NSS Information and Intelligence

NHS National Services Scotland

Scottish Renal Registry Annual Report 2017.

With demographic data to 2017 and audit data to 2018.

PHI Graphics Team
NHS National Services Scotland
Gyle Square
1 South Gyle Crescent
Edinburgh EH12 9EB

Tel: +44 (0)131 275 6233
Email: nss.phigraphics@nhs.net

Designed and typeset by:
Chris Dunn, PHI Digital Services

Translation Service

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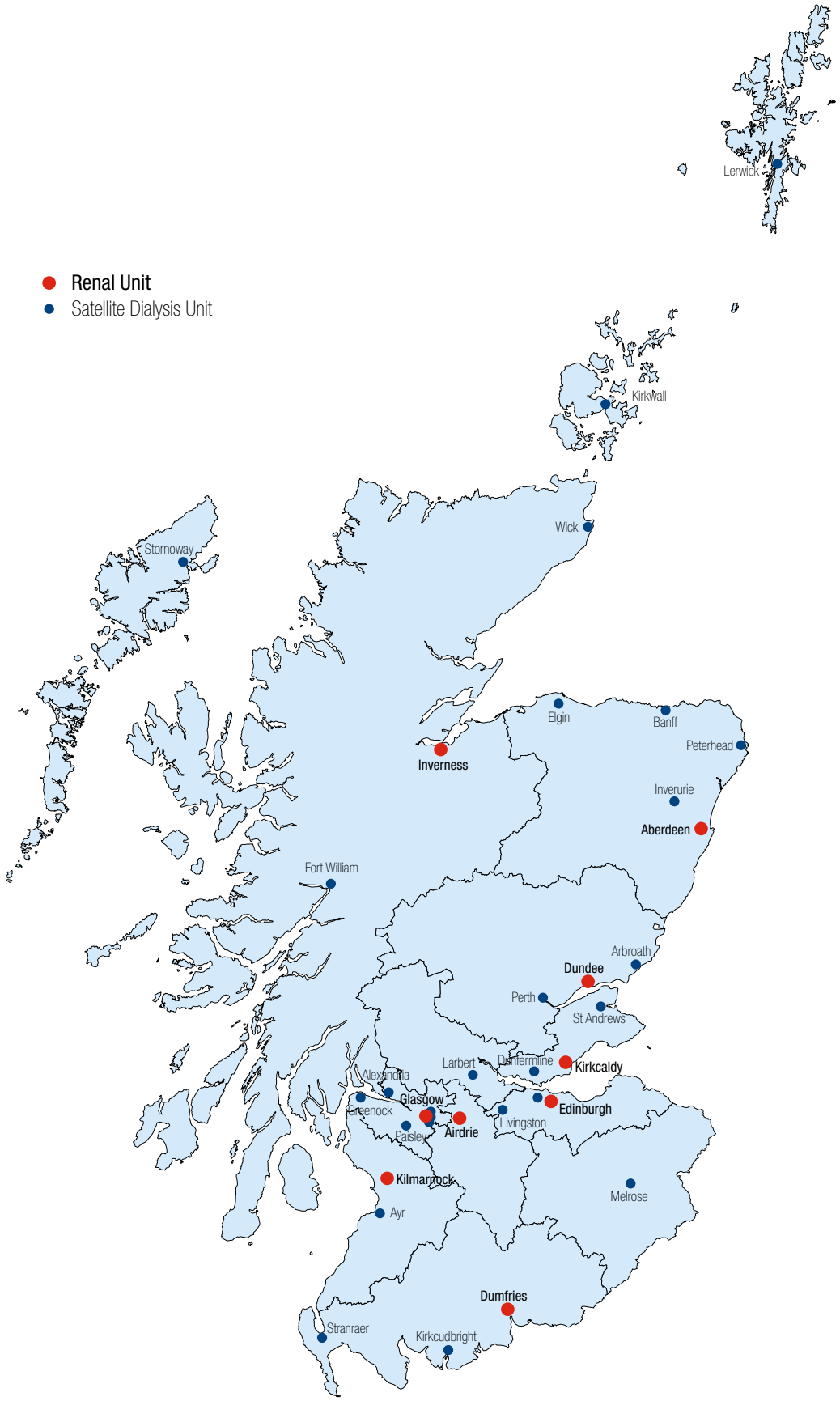
RENAL UNITS AND SATELLITE DIALYSIS UNITS IN SCOTLAND ON 31 DECEMBER 2017



ACKNOWLEDGEMENTS

The steering group of the Scottish Renal Registry and the report editors would like to thank the staff in all renal units in Scotland for their immense efforts with data collection and checking. Jackie McDonald of ISD runs the SRR office with energy, skill and dedication and is integral to the work of the Registry; she is ably assisted by Stephanie Tippen. The SRR website is managed by the web and publications team at ISD and the report has once again been expertly published by Chris Dunn and his team. Our statistical advice and much of the core data analysis is provided by Jacqueline Campbell who has done an excellent job in helping to develop several areas including our linkage work with HPS and the introduction of Tableau.

The quality and completeness of the data within this report represents the concerted efforts of many members of staff in each renal unit and would not be possible without them. Their dedication and diligence is greatly appreciated. The analysis and presentation of the data is the result of hard work by many contributing chapter author:

Section	Authors
A Incidence	J Campbell[1], JP Traynor[2], W Metcalfe[3], B MacKinnon[2]
B Prevalence	J Campbell[1], JP Traynor[2], W Metcalfe[3], B MacKinnon[2]
C Survival	J Campbell[1], JP Traynor[2], W Metcalfe[3], B MacKinnon[2]
D Cause of Death	J Campbell[1], JP Traynor[2], W Metcalfe[3], B MacKinnon[2]
E SMARRT	M Findlay[2], S Methven[4] on behalf of the SMARRT group*
F Kidney Transplantation	J Campbell[1], JP Traynor[2], W Metcalfe[3], B MacKinnon[2]
G Peritoneal Dialysis	M Petrie[3]
H Vascular Access for Haemodialysis	Thomson P[2], Lim M[5], Stoumpos S[2], JP Traynor[2]
I Bacteraemia in RRT Recipients	J Campbell[1], J Bishop[6], L Imrie[6], B MacKinnon[2], W Metcalfe[3], F Murdoch[6], JP Traynor[2]
J Adequacy of haemodialysis	JP Traynor[2]
K Anaemia	S Robertson[7], JP Traynor[2]
L Bone Mineral Metabolism	A Almond[7], JP Traynor[2]
M + N Scottish Renal Biopsy Registry	CC Geddes[2] on behalf of the Scottish Renal Biopsy Registry steering group**

1. Information Services Division, NHS National Services Scotland.
2. Glasgow Renal and Transplant Unit.
3. Royal Infirmary of Edinburgh.
4. Aberdeen Royal Infirmary.
5. Ninewells Hospital, Dundee.
6. Health Protection Scotland, NHS National Services Scotland.
7. Dumfries & Galloway Royal Infirmary.

* Members of the SMARRT group are listed at: http://www.srr.scot.nhs.uk/Contacts/SMARRT-Group.html.

** Members of the Scottish Renal Biopsy Registry steering group are listed at: http://www.srr.scot.nhs.uk/Contacts/Biopsy-registry-steering-group.html.

We have benefitted greatly from collaborative working with colleagues from Health Protection Scotland and present data about bacteraemia occurring in patients receiving renal replacement therapy as a result of that work.

We very much value our collaboration with NHS Blood and Transplant (NHSBT) who, through data linkage, provide us with transplant listing status and donor details for patients on the SRR who are registered with them on the UK national transplant waiting list. We thank them for their support of the SRR.

We thank the National Records of Scotland for allowing us to use and report data from the population census.

Our computer hardware is supported by Greater Glasgow and Clyde IT department and our software by VitalPulse. The database software is Proton from Clinical Computing plc. The Information Technology staff of the hospitals and NHS Scotland support our use of the NHS computer network.

We are indebted to patients attending all renal units in Scotland and to their friends, families and carers for their brave and unwavering support and for their continuing encouragement to obtain and publish hard facts about the quality of the service, quality of life and outcomes. Patients are full members of the SRR Steering group, they vote on all major decisions and have organised major projects.

The report has been edited by Jamie Traynor, Wendy Metcalfe and Bruce Mackinnon. As editors we remain responsible for the content.

Bruce Mackinnon

Chair Scottish Renal Registry

Scottish Renal Registry
Meridian Court
ISD Scotland
5 Cadogan Street
Glasgow G2 6QE

Tel + 00 44 (0)141 282 2253
Email NSS.isdsrr@nhs.net
Web http://www.srr.scot.nhs.uk

EXECUTIVE SUMMARY

The first person was dialysed for established renal failure (ERF) in Scotland in 1960. Up to 31 December 2017, 17975 patients had started renal replacement therapy (RRT) for ERF in Scotland. On 31 December 2017 there were 9 adult and one paediatric renal units in Scotland with 25 satellite dialysis units between them. All units contribute fully to the Scottish Renal Registry (SRR) and all patients receiving RRT for ERF are registered.

Demographic and Survival Data

In 2017 638 people (118 per million population (pmp)) started RRT for ERF. The median age of individuals starting RRT was 61 years. Over the last 2 decades the median age of new patients has fallen and incidence has remained static. There was no significant variation between NHS Health Board areas in the incidence of new patients starting RRT in the 5 years 2013-2017. The proportion of patients starting RRT after developing ERF due to diabetic nephropathy continues to increase. Between 2013 and 2017 such patients were the largest single group, making up 28% of all patients starting RRT.

In contrast to numbers of new patients starting RRT, the numbers of prevalent patients is still rising. There are significant differences (after adjustment for age, sex and social deprivation) between NHS Health Board areas in the number of patients receiving RRT. NHS Lothian has a prevalence more than 3 standard deviations lower than the mean and NHS Greater Glasgow and Clyde more than 3 standard deviations above the mean.

Patients starting RRT in the 10 years 2008-2017 are increasingly likely to survive for 5 years. Of those patients who started RRT between 1993-2012 when aged 45 to 64 years there is a significant trend of improving survival for each primary renal diagnosis group. There are no significant differences between NHS Health Board areas in mortality when standardised for age, sex, social deprivation and PRD at 90 days, 1 year or at 5 years after starting RRT. The most common cause of death among patients on RRT is cardiovascular disease accounting for 32% of deaths over the period 2008-2017, infections were the main cause of death in 22% of cases and malignancy 11% overall, but 24% of those patients dying with a functioning kidney transplant. 66% of RRT patients who died in 2017 did so in hospital.

Transplantation

Since 2011 the commonest treatment among prevalent patients for ERF in Scotland has been renal transplantation. On 31 December 2017 there were 5191 prevalent patients receiving RRT, 58% of whom had a functioning kidney transplant, 37% were being treated with haemodialysis (HD) and 3% with peritoneal dialysis (PD). 313 patients resident in Scotland received a kidney transplant in Scotland in 2017, 50 (16%) of those transplants were pre-emptive meaning they were performed before the patient had required any other form of RRT. 30% of kidney transplants performed 2013-2017 were from living donors.

There is a significant trend of improving survival of function of transplanted kidneys from 1960 – 2016 and also patient survival following kidney transplantation up to 10 years post transplant.

Clinical Audit Data

The Renal Association (UKRA) is the professional body for UK Nephrologists and produces clinical practice guidelines for the management of patients with renal disease, a process

accredited by the National Institute for Health and Care Excellence (NICE). Measures of quality of care are compared against the UKRA guidelines facilitating nationwide comparative audit and identification of areas of concern and of excellence in practice. This is one of the mechanisms through which the SRR contributes to continued efforts to improve standards of delivered care for renal patients across Scotland.

For UKRA clinical practice guidelines refer to website: http://www.renal.org/guidelines/

The incidence of PD related peritonitis across Scotland was 17 months between episodes in 2017. While not reaching the guideline standard of 18 months this represents an improvement on the previous year's performance of 15.8 months between episodes.

Vascular access describes the connection between a patient's circulation and a haemodialysis machine. The optimum form of access is an arteriovenous (AV) fistula which minimises the risk of bacteraemia. The UKRA guideline suggests at least 60% of incident and 80% of prevalent patients be using AV access. In the first six months of 2018 45% of patients started HD via AV access. There were significant differences between renal units with three (ARI, DGRI and RIE) achieving the guideline rate of 60%. In May 2018 72% of prevalent HD patients had a form of AV access, 28% were using central venous catheters. Significant differences persist between renal units with two (ARI, RAIG) meeting the suggested guideline for prevalent HD patients.

Data linkage with Health Protection Scotland reveals significant differences between renal units in rates of bacteraemia occurring in patients treated by haemodialysis including significantly differing rates of Staphylococcus aureus bacteraemia (SAB) episodes. Patients suffering an episode of SAB had a 34% risk of death in the subsequent 12 months.

83% of patients treated three times weekly by HD in May 2018 achieved the guideline urea reduction ratio (URR) of >65%.

60% of patients (excluding those not treated with an erythropoiesis stimulating agent (ESA)) treated by HD had blood haemoglobin concentration in the guideline range 100-120 g/L in May 2018.

In May 2018 50% of patients treated by HD had pre-dialysis phosphate in the recommended range; 81% had corrected calcium within their local laboratories normal range; 55% had PTH concentration within international guidelines target range when assay specific ranges were taken into account.

Data from the Scottish renal biopsy registry show that the rate of transplanted kidney biopsy in 2017 equated to 0.10 biopsies per transplant per year. The rate of native kidney biopsy for a new indication in 2017 was 120 biopsies per million population. There are differences in biopsy rates and practice between renal units across Scotland with units serving larger populations performing more biopsies per population. 2% of native kidney biopsies performed in 2017 had a significant complication.

Extensive information about the conduct of the audits and the quality assurance and validation methods used and much background information are available on the SRR website. A list of publications and a copy of the SRR reports are also available:

http://www.srr.scot.nhs.uk

INTRODUCTION

Revisions statement

Revisions relevant to this publication

The prevalence per 100,000 column in Table F6.1 has been revised in this publication due to a technical error. The formula in the background excel document was not copied down to all NHS Boards and was showing prevalence per 100,000 for all RRT patients rather than prevalence per 100,000 of those who were transplant or transplant listed as at 31/12/17 which is now showing.

The Scottish Renal Registry aims to improve the care of patients with established renal failure (ERF) treated with renal replacement therapy (RRT) by systematic and comprehensive analysis including audits, of service provision, patient reported measures, clinical management and outcomes.

The Scottish Renal Registry (SRR) presents information about the causes, incidence, prevalence, distribution, methods of treatment and outcome of patients receiving RRT for established renal failure ERF in Scotland between 1960 and 31 December 2017.

It also presents audit data relating to the quality of treatment delivered up until 30 June 2018 measured against national quality indicators/ guidelines.

In addition we present national data from the Scottish renal biopsy registry relating to both native and transplanted kidney biopsies performed in Scotland in 2017.

Throughout the report readers will see the icon next to some figures. This indicates that on the web version of this report data are available in a Tableau format which enables interaction with the data. The web version of this report is available at:

http://www.srr.scot.nhs.uk/Publications/Main.html

Funding

The Information and Services Division (ISD) of NHS Scotland assumed overall responsibility and funding for the SRR in April 1999. In the period covered by this report, no financial assistance was received from commercial organisations.

Other background information

Detailed information about our computer hardware, software, analytic tools, the SRR office, staff, steering group, projects, data quality assurance, publications, security and confidentiality and details of how data are provided to external bodies is published on the SRR website.

http://www.srr.scot.nhs.uk

Renal unit anonymity has been progressively removed since 1998.

Patient anonymity is rigorously protected.

Conflict of interest

The SRR Chair, steering group and report editorial group do not have any conflicting interests.

SUMMARY OF DATA AND METHODS

Patients

18010 patients have been registered with the SRR from its inception in 1991 until 31 December 2017 when the data for this report were collated. 12330 of the patients registered with the SRR are known to have died by 31 December 2017. The total number of patients receiving RRT for ERF who died in 2017 was 487.

Inclusions and exclusions from analyses

Incident patients
All patients starting RRT in Scotland are included in incidence figures. Patients who have moved into Scotland already receiving RRT, either dialysis or with a functioning kidney transplant are excluded. This Report does not contain information about RRT for acute kidney injury. Patients who move out with Scotland within 90 days of starting RRT are not included in incidence figures.

Prevalent patients
All patients whose treatment started on or before 31 December 2017 and who were still alive and resident in Scotland on that date are included. Patients who have moved outside of Scotland, those who are lost to follow-up and those who have recovered renal function (within 90 days of starting RRT) are excluded.

Survival analyses
The start date for the survival analyses is the first date of RRT. The end date is the date of death or the censor date of 31 December 2017. Also censored are those patients moving outside of Scotland and those lost to follow-up, both groups are censored on the date that the SRR received the last laboratory or treatment information about them. Patients who were lost to follow up or moved, but later came back to have RRT in Scotland had their entire period of RRT included for survival analyses.

Cause of death analyses
Patients who die in Scotland whilst being treated by RRT are included. Some patients stop RRT with no expectation of recovery of renal function. If death does not occur within 90 days of stopping RRT such patients are excluded from cause of death analyses.

Patients who recover native renal function

Patients who recovered renal function within 90 days of starting RRT and have not yet needed to restart RRT were excluded from the analyses. Patients who recovered, but required more than 90 days RRT remain in the data set.

If a patient had to restart RRT within a 90 day period after initial recovery, the date of first starting RRT is considered as the beginning of the first period of treatment. If however the initial period of treatment is less than 90 days, and the period of recovery greater than 90 days, the date of first RRT is recorded as that on which they restart treatment that lasts for at least 90 days.

Where a patient started RRT and then died before the 91st day or if they recovered before the 91st day but then died within the next 90 days, their nephrologist was asked to decide whether they had been treated for acute or established renal failure. Only those with ERF are included in this report.

Primary renal diagnoses

A diagnosis code for the primary renal disease (PRD) has been chosen by the nephrologists responsible for the care of the patient from the code list published by the ERA-EDTA. In 2012 the ERA-EDTA published an updated primary renal diagnosis code list and since 01 January 2014 that revised code list has been used exclusively. To simplify analysis of the data ERA-EDTA PRD codes have been grouped into five categories: glomerulonephritis, interstitial nephritis, diabetic nephropathy, multi-system disorders and unknown diagnosis. It is often not possible to make a precise diagnosis for patients presenting with ERF because the subtle signs of the original disease may have been obscured. The PRD groupings of both old and new ERA-EDTA PRD codes as used in all SRR publications are listed on the SRR website:

http://www.srr.scot.nhs.uk/Projects/Methods.html

31 patients have no PRD recorded on the SRR, 1 has moved outside of Scotland. The remaining 30 patients are deceased and their clinical notes have been destroyed. They started RRT in 4 units: ARI (10), MONK (5), NINE (14), RIE (1).

Renal units in Scotland

All renal units in Scotland contribute fully to the SRR. A complete list of units is given in Appendix 2.

NHS Health Board Areas

On 01 April 2014 Scottish NHS Health Board area boundaries were changed to align with those of local authorities. In line with guidance issued all analyses in this report use population data defined by the new NHS Health board boundaries. More information is available at:

http://www.isdscotland.org/Products-and-Services/GPD-Support/Geography/NHS-Board-Boundary-Changes/

Presentation of the data

Throughout the report numeric data are shown either in charts or in a separate table. In many charts the data are shown in five year bands, in order to present all the available data, the first time band represents a different number of years.

Where data are reported using funnel plots the 2SD and 3SD lines represent 95% and 99.7% of data respectively.

Abbreviations

Throughout this report for brevity and ease of reading some abbreviations are used. These are listed in full in Appendix 1 and on the SRR website.

Extensive information about the conduct of SRR audits, the quality assurance and validation methods used and background information is available on the SRR website. A list of publications and copies of SRR reports are also available:

