013	2014	2015	2016
East Anglia	NHS Cambridgeshire and Peterborough[b]	E38000026	46	43	41	42		
	NHS Great Yarmouth & Waveney[a]	E38000063	17	15	13	13	15	14
	NHS Ipswich and East Suffolk[a]	E38000086	27	24	26	29	29	30
	NHS North Norfolk	E38000124	16	21	15	14	15	13
	NHS Norwich	E38000218	12	11	15	18	17	20
	NHS South Norfolk[b]	E38000219	27	25	22	18		
	NHS West Norfolk[b]	E38000203	13	7	6	7		
	NHS West Suffolk[b]	E38000204	9	17	14	13		
Essex	NHS Basildon and Brentwood	E38000007	20	19	18	18	29	26
	NHS Castle Point, Rayleigh and Rochford	E38000030	12	10	11	13	12	18
	NHS Mid Essex[b]	E38000106	21	21	20	23		
	NHS North East Essex[b]	E38000117	16	15	12	13		
	NHS Southend	E38000168	11	9	12	10	10	18
	NHS Thurrock	E38000185	11	11	16	12	10	9
	NHS West Essex[b]	E38000197	7	16	14	17		
Hertfordshire and the South Midlands	NHS Bedfordshire[b]	E38000010	27	27	28	21		
	NHS Corby	E38000037		5	6	8	7	10
	NHS East and North Hertfordshire[a]	E38000049	23	22	29	30	25	29
	NHS Herts Valleys	E38000079	10	18	24	23	19	18
	NHS Luton[a]	E38000102	9	10	19	14	7	7
	NHS Milton Keynes	E38000107	17	16	20	15	14	18
	NHS Nene	E38000108	49	64	60	44	38	32
Leicestershire and Lincolnshire	NHS East Leicestershire and Rutland	E38000051	26	25	28	22	27	22
	NHS Leicester City	E38000097	25	31	23	27	22	17
	NHS Lincolnshire East	E38000099	20	26	31	23	22	24
	NHS Lincolnshire West	E38000100	22	22	19	24	24	15
	NHS South Lincolnshire[a]	E38000157	12	12	14	13	13	15
	NHS South West Lincolnshire	E38000165	14	11	11	12	8	8
	NHS West Leicestershire	E38000201	29	27	29	28	28	26
Shropshire and Staffordshire	NHS Cannock Chase	E38000028	17	18	20	25	21	25
	NHS East Staffordshire	E38000053	21	18	18	19	22	18
	NHS North Staffordshire	E38000126	33	34	33	36	30	23
	NHS Shropshire	E38000147	35	36	32	36	38	37
	NHS South East Staffs and Seisdon and Peninsular	E38000153	27	26	23	19	21	27
	NHS Stafford and Surrounds	E38000173	19	24	24	24	21	21
	NHS Stoke on Trent	E38000175	28	24	28	29	25	32
	NHS Telford & Wrekin	E38000183	11	22	21	18	27	26
London	NHS Barking & Dagenham	E38000004	22	28	25	31	30	26
	NHS Barnet	E38000005	35	35	36	39	39	38
	NHS Camden	E38000027	9	11	12	13	15	15
	NHS City and Hackney	E38000035	15	18	24	18	18	18
	NHS Enfield	E38000057	22	29	30	35	42	43
	NHS Haringey	E38000072	14	23	27	26	28	32
	NHS Havering	E38000077	17	27	22	21	22	25
	NHS Islington	E38000088	10	15	18	20	20	19
	NHS Newham	E38000113	42	42	33	38	48	44
	NHS Redbridge	E38000138	27	32	36	42	42	47
	NHS Tower Hamlets	E38000186	19	24	25	27	22	24
	NHS Waltham Forest	E38000192	23	25	23	39	33	29
	NHS Brent	E38000020	6	9	14	17	17	16

Table F3.3. Continued

UK Area	CCG/HB Name	Code	Prevalent numbers on home-therapies					
			2011	2012	2013	2014	2015	2016
London (cont.)	NHS Central London (Westminster)	E38000031			6	10	9	11
	NHS Ealing	E38000048	5	10	15	14	18	18
	NHS Hammersmith and Fulham	E38000070	6	7	5			10
	NHS Harrow	E38000074	6	9	9	9	9	9
	NHS Hillingdon	E38000082	8	9	9	11	13	18
	NHS Hounslow	E38000084	10	13	15	12	14	20
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	E38000202		5	5	7	8	10
	NHS Bexley	E38000011	23	23	18	20	22	28
	NHS Bromley	E38000023	23	23	26	28	26	22
	NHS Croydon	E38000040	27	29	31	37	36	37
	NHS Greenwich	E38000066	15	14	28	22	27	29
	NHS Kingston	E38000090	13	11	10	12	7	9
	NHS Lambeth	E38000092	20	25	29	22	28	24
	NHS Lewisham	E38000098	18	23	20	23	15	15
	NHS Merton	E38000105	14	14	13	18	14	11
	NHS Richmond	E38000140	5	5		5	8	8
	NHS Southwark	E38000171	14	15	19	15	10	17
	NHS Sutton	E38000179	9	10	12	12	14	16
	NHS Wandsworth	E38000193	16	14	15	16	18	16
Bath, Gloucestershire, Swindon and Wiltshire	NHS Bath and North East Somerset	E38000009	6	8	9	8	10	10
	NHS Gloucestershire	E38000062	49	45	41	50	40	48
	NHS Swindon	E38000181	24	22	21	18	21	16
	NHS Wiltshire	E38000206	25	21	26	27	28	36
Bristol, North Somerset, Somerset and South Gloucestershire	NHS Bristol	E38000022	28	26	27	25	22	13
	NHS North Somerset	E38000125	16	13	12	12	13	12
	NHS Somerset	E38000150	44	42	35	44	34	45
	NHS South Gloucestershire	E38000155	15	17	19	20	12	14
Devon, Cornwall and Isles of Scilly	NHS Kernow	E38000089	48	48	51	50	47	45
	NHS North, East, West Devon	E38000129	67	59	55	57	58	69
	NHS South Devon and Torbay	E38000152	29	26	28	30	32	24
Kent and Medway	NHS Ashford	E38000002	9	10	10	8	6	6
	NHS Canterbury and Coastal	E38000029	24	19	19	18	18	15
	NHS Dartford, Gravesham and Swanley	E38000043	27	26	30	28	23	25
	NHS Medway	E38000104	9	11	12	16	17	18
	NHS South Kent Coast	E38000156	18	11	10	13	12	13
	NHS Swale	E38000180	6	10	12	13	11	14
	NHS Thanet	E38000184	16	16	14	11	8	8
	NHS West Kent	E38000199	21	14	16	18	17	17
Surrey and Sussex	NHS Brighton & Hove	E38000021	14	23	20	19	14	21
	NHS Coastal West Sussex	E38000213	29	36	35	44	43	49
	NHS Crawley	E38000039	10	8	7	10	10	12
	NHS East Surrey	E38000054	14	18	20	17	17	14
	NHS Eastbourne, Hailsham and Seaford	E38000055	23	27	30	22	22	19
	NHS Guildford and Waverley	E38000214	15	14	12	11	10	9
	NHS Hastings & Rother	E38000076	15	19	24	23	26	13
	NHS High Weald Lewes Havens	E38000081	13	13	9	8	13	14
	NHS Horsham and Mid Sussex	E38000083	23	16	15	16	12	15
	NHS North West Surrey	E38000128	19	24	25	31	32	39
	NHS Surrey Downs	E38000177	28	31	25	23	18	12
	NHS Surrey Heath	E38000178	5	7	6	9	7	

Table F3.3. Continued

UK Area	CCG/HB Name	Code	Prevalent numbers on home-therapies					
			2011	2012	2013	2014	2015	2016
Thames Valley	NHS Aylesbury Vale	E38000003	12	5	9	5	6	11
	NHS Bracknell and Ascot	E38000017			8	9	9	8
	NHS Chiltern	E38000033	16	12	17	16	21	16
	NHS Newbury and District	E38000110	7	11	8	7	12	16
	NHS North & West Reading	E38000114	9	8	9	8	6	7
	NHS Oxfordshire	E38000136	38	40	48	40	38	34
	NHS Slough	E38000148	20	24	19	14	13	10
	NHS South Reading	E38000160	14	13	14	17	11	9
	NHS Windsor, Ascot and Maidenhead	E38000207	14	8	8	14	10	11
	NHS Wokingham	E38000209	11	10	13	9	8	6
Wessex	NHS Dorset	E38000045	43	45	51	55	47	42
	NHS Fareham and Gosport	E38000059	21	23	18	21	24	20
	NHS Isle of Wight	E38000087			6	9	12	12
	NHS North East Hampshire and Farnham	E38000118	9	9	11	16	10	14
	NHS North Hampshire	E38000120	6	7	16	17	15	11
	NHS Portsmouth	E38000137	6	9	12	9	8	15
	NHS South Eastern Hampshire	E38000154	14	12	14	8	7	13
	NHS Southampton	E38000167	10	7	7	11	15	20
	NHS West Hampshire	E38000198	31	25	27	30	30	30
Wales	Betsi Cadwaladr University	W11000023	69	76	72	76	99	85
	Powys Teaching	W11000024	15	14	12	14	12	12
	Hywel Dda	W11000025	34	35	34	41	51	52
	Abertawe Bro Morgannwg University	W11000026	56	64	51	56	50	55
	Cwm Taf	W11000027	36	26	24	24	16	15
	Aneurin Bevan	W11000028	50	48	47	48	55	61
	Cardiff and Vale University	W11000029	29	19	24	26	24	25
Scotland	Ayrshire and Arran	S08000015	57	52	53	49	51	42
	Borders	S08000016	6	6	7			
	Dumfries and Galloway	S08000017	14	17	18	17	13	13
	Fife	S08000018	33	22	24	18	21	20
	Forth Valley	S08000019	12	14	11	13	12	8
	Grampian	S08000020	26	28	32	33	28	23
	Greater Glasgow and Clyde	S08000021	51	52	42	39	44	49
	Highland	S08000022	27	31	22	23	24	19
	Lanarkshire	S08000023	18	18	21	15	25	34
	Lothian	S08000024	43	41	29	24	29	39
	Orkney	S08000025						
	Shetland	S08000026						
	Tayside	S08000027	15	19	19	23	18	21
	Western Isles	S08000028						6
Northern Ireland	Belfast	ZC010	12	20	19	12	20	17
	Northern	ZC020	28	30	27	21	29	21
	Southern	ZC030	21	27	28	22	26	24
	South Eastern	ZC040	23	20	18	13	14	19
	Western	ZC050	21	20	19	16	15	13

[a]CCGs where between 5% and 15% of the prevalent dialysis population from 2014 were prevalent patients of the Cambridge renal centre. In these CCGs the numbers for 2015 and 2016 are likely to be underestimated
[b]CCGs where >15% of the prevalent dialysis population from 2014 were prevalent patients of the Cambridge renal centre. These have not been included in the analysis for 2015 or 2016
Blank cells – values of <5 have been suppressed

Table F3.4. Number of prevalent patients on transplant by year and CCG/HB

UK area	CCG/HB name	Code	Prevalent numbers on transplant					
			2011	2012	2013	2014	2015	2016
Cheshire, Warrington and Wirral	NHS Eastern Cheshire	E38000056	74	78	83	88	92	101
	NHS South Cheshire	E38000151	68	71	79	87	93	103
	NHS Vale Royal	E38000189	31	34	38	39	43	45
	NHS Warrington	E38000194	76	81	93	96	95	100
	NHS West Cheshire	E38000196	93	97	104	109	105	113
	NHS Wirral	E38000208	113	111	114	115	121	136
Durham, Darlington and Tees	NHS Darlington	E38000042	43	44	49	53	54	55
	NHS Durham Dales, Easington and Sedgefield	E38000047	123	125	138	151	150	155
	NHS Hartlepool and Stockton-on-Tees	E38000075	115	122	128	137	144	150
	NHS North Durham	E38000116	97	100	103	103	107	104
	NHS South Tees	E38000162	156	160	161	169	175	176
Greater Manchester	NHS Bolton	E38000016	140	150	154	157	169	176
	NHS Bury	E38000024	75	80	81	89	98	103
	NHS Heywood, Middleton & Rochdale	E38000080	94	97	104	97	106	124
	NHS Manchester	E38000217	160	175	191	210	231	245
	NHS Oldham	E38000135	92	94	106	105	116	123
	NHS Salford	E38000143	89	101	102	109	118	124
	NHS Stockport	E38000174	114	118	125	128	137	147
	NHS Tameside and Glossop	E38000182	116	118	123	131	136	153
	NHS Trafford	E38000187	81	88	95	104	111	117
	NHS Wigan Borough	E38000205	141	152	167	170	177	189
Lancashire	NHS Blackburn with Darwen	E38000014	55	59	64	71	73	73
	NHS Blackpool	E38000015	45	55	65	69	71	75
	NHS Chorley and South Ribble	E38000034	69	70	78	81	85	91
	NHS East Lancashire	E38000050	169	170	183	190	203	212
	NHS Fylde & Wyre	E38000060	56	62	67	67	77	80
	NHS Greater Preston	E38000065	64	72	75	81	85	87
	NHS Morecombe Bay	E38000216	122	132	142	145	153	164
	NHS West Lancashire	E38000200	42	45	46	46	50	49
Merseyside	NHS Halton	E38000068	51	56	58	63	66	66
	NHS Knowsley	E38000091	56	59	64	65	64	68
	NHS Liverpool	E38000101	176	185	204	214	215	217
	NHS South Sefton	E38000161	59	65	67	68	70	76
	NHS Southport and Formby	E38000170	36	33	41	42	43	43
	NHS St Helens	E38000172	63	64	71	80	84	81
Cumbria, Northumberland, Tyne and Wear	NHS Cumbria North	E38000215	129	128	136	147	158	149
	NHS Newcastle Gateshead	E38000212	196	196	200	206	209	225
	NHS North Tyneside	E38000127	116	118	119	112	116	119
	NHS Northumberland	E38000130	132	135	145	151	149	157
	NHS South Tyneside	E38000163	75	76	84	78	75	83
	NHS Sunderland	E38000176	130	137	143	146	145	157

Table F3.4. Continued

UK area	CCG/HB name	Code	Prevalent numbers on transplant					
			2011	2012	2013	2014	2015	2016
North Yorkshire and Humber	NHS East Riding of Yorkshire	E38000052	130	139	159	162	166	169
	NHS Hambleton, Richmondshire and Whitby	E38000069	51	52	59	73	78	75
	NHS Harrogate and Rural District	E38000073	74	82	82	86	91	93
	NHS Hull	E38000085	100	107	116	120	133	141
	NHS North East Lincolnshire	E38000119	64	68	71	70	74	79
	NHS North Lincolnshire	E38000122	48	48	51	57	61	68
	NHS Scarborough and Ryedale	E38000145	57	58	56	59	63	64
	NHS Vale of York	E38000188	144	163	173	183	189	195
South Yorkshire and Bassetlaw	NHS Barnsley	E38000006	96	98	102	113	117	125
	NHS Bassetlaw	E38000008	36	36	37	42	49	52
	NHS Doncaster	E38000044	112	119	122	133	144	151
	NHS Rotherham	E38000141	111	116	125	137	140	144
	NHS Sheffield	E38000146	213	222	233	242	248	253
West Yorkshire	NHS Airedale, Wharfedale and Craven	E38000001	69	73	78	80	88	89
	NHS Bradford City	E38000018	36	42	47	49	58	66
	NHS Bradford Districts	E38000019	158	174	187	193	204	215
	NHS Calderdale	E38000025	103	110	109	106	109	114
	NHS Greater Huddersfield	E38000064	103	110	114	123	131	139
	NHS Leeds North	E38000094	86	88	89	97	104	105
	NHS Leeds South and East	E38000095	92	97	108	107	114	116
	NHS Leeds West	E38000096	108	123	138	149	152	157
	NHS North Kirklees	E38000121	92	92	107	119	125	123
	NHS Wakefield	E38000190	119	125	133	140	145	158
Arden, Herefordshire and Worcestershire	NHS Coventry and Rugby	E38000038	174	184	191	211	222	233
	NHS Herefordshire	E38000078	57	60	62	66	73	79
	NHS Redditch and Bromsgrove	E38000139	62	68	69	75	76	85
	NHS South Warwickshire	E38000164	107	120	126	130	139	135
	NHS South Worcestershire	E38000166	100	103	110	114	115	123
	NHS Warwickshire North	E38000195	88	87	91	91	95	100
	NHS Wyre Forest	E38000211	34	36	40	38	37	43
Birmingham and the Black Country	NHS Birmingham CrossCity	E38000012	272	289	309	332	349	381
	NHS Birmingham South and Central	E38000013	73	71	82	91	95	103
	NHS Dudley	E38000046	96	91	101	107	116	125
	NHS Sandwell and West Birmingham	E38000144	175	186	217	216	226	256
	NHS Solihull	E38000149	64	69	70	76	79	80
	NHS Walsall	E38000191	113	118	129	139	139	149
	NHS Wolverhampton	E38000210	74	80	96	101	101	108
Derbyshire and Nottinghamshire	NHS Erewash	E38000058	27	27	37	41	41	43
	NHS Hardwick	E38000071	27	27	25	31	35	37
	NHS Mansfield & Ashfield	E38000103	80	89	96	100	98	102
	NHS Newark & Sherwood	E38000109	53	59	63	67	65	63
	NHS North Derbyshire	E38000115	98	111	110	111	116	125
	NHS Nottingham City	E38000132	100	108	118	123	130	137
	NHS Nottingham North & East	E38000133	56	60	66	62	66	70
	NHS Nottingham West	E38000134	49	51	54	58	63	65
	NHS Rushcliffe	E38000142	43	45	52	50	48	47
	NHS Southern Derbyshire	E38000169	200	211	229	238	250	273

Table F3.4. Continued

UK area	CCG/HB name	Code	Prevalent numbers on transplant					
			2011	2012	2013	2014	2015	2016
East Anglia	NHS Cambridgeshire and Peterborough[b]	E38000026	341	353	376	392		
	NHS Great Yarmouth & Waveney[b]	E38000063	72	78	96	107		
	NHS Ipswich and East Suffolk[a]	E38000086	148	150	171	178	165	170
	NHS North Norfolk	E38000124	70	65	87	83	86	90
	NHS Norwich[a]	E38000218	67	65	86	92	92	94
	NHS South Norfolk[b]	E38000219	81	85	103	104		
	NHS West Norfolk[b]	E38000203	59	67	67	74		
	NHS West Suffolk[b]	E38000204	88	96	98	98		
Essex	NHS Basildon and Brentwood	E38000007	95	98	119	111	107	115
	NHS Castle Point, Rayleigh and Rochford	E38000030	63	65	73	85	79	79
	NHS Mid Essex[b]	E38000106	163	159	180	185		
	NHS North East Essex[b]	E38000117	125	129	142	157		
	NHS Southend	E38000168	59	67	77	81	79	84
	NHS Thurrock	E38000185	55	56	57	60	65	65
	NHS West Essex[b]	E38000197	106	114	117	128		
Hertfordshire and the South Midlands	NHS Bedfordshire[b]	E38000010	180	203	210	223		
	NHS Corby[a]	E38000037	22	21	20	19	27	29
	NHS East and North Hertfordshire[b]	E38000049	214	233	250	264		
	NHS Herts Valleys	E38000079	229	236	255	273	294	314
	NHS Luton[b]	E38000102	86	96	105	120		
	NHS Milton Keynes	E38000107	105	112	112	130	139	148
	NHS Nene	E38000108	256	252	269	299	302	327
Leicestershire and Lincolnshire	NHS East Leicestershire and Rutland	E38000051	127	134	138	151	155	168
	NHS Leicester City	E38000097	177	185	204	224	234	250
	NHS Lincolnshire East	E38000099	88	93	101	108	110	119
	NHS Lincolnshire West	E38000100	80	81	90	98	94	96
	NHS South Lincolnshire[b]	E38000157	39	43	43	52		
	NHS South West Lincolnshire	E38000165	39	41	42	44	46	48
	NHS West Leicestershire	E38000201	168	175	186	193	199	213
Shropshire and Staffordshire	NHS Cannock Chase	E38000028	44	44	49	49	49	53
	NHS East Staffordshire	E38000053	33	33	40	39	44	50
	NHS North Staffordshire	E38000126	82	88	97	95	102	108
	NHS Shropshire	E38000147	112	108	112	117	128	124
	NHS South East Staffs and Seisdon and Peninsular	E38000153	82	79	88	94	98	103
	NHS Stafford and Surrounds	E38000173	57	62	67	72	78	79
	NHS Stoke on Trent	E38000175	104	111	112	119	120	126
	NHS Telford & Wrekin	E38000183	50	50	56	56	65	60
London	NHS Barking & Dagenham	E38000004	73	74	86	93	95	105
	NHS Barnet	E38000005	190	214	225	229	240	242
	NHS Camden	E38000027	103	108	108	108	113	119
	NHS City and Hackney	E38000035	75	82	92	106	117	134
	NHS Enfield	E38000057	158	176	182	199	216	235
	NHS Haringey	E38000072	119	128	136	150	166	180
	NHS Havering	E38000077	77	79	92	89	96	102
	NHS Islington	E38000088	101	107	113	121	126	129
	NHS Newham	E38000113	96	112	131	151	163	172
	NHS Redbridge	E38000138	124	139	145	162	166	178
	NHS Tower Hamlets	E38000186	77	85	89	102	106	116
	NHS Waltham Forest	E38000192	117	121	131	150	166	179
	NHS Brent	E38000020	190	202	220	227	242	258

Table F3.4. Continued

UK area	CCG/HB name	Code	Prevalent numbers on transplant					
			2011	2012	2013	2014	2015	2016
London (cont.)	NHS Central London (Westminster)	E38000031	69	73	76	85	93	99
	NHS Ealing	E38000048	198	206	211	231	243	258
	NHS Hammersmith and Fulham	E38000070	73	75	81	87	89	91
	NHS Harrow	E38000074	162	170	172	185	192	213
	NHS Hillingdon	E38000082	166	175	177	194	193	203
	NHS Hounslow	E38000084	124	128	146	159	171	168
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	E38000202	103	102	106	113	112	110
	NHS Bexley	E38000011	122	126	137	140	156	157
	NHS Bromley	E38000023	147	155	162	168	178	190
	NHS Croydon	E38000040	133	135	154	158	173	182
	NHS Greenwich	E38000066	104	113	125	148	157	169
	NHS Kingston	E38000090	65	72	73	78	82	90
	NHS Lambeth	E38000092	112	125	138	150	162	175
	NHS Lewisham	E38000098	100	102	125	135	152	155
	NHS Merton	E38000105	87	95	104	109	115	122
	NHS Richmond	E38000140	65	72	78	81	80	75
	NHS Southwark	E38000171	149	168	180	195	199	207
	NHS Sutton	E38000179	84	91	94	93	97	105
	NHS Wandsworth	E38000193	108	116	124	136	142	150
Bath, Gloucestershire, Swindon and Wiltshire	NHS Bath and North East Somerset	E38000009	52	53	63	69	72	80
	NHS Gloucestershire	E38000062	237	235	262	263	280	291
	NHS Swindon	E38000181	91	93	101	110	124	136
	NHS Wiltshire	E38000206	182	191	194	206	218	226
Bristol, North Somerset, Somerset and South Gloucestershire	NHS Bristol	E38000022	206	214	227	235	241	249
	NHS North Somerset	E38000125	96	103	109	109	113	111
	NHS Somerset	E38000150	222	225	237	244	249	250
	NHS South Gloucestershire	E38000155	122	124	132	134	138	140
Devon, Cornwall and Isles of Scilly	NHS Kernow	E38000089	268	291	305	315	329	330
	NHS North, East, West Devon	E38000129	380	403	432	443	462	478
	NHS South Devon and Torbay	E38000152	143	145	160	167	166	173
Kent and Medway	NHS Ashford	E38000002	56	62	62	68	68	77
	NHS Canterbury and Coastal	E38000029	90	103	105	115	112	113
	NHS Dartford, Gravesham and Swanley	E38000043	119	124	131	142	152	149
	NHS Medway	E38000104	105	107	117	118	121	128
	NHS South Kent Coast	E38000156	74	80	88	98	99	102
	NHS Swale	E38000180	62	67	74	75	77	75
	NHS Thanet	E38000184	60	72	77	79	84	87
	NHS West Kent	E38000199	166	178	190	199	204	224
Surrey and Sussex	NHS Brighton & Hove	E38000021	100	102	103	106	119	123
	NHS Coastal West Sussex	E38000213	212	210	227	235	245	260
	NHS Crawley	E38000039	31	35	34	35	34	34
	NHS East Surrey	E38000054	65	69	73	71	74	79
	NHS Eastbourne, Hailsham and Seaford	E38000055	59	61	66	69	72	71
	NHS Guildford and Waverley	E38000214	51	59	62	66	69	71
	NHS Hastings & Rother	E38000076	67	66	70	76	77	83
	NHS High Weald Lewes Havens	E38000081	54	64	65	69	68	72
	NHS Horsham and Mid Sussex	E38000083	70	71	78	89	95	93

Table F3.4. Continued

UK area	CCG/HB name	Code	Prevalent numbers on transplant					
			2011	2012	2013	2014	2015	2016
Surrey and Sussex (cont.)	NHS North West Surrey	E38000128	143	152	162	167	170	173
	NHS Surrey Downs	E38000177	111	112	120	127	131	136
	NHS Surrey Heath	E38000178	49	52	49	45	45	48
Thames Valley	NHS Aylesbury Vale	E38000003	110	114	117	122	121	136
	NHS Bracknell and Ascot	E38000017	60	61	64	65	65	70
	NHS Chiltern	E38000033	136	153	162	162	170	180
	NHS Newbury and District	E38000110	60	61	62	60	58	59
	NHS North & West Reading	E38000114	40	43	45	44	45	46
	NHS Oxfordshire	E38000136	278	298	310	338	354	368
	NHS Slough	E38000148	87	92	110	117	127	127
	NHS South Reading	E38000160	52	50	56	60	66	76
	NHS Windsor, Ascot and Maidenhead	E38000207	62	73	80	87	89	90
	NHS Wokingham	E38000209	66	70	72	77	80	82
Wessex	NHS Dorset	E38000045	307	304	313	329	343	358
	NHS Fareham and Gosport	E38000059	82	83	96	102	105	108
	NHS Isle of Wight	E38000087	47	48	45	47	52	55
	NHS North East Hampshire and Farnham	E38000118	73	77	84	90	97	107
	NHS North Hampshire	E38000120	76	79	83	85	92	95
	NHS Portsmouth	E38000137	77	78	81	79	81	86
	NHS South Eastern Hampshire	E38000154	94	100	102	115	119	124
	NHS Southampton	E38000167	92	101	109	117	120	125
	NHS West Hampshire	E38000198	223	228	239	244	249	267
Wales	Betsi Cadwaladr University	W11000023	253	249	238	252	309	336
	Powys Teaching	W11000024	54	48	50	52	53	51
	Hywel Dda	W11000025	171	167	190	192	193	190
	Abertawe Bro Morgannwg University	W11000026	285	301	314	319	322	313
	Cwm Taf	W11000027	192	199	214	214	213	212
	Aneurin Bevan	W11000028	301	336	344	348	354	364
	Cardiff and Vale University	W11000029	222	238	244	243	257	267
Scotland	Ayrshire and Arran	S08000015	152	164	175	188	195	210
	Borders	S08000016	51	58	59	60	59	66
	Dumfries and Galloway	S08000017	63	63	63	69	73	75
	Fife	S08000018	135	143	154	158	165	165
	Forth Valley	S08000019	110	118	127	141	149	160
	Grampian	S08000020	226	236	255	258	277	294
	Greater Glasgow and Clyde	S08000021	507	559	600	637	655	688
	Highland	S08000022	159	159	167	174	184	189
	Lanarkshire	S08000023	286	308	323	351	359	372
	Lothian	S08000024	314	322	331	353	362	365
	Orkney	S08000025	8	8	8	6	6	6
	Shetland	S08000026	5	6	6	6	6	8
	Tayside	S08000027	174	176	184	189	197	201
	Western Isles	S08000028	8	8	8	8	8	10
Northern Ireland	Belfast	ZC010	146	158	169	187	196	207
	Northern	ZC020	178	183	199	221	236	250
	Southern	ZC030	128	144	156	174	199	222
	South Eastern	ZC040	138	141	149	163	179	197
	Western	ZC050	108	110	133	158	173	186

[a]CCGs where between 5% and 15% of the prevalent transplant population from 2014 were prevalent patients of the Cambridge renal centre. In these CCGs the numbers for 2015 and 2016 are likely to be underestimated

[b]CCGs where >15% of the prevalent transplant population from 2014 were prevalent patients of the Cambridge renal centre. These have not been included in the analysis for 2015 or 2016

Blank cells – values of <5 have been suppressed

F:4 Data completeness for haemodialysis session variables

Table F.4.1. Data completeness for haemodialysis session variables in all available HD-sessions of patients starting HD in 2016, by centre

			% completeness								
					Weight		SBP		DBP		
Centre	*N* Patients with data	*N* Sessions with data	Vascular access	Symptomatic hypotension	pre-HD	post-HD	pre-HD	post-HD	pre-HD	post-HD	Time dialysed
Antrim	43	1,695	83.1	100.0	98.6	88.4	99.8	91.8	99.8	91.8	71.8
B Heart	85	5,342	99.4	0.0	90.3	79.3	99.4	98.1	99.4	98.1	99.9
B QEH	186	12,326	100.0	0.0	95.3	92.3	99.6	99.1	99.6	99.0	100.0
Bangor	18	913	0.0	0.0	94.4	88.0	99.9	95.9	99.9	96.2	0.0
Basldn	46	1,557	89.9	100.0	99.6	99.3	99.7	99.4	99.7	99.4	99.2
Belfast	65	4,133	66.5	100.0	92.6	79.7	99.8	94.3	99.8	94.3	26.5
Bradfd	36	161	100.0	0.0	4.3	1.9	100.0	96.9	100.0	96.9	0.0
Brightn	148	8,084	39.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.4
Bristol	169	8,312	100.0	100.0	94.0	88.3	99.5	97.5	99.5	97.6	0.0
Cardff	44	2,566	0.0	0.0	100.0	99.7	100.0	100.0	99.9	99.9	0.0
Carlis	35	1,611	0.0	0.0	92.2	91.4	100.0	98.5	99.9	98.3	99.4
Carsh	275	13,610	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.0
Chelms	51	2,414	96.4	100.0	99.3	96.5	99.3	98.0	99.3	98.0	98.8
Clwyd	8	162	0.0	0.0	88.3	87.7	100.0	99.4	100.0	99.4	0.0
Colchr	36	1,990	45.7	45.7	88.7	87.5	97.0	97.0	96.9	96.5	45.7
Covnt	134	5,941	0.0	0.0	90.2	83.9	98.9	98.1	98.7	97.9	98.4
Derby	90	3,685	99.5	0.0	92.1	89.1	93.6	93.4	93.5	93.4	0.0
Donc	47	3,386	88.2	100.0	99.7	98.3	99.8	99.0	99.8	99.0	96.2
Dorset	75	3,698	98.1	100.0	97.2	93.1	99.8	99.3	99.8	99.3	97.9
Dudley	87	1,505	80.9	100.0	99.8	97.2	99.7	99.0	99.7	99.0	98.2
Exeter	186	8,314	100.0	100.0	92.4	82.3	99.7	92.6	99.7	92.4	0.0
Glouc	76	3,517	99.9	0.0	93.0	90.2	99.5	98.1	99.5	98.0	0.0
Hull	60	418	100.0	0.0	34.7	33.0	94.3	95.0	94.3	95.0	0.0
Ipswi	33	1,933	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90.6
Kent	114	7,289	92.6	100.0	73.3	73.9	100.0	99.2	99.8	99.1	0.0
L Guys	135	9,951	99.3	0.0	76.9	72.6	81.3	78.7	76.2	73.4	93.8
L Kings	140	6,870	99.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73.6
L Rfree	177	8,592	0.0	0.0	90.3	79.4	99.5	95.3	99.5	95.2	0.0
L West	309	18,717	27.4	0.0	89.8	81.9	99.8	99.5	99.7	99.4	99.2
Leeds	131	767	100.0	0.0	18.8	2.7	99.3	97.0	99.3	97.1	0.0
Leic	336	15,509	99.8	0.0	85.0	78.0	97.7	94.6	97.7	94.5	98.7
M RI	33	964	32.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Middlbr	116	5,352	100.0	0.0	88.4	71.5	99.9	99.2	99.9	99.1	97.8
Newc	168	4,162	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.9
Newry	24	1,150	67.4	100.0	97.1	92.4	99.7	98.5	99.7	98.5	97.6
Nottm	145	4,926	96.3	100.0	87.6	83.5	97.9	96.0	97.9	96.0	73.4
Oxford	135	3,518	99.2	0.0	96.9	93.5	99.4	98.9	99.4	98.9	0.0
Plymth	67	2,139	0.0	0.0	86.8	78.3	98.3	92.7	98.3	92.6	0.0
Ports	181	9,624	99.7	0.0	85.5	79.2	91.6	90.8	91.6	90.8	91.6
Redng	78	4,004	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.4
Salford	155	7,237	74.0	0.0	87.4	71.9	98.9	97.7	99.0	97.9	0.0
Shrew	82	2,269	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.2
Stevng	214	9,715	0.0	100.0	99.1	98.6	99.6	99.1	99.6	99.1	99.1
Sthend	47	2,099	92.6	0.0	93.0	93.0	100.0	99.4	99.9	99.4	100.0
Swanse	206	6,430	98.6	72.5	86.4	80.6	99.2	97.0	99.3	96.9	97.4
Truro	58	2,434	99.2	100.0	62.7	64.7	99.8	98.5	99.4	98.4	0.0
Ulster	35	1,791	88.8	100.0	95.8	93.6	99.9	97.7	99.9	97.7	27.3
West NI	32	2,078	33.5	100.0	99.3	97.5	99.9	98.7	99.9	98.7	91.9
Wolve	100	3,677	0.0	100.0	86.8	82.6	91.9	93.7	91.9	93.5	31.6
Wrexm	45	2,385	0.0	0.0	96.4	90.1	99.9	94.3	99.9	94.6	0.0
York	46	299	100.0	0.0	35.8	34.8	99.3	93.0	99.7	93.0	0.0
Total	**5,342**	**241,221**	**64.5**	**30.5**	**73.7**	**68.8**	**80.8**	**79.3**	**80.6**	**79.1**	**67.4**

SBP – systolic blood-pressure; DBP = diastolic blood-pressure

F:5 Incidence rates in over 75 year olds by CCG/HB for 2011 to 2016 combined

Table F.5.1. Incident rate (2011–2016) in over 75 year olds (per year per million age related population) by CCG/HB

UK area	CCG/HB name	Code	Incident rate in those aged over 75 per year per million age related population 2011–2016
Cheshire, Warrington and Wirral	NHS Eastern Cheshire	E38000056	248
	NHS South Cheshire	E38000151	243
	NHS Vale Royal	E38000189	269
	NHS Warrington	E38000194	193
	NHS West Cheshire	E38000196	328
	NHS Wirral	E38000208	257
Durham, Darlington and Tees	NHS Darlington	E38000042	294
	NHS Durham Dales, Easington and Sedgefield	E38000047	270
	NHS Hartlepool and Stockton-on-Tees	E38000075	271
	NHS North Durham	E38000116	191
	NHS South Tees	E38000162	355
Greater Manchester	NHS Bolton	E38000016	244
	NHS Bury	E38000024	491
	NHS Heywood, Middleton & Rochdale	E38000080	386
	NHS Manchester	E38000217	567
	NHS Oldham	E38000135	293
	NHS Salford	E38000143	174
	NHS Stockport	E38000174	256
	NHS Tameside and Glossop	E38000182	319
	NHS Trafford	E38000187	286
	NHS Wigan Borough	E38000205	144
Lancashire	NHS Blackburn with Darwen	E38000014	316
	NHS Blackpool	E38000015	230
	NHS Chorley and South Ribble	E38000034	350
	NHS East Lancashire	E38000050	206
	NHS Fylde & Wyre	E38000060	242
	NHS Greater Preston	E38000065	221
	NHS Morecombe Bay	E38000216	162
	NHS West Lancashire	E38000200	309
Merseyside	NHS Halton	E38000068	353
	NHS Knowsley	E38000091	412
	NHS Liverpool	E38000101	362
	NHS South Sefton	E38000161	470
	NHS Southport and Formby	E38000170	231
	NHS St Helens	E38000172	107
Cumbria, Northumberland, Tyne and Wear	NHS Cumbria North	E38000215	269
	NHS Newcastle Gateshead	E38000212	233
	NHS North Tyneside	E38000127	194
	NHS Northumberland	E38000130	238
	NHS South Tyneside	E38000163	258
	NHS Sunderland	E38000176	237

Table F.5.1. Continued

UK area	CCG/HB name	Code	Incident rate in those aged over 75 per year per million age related population 2011–2016
North Yorkshire and Humber	NHS East Riding of Yorkshire	E38000052	234
	NHS Hambleton, Richmondshire and Whitby	E38000069	352
	NHS Harrogate and Rural District	E38000073	235
	NHS Hull	E38000085	251
	NHS North East Lincolnshire	E38000119	274
	NHS North Lincolnshire	E38000122	330
	NHS Scarborough and Ryedale	E38000145	198
	NHS Vale of York	E38000188	167
South Yorkshire and Bassetlaw	NHS Barnsley	E38000006	370
	NHS Bassetlaw	E38000008	350
	NHS Doncaster	E38000044	412
	NHS Rotherham	E38000141	294
	NHS Sheffield	E38000146	378
West Yorkshire	NHS Airedale, Wharfedale and Craven	E38000001	175
	NHS Bradford City	E38000018	475
	NHS Bradford Districts	E38000019	350
	NHS Calderdale	E38000025	145
	NHS Greater Huddersfield	E38000064	230
	NHS Leeds North	E38000094	227
	NHS Leeds South and East	E38000095	268
	NHS Leeds West	E38000096	209
	NHS North Kirklees	E38000121	262
	NHS Wakefield	E38000190	294
Arden, Herefordshire and Worcestershire	NHS Coventry and Rugby	E38000038	579
	NHS Herefordshire	E38000078	330
	NHS Redditch and Bromsgrove	E38000139	273
	NHS South Warwickshire	E38000164	306
	NHS South Worcestershire	E38000166	256
	NHS Warwickshire North	E38000195	387
	NHS Wyre Forest	E38000211	261
Birmingham and the Black Country	NHS Birmingham CrossCity	E38000012	581
	NHS Birmingham South and Central	E38000013	539
	NHS Dudley	E38000046	306
	NHS Sandwell and West Birmingham	E38000144	476
	NHS Solihull	E38000149	394
	NHS Walsall	E38000191	349
	NHS Wolverhampton	E38000210	396
Derbyshire and Nottinghamshire	NHS Erewash	E38000058	140
	NHS Hardwick	E38000071	285
	NHS Mansfield & Ashfield	E38000103	217
	NHS Newark & Sherwood	E38000109	370
	NHS North Derbyshire	E38000115	269
	NHS Nottingham City	E38000132	502
	NHS Nottingham North & East	E38000133	279
	NHS Nottingham West	E38000134	356
	NHS Rushcliffe	E38000142	353
	NHS Southern Derbyshire	E38000169	259

Table F.5.1. Continued

UK area	CCG/HB name	Code	Incident rate in those aged over 75 per year per million age related population 2011–2016
East Anglia	NHS Cambridgeshire and Peterborough	E38000026	337
	NHS Great Yarmouth & Waveney	E38000063	312
	NHS Ipswich and East Suffolk	E38000086	349
	NHS North Norfolk	E38000124	279
	NHS Norwich	E38000218	370
	NHS South Norfolk	E38000219	272
	NHS West Norfolk	E38000203	351
	NHS West Suffolk	E38000204	326
Essex	NHS Basildon and Brentwood	E38000007	433
	NHS Castle Point, Rayleigh and Rochford	E38000030	370
	NHS Mid Essex	E38000106	291
	NHS North East Essex	E38000117	355
	NHS Southend	E38000168	278
	NHS Thurrock	E38000185	325
	NHS West Essex	E38000197	318
Hertfordshire and the South Midlands	NHS Bedfordshire	E38000010	251
	NHS Corby	E38000037	249
	NHS East and North Hertfordshire	E38000049	348
	NHS Herts Valleys	E38000079	280
	NHS Luton	E38000102	444
	NHS Milton Keynes	E38000107	308
	NHS Nene	E38000108	281
Leicestershire and Lincolnshire	NHS East Leicestershire and Rutland	E38000051	303
	NHS Leicester City	E38000097	470
	NHS Lincolnshire East	E38000099	232
	NHS Lincolnshire West	E38000100	230
	NHS South Lincolnshire	E38000157	324
	NHS South West Lincolnshire	E38000165	312
	NHS West Leicestershire	E38000201	290
Shropshire and Staffordshire	NHS Cannock Chase	E38000028	404
	NHS East Staffordshire	E38000053	299
	NHS North Staffordshire	E38000126	446
	NHS Shropshire	E38000147	381
	NHS South East Staffs and Seisdon and Peninsular	E38000153	357
	NHS Stafford and Surrounds	E38000173	487
	NHS Stoke on Trent	E38000175	483
	NHS Telford & Wrekin	E38000183	433
London	NHS Barking & Dagenham	E38000004	316
	NHS Barnet	E38000005	544
	NHS Camden	E38000027	425
	NHS City and Hackney	E38000035	359
	NHS Enfield	E38000057	541
	NHS Haringey	E38000072	768
	NHS Havering	E38000077	251
	NHS Islington	E38000088	648

Table F.5.1. Continued

UK area	CCG/HB name	Code	Incident rate in those aged over 75 per year per million age related population 2011–2016
London (cont.)	NHS Newham	E38000113	535
	NHS Redbridge	E38000138	466
	NHS Tower Hamlets	E38000186	796
	NHS Waltham Forest	E38000192	445
	NHS Brent	E38000020	1048
	NHS Central London (Westminster)	E38000031	450
	NHS Ealing	E38000048	620
	NHS Hammersmith and Fulham	E38000070	421
	NHS Harrow	E38000074	456
	NHS Hillingdon	E38000082	366
	NHS Hounslow	E38000084	547
	NHS West London (Kensington and Chelsea, Queen's Park and Paddington)	E38000202	577
	NHS Bexley	E38000011	364
	NHS Bromley	E38000023	354
	NHS Croydon	E38000040	555
	NHS Greenwich	E38000066	400
	NHS Kingston	E38000090	374
	NHS Lambeth	E38000092	679
	NHS Lewisham	E38000098	538
	NHS Merton	E38000105	562
	NHS Richmond	E38000140	192
	NHS Southwark	E38000171	598
	NHS Sutton	E38000179	552
	NHS Wandsworth	E38000193	546
Bath, Gloucestershire, Swindon and Wiltshire	NHS Bath and North East Somerset	E38000009	251
	NHS Gloucestershire	E38000062	359
	NHS Swindon	E38000181	270
	NHS Wiltshire	E38000206	219
Bristol, North Somerset, Somerset and South Gloucestershire	NHS Bristol	E38000022	512
	NHS North Somerset	E38000125	404
	NHS Somerset	E38000150	284
	NHS South Gloucestershire	E38000155	333
Devon, Cornwall and Isles of Scilly	NHS Kernow	E38000089	304
	NHS North, East, West Devon	E38000129	334
	NHS South Devon and Torbay	E38000152	356
Kent and Medway	NHS Ashford	E38000002	421
	NHS Canterbury and Coastal	E38000029	283
	NHS Dartford, Gravesham and Swanley	E38000043	437
	NHS Medway	E38000104	358
	NHS South Kent Coast	E38000156	301
	NHS Swale	E38000180	410
	NHS Thanet	E38000184	310
	NHS West Kent	E38000199	276

Table F.5.1. Continued

UK area	CCG/HB name	Code	Incident rate in those aged over 75 per year per million age related population 2011–2016
Surrey and Sussex	NHS Brighton & Hove	E38000021	388
	NHS Coastal West Sussex	E38000213	278
	NHS Crawley	E38000039	336
	NHS East Surrey	E38000054	396
	NHS Eastbourne, Hailsham and Seaford	E38000055	284
	NHS Guildford and Waverley	E38000214	343
	NHS Hastings & Rother	E38000076	271
	NHS High Weald Lewes Havens	E38000081	364
	NHS Horsham and Mid Sussex	E38000083	331
	NHS North West Surrey	E38000128	423
	NHS Surrey Downs	E38000177	477
	NHS Surrey Heath	E38000178	197
Thames Valley	NHS Aylesbury Vale	E38000003	291
	NHS Bracknell and Ascot	E38000017	426
	NHS Chiltern	E38000033	266
	NHS Newbury and District	E38000110	308
	NHS North & West Reading	E38000114	265
	NHS Oxfordshire	E38000136	322
	NHS Slough	E38000148	591
	NHS South Reading	E38000160	580
	NHS Windsor, Ascot and Maidenhead	E38000207	381
	NHS Wokingham	E38000209	344
Wessex	NHS Dorset	E38000045	225
	NHS Fareham and Gosport	E38000059	204
	NHS Isle of Wight	E38000087	279
	NHS North East Hampshire and Farnham	E38000118	420
	NHS North Hampshire	E38000120	206
	NHS Portsmouth	E38000137	388
	NHS South Eastern Hampshire	E38000154	250
	NHS Southampton	E38000167	241
	NHS West Hampshire	E38000198	185
Wales	Betsi Cadwaladr University	W11000023	359
	Powys Teaching	W11000024	418
	Hywel Dda	W11000025	436
	Abertawe Bro Morgannwg University	W11000026	576
	Cwm Taf	W11000027	369
	Aneurin Bevan	W11000028	292
	Cardiff and Vale University	W11000029	364
Scotland	Ayrshire and Arran	S08000015	272
	Borders	S08000016	
	Dumfries and Galloway	S08000017	223
	Fife	S08000018	312
	Forth Valley	S08000019	254

Table F.5.1. Continued

UK area	CCG/HB name	Code	Incident rate in those aged over 75 per year per million age related population 2011–2016
Scotland (cont.)	Grampian	S08000020	201
	Greater Glasgow and Clyde	S08000021	289
	Highland	S08000022	130
	Lanarkshire	S08000023	280
	Lothian	S08000024	127
	Orkney	S08000025	
	Shetland	S08000026	
	Tayside	S08000027	306
	Western Isles	S08000028	
Northern Ireland	Belfast	ZC010	524
	Northern	ZC020	457
	Southern	ZC030	297
	South Eastern	ZC040	372
	Western	ZC050	350

Blank cells – rates based on values of <5 have been suppressed

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UK Renal Registry 20th 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 downloads menu at www.renalreg.org/datasets/the-uk-renal-registry-dataset/.

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UK Renal Registry 20th Annual Report: Appendix H Coding: Ethnicity, EDTA Primary Renal Diagnoses, EDTA Causes of Death

H1: Ethnicity coding

Tables H1.1 and H1.2 show the groupings of ethnicity information used in this report. Ethnic categories are condensed into five groups (White, South Asian, Black, Chinese and Other). For some analyses Chinese are grouped into Other.

Table H1.1. Read code groupings

Read code	Ethnic category	Assigned group
9S1..	White	White
9SA9.	Irish (NMO)	White
9SAA.	Greek Cypriot (NMO)	White
9SAB.	Turkish Cypriot (NMO)	White
9SAC.	Other European (NMO)	White
9S6..	Indian	S Asian
9S7..	Pakistani	S Asian
9S8..	Bangladeshi	S Asian
9SA6.	East African Asian	S Asian
9SA7.	Indian Subcontinent	S Asian
9SA8.	Other Asian	S Asian
9S2..	Black Caribbean	Black
9S3..	Black African	Black
9S4..	Black/Other/non-mixed origin	Black
9S41.	Black British	Black
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
9S5..	Black other/mixed	Black
9S51.	Other Black – Black/White origin	Black
9S52.	Other Black – Black/Asian origin	Black
9S9..	Chinese	Chinese
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

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Table H1.1. Continued

Read code	Ethnic category	Assigned group
9SA4.	North African Arab (NMO)	Other
9SA5.	Other African countries (NMO)	Other
9SAD.	Other ethnic NEC (NMO)	Other
9SB..	Other ethnic/mixed origin	Other
9SB1.	Other ethnic/Black/White origin	Other
9SB2.	Other ethnic/Asian/White origin	Other
9SB3.	Other ethnic/mixed White origin	Other
9SB4.	Other ethnic/Other mixed origin	Other

NMO – non-mixed origin

Table H1.2. Ethnicity groupings

Code	Ethnic category (description)	Assigned group
A	White – British	White
B	White – Irish	White
C	Other White background	White
D	Mixed – White and Black Caribbean	Other
E	Mixed – White and Black African	Other
F	Mixed – White and Asian	Other
G	Other Mixed background	Other
H	Asian or Asian British – Indian	S Asian
J	Asian or Asian British – Pakistani	S Asian
K	Asian or Asian British – Bangladeshi	S Asian
L	Other Asian background	S Asian
M	Black Caribbean	Black
N	Black African	Black
P	Other Black background	Black
R	Chinese	Chinese
S	Other ethnic background	Other

H2: EDTA primary renal diagnoses

New primary renal diagnosis (PRD) codes were produced in 2012 [1]. The data used for this report included a mixture of old and new ERA-EDTA codes. The old codes were used where available, and for those people without an old code, new codes (where available) were mapped back to old codes using the mapping available on the ERA-EDTA website. As recommended in the notes for users in the ERA-EDTA's PRD code list document, the mapping of new to old codes is provided for guidance only and has not been validated; therefore care must be taken not to over interpret data from this mapping.

The old codes (both those received from centres and those mapped back from new codes) were then grouped into the same eight categories as in previous reports as shown in table H2.1.

Table H2.1. Old code mapping

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

Table H2.1. Continued

Code	Title	Group
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
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

Table H2.1. Continued

Code	Title	Group
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

Table H3.1. Cause of death categories

EDTA code	Cause	UKRR category
0	Cause of death uncertain/not determined	Uncertain
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 (CVA), 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
29	Mesenteric infarction	Other
31	Pulmonary infection bacterial (not code 73)	Infection
32	Pulmonary infection (viral)	Infection
33	Pulmonary infection (fungal or protozoal; parasitic)	Infection
34	Infections elsewhere except viral hepatitis	Infection
35	Septicaemia	Infection
36	Tuberculosis (lung)	Infection
37	Tuberculosis (elsewhere)	Infection
38	Generalized viral infection	Infection
39	Peritonitis (all causes except for peritoneal dialysis)	Infection
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

Table H3.1. Continued

EDTA code	Cause	UKRR category
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)	Infection
101	Peritonitis (fungal, with peritoneal dialysis)	Infection
102	Peritonitis (due to other cause, with peritoneal dialysis)	Infection

*Prior to the 15th Annual Report categorised as 'uncertain'
Trt stop – treatment stopped

Reference

1 Venkat-Raman G. et al. New Primary diagnosis codes for the ERA-EDTA. Nephrol Dial Transplant 2012;27(12):4414–9

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UK Renal Registry 20th Annual Report: Appendix I Acronyms and Abbreviations used in the Annual Report

AAB	Academic Affairs Board (Renal Association)
ACE (inhibitor)	Angiotensin converting enzyme (inhibitor)
ACHD	Started with acute HD and recoded as ERF
ACR	Albumin : creatinine ratio
ADPKD	Autosomal dominant polycystic kidney disease
AHD	Started with acute HD but never coded as ERF
AKI	Acute kidney injury
ANOVA	Analysis of variance
ANZDATA	Australia and New Zealand Dialysis and Transplant Registry
APD	Automated peritoneal dialysis
APKD	Adult polycystic kidney disease
ATTOM	Access to Transplant and Transplant Outcome Measures
ATTOMic	Access to transplant and transplant outcome measures in children
AV	Arteriovenous
AVF	Arteriovenous fistula
AVG	Arteriovenous graft
BAPN	British Association for Paediatric Nephrology
BCG	Bromocresol green
BCP	Bromocresol purple
Bicarb	Bicarbonate
BISTRO	BioImpedance Spectroscopy to Maintain Renal Output
BKN	BK virus nephropathy
BMD	Bone mineral disease
BMI	Body mass index
BP	Blood pressure
BPAR	Biopsy proven acute rejection
BPSU	British Paediatric Surveillance Unit
BSI	Blood stream infection
BTS	British Transplant Society
Ca	Calcium
CAB	Clinical Affairs Board (Renal Association)
CABG	Coronary artery bypass grafting
CAKUT	Congenital anomalies of the kidneys and urinary tract
CAPD	Continuous ambulatory peritoneal dialysis
CCG	Clinical Commissioning Group
CCL	Clinical Computing Limited
CCPD	Cycling peritoneal dialysis
CDI	Clostridium difficile infection
CHD	Started HD with ERF
Chol	Cholesterol

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CHr	Target reticulocyte Hb content
CI	Confidence interval
CICR	Cumulative incidence competing risk
CIF	Cumulative incidence function
Circ fail	Circulatory failure
CK	Creatine kinase
CKD	Chronic kidney disease
CKD-EPI	Chronic kidney disease epidemiology collaboration
CK-MB	Creatine kinase isoenzyme MB
CKD-MBD	Chronic kidney disease-mineral bone disorder
CMV	Cytomegalovirus
CNI(s)	Calcineurin inhibitor(s)
COPD	Chronic obstructive pulmonary disease
Creat	Creatinine
cRF	Calculated HLA antibody reaction frequency
CRF	Chronic renal failure
CRP	C-reactive protein
CVRF	Cardiovascular risk factor
CVVH	Continuous veno-venous haemofiltration
CXR	Chest x-ray
DBD	Donor after brainstem death
DBP	Diastolic blood pressure
DCCT	Diabetes Control and Complications Trial
DCD	Donor after circulatory death
DH	Department of Health
DM	Diabetes mellitus
DOB	Date of birth
DOPPS	Dialysis Outcomes and Practice Patterns Study
E_i	Expected cases in area i
E Coli	Escherichia coli
E&W	England and Wales
E, W & NI	England, Wales and Northern Ireland
EBPG	European Best Practice Guidelines
EBV	Epstein Barr Virus
ECG	Electrocardiogram
EDTA	European Dialysis and Transplant Association
EF	Error factor
eGFR	Estimated glomerular filtration rate
ECD	Extended Criteria Donor
EDTA	European Dialysis and Transplant Association
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
ESPN	European Society for Paediatric Nephrology
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
GIRFT	Getting It Right First Time
GFR	Glomerular filtration rate
GH	Growth hormone
GN	Glomerulonephritis
GP	General practitioner
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
HES	Hospital Episode Statistics
HHD	Home haemodialysis
HLA	Human leucocyte antigen
HPA	Health Protection Agency
HQIP	Health Quality Improvement Partnership
HR	Hazard ratio
HRC	Hypochromic red blood cells
HSV	Herpes simplex virus
Ht	Height
HT	Home therapy
HTN	Hypertension
HUS	Haemolytic uraemic syndrome
Hypvol	Hypovolaemia
ICHD	In centre haemodialysis
ICNARC	Intensive Care National Audit and Research Centre
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
IL2-RA	Interleukin-2 receptor antagonists
ILRA	Interleukin receptor antagonist
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	Intravenous
KDIGO	Kidney Disease: Improving Global Outcomes
KDOQI	Kidney Disease Outcomes Quality Initiative
KM	Kaplan Meier
KQuIP	Kidney Quality Improvement Partnership
KTR	Kidney Transplant Recipient
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
LOINC	Logical Observation Identifiers Names and Codes
LSOA	Lower super output area
LTFU	Lost to follow-up
M : F	Male : Female
MAGIC	Managing Access by Generating Improvements in Cannulation
MAP	Mean arterial blood pressure
MDRD	Modification of diet in renal disease
MI	Myocardial infarction
MMF	Mycophenolate mofetil
MPA	Mycophenolic acid
MRSA	Methicillin resistant Staphylococcal aureus
MSSA	Methicillin sensitive Staphylococcal aureus
N	Number

N Ireland	Northern Ireland
NCDS	National Co-operative Dialysis Study
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
NKF	National Kidney Federation
NMO	Non-mixed origin
NODAT	New onset of diabetes after transplantation
NRS	National Records of Scotland
NSF	National service framework
NTC	Non-tunnelled dialysis catheter
NTL	Non-tunnelled line
NURTuRE	National Unified Renal Translational Research Enterprise
NW	North West
O/E	Observed/expected
O_i	Observed cases in area i
ODT	Organ Donation and Transplantation (a Directorate of NHS Blood and transplant)
ONS	Office for National Statistics
ONSPD	ONS postcode directory
OR	Odds ratio
OW	Over weight
PAS	Patient Administration System
PCR	Protein : creatinine ratio
PCT	Primary Care Trust
PD	Peritoneal dialysis
PDOPPS	UK Peritoneal Dialysis Outcomes and Practice Patterns Study
PEx	Plasma exchange
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
PO_4	Phosphate
PP	Pulse pressure
PRD	Primary renal disease
PREM	Patient Reported Experience Measures
PTH	Parathyroid hormone
PTLD	Post transplant lymphoproliferative disorder
PTx	Pre-emptive transplant
PV	PatientView
PVD	Peripheral vascular disease
Pyelo	Pyelonephritis
QI	Quality improvement
QOF	Quality and Outcomes Framework
QUEST	Quality European Studies
RA	Renal Association
RaDaR	National Registry of Rare Kidney Diseases
RAS	Renin angiotensin system
Rhabdo	Rhabdomyolysis
rhGH	Recombinant human growth hormone
RI	Royal Infirmary
RNSF	Renal National Service Framework (or NSF)
RPV	Renal Patient View

RR	Relative risk
RRDSS	RenalRegistry data set specification
RRT	Renal replacement therapy
RVD	Renovascular disease
S Asian	South Asian
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)
SIR	Standardised incidence ratio (= O/E)
SMR	Standardised mortality ratios
SNOWMED CT	Systematised Nomenclature of Medicine Clinical Terms
SPIRIT	Serum Phosphate Intervention in Renal Replacement Therapy
spKt/V	Single pool Kt/V
SPC	Statistical process control
SPR	Standardised prevalence ratio (= O/E)
SR	Standardised ratio (used to cover either SAR or SPR)
SRR	Scottish Renal Registry
SUS	Secondary uses service
SW	South West
TC	Tunnelled dialysis catheter
TDAs	T-cell (lymphocyte) depleting antibodies
TID	Tubulointerstitial disease
TL	Tunnelled line
TP-CKD	Transforming Participation in Chronic Kidney Disease
TSAT	Transferrin saturation
TWL	Transplant waiting list
Tx	Transplant
UCL	Upper confidence limit
UK	United Kingdom
UKRDC	UK Renal Data Collaboration
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
VZV	Varicella zoster virus
WHO	World Health Organization
Wt	Weight

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UK Renal Registry 20th Annual Report: Appendix J Laboratory Conversion Factors

Laboratory measure	Conversion factors from SI units
Albumin	g/dl = g/L × 0.1
Aluminium	μg/L = μmol/L × 27.0
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 × 18.02
Potassium	mEq/L = mmol/L
Phosphate	mg/dl = mmol/L × 3.1
PTH	ng/L = pmol/L × 9.4
Urea	mg/dl = mmol/L × 6.0
Urea nitrogen	mg/dl = mmol/L × 2.8

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UK Renal Registry 20th 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 and Warwick	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 and St Mary's Hospitals	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
Nottingham	Nottingham City Hospital	Nottm
Oxford	Oxford Radcliffe Hospital	Oxford

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City	Hospital	Abbreviation
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	University Hospital of North Staffordshire	Stoke
Sunderland	Sunderland Royal Hospital	Sund
Truro	Royal Cornwall Hospital	Truro
Wirral	Arrowe Park Hospital	Wirral
Wolverhampton	New Cross Hospital	Wolve
York	York District General Hospital	York
Wales		
Bangor	Ysbyty Gwynedd	Bangor
Cardiff	University Hospital of Wales	Cardff
Clwyd	Ysbyty 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 and Galloway Royal Infirmary	D & Gall
Dundee	Ninewells Hospital	Dundee
Edinburgh	Royal Infirmary of Edinburgh	Edinb
Glasgow	Queen Elizabeth University, Glasgow Royal Infirmary and Stobhill Hospitals	Glasgw
Inverness	Raigmore Hospital	Inverns
Kilmarnock	University Hospital Crosshouse	Klmarnk
Kirkcaldy	Victoria Hospital	Krkcldy
Northern Ireland		
Antrim	Antrim Hospital (Northern Trust)	Antrim
Belfast	Belfast City Hospital	Belfast
Londonderry and Omagh	Tyrone County Hospital (Western Trust)	West NI
Newry	Daisy Hill Hospital (Southern Trust)	Newry
Ulster, Belfast	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	Children's Kidney Centre University Hospital Wales	Cardf_P	Wales
Glasgow	Royal Hospital for Children Glasgow	Glasg_P	Scotland
Leeds	Leeds Children's Hospital	Leeds_P	England
Liverpool	Alder Hey Children's Hospital	Livpl_P	England
London	Evelina London Children's Hospital	L Eve_P	England
London	Great Ormond Street Hospital for Children	L GOSH_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 Children's Hospital	Soton_P	England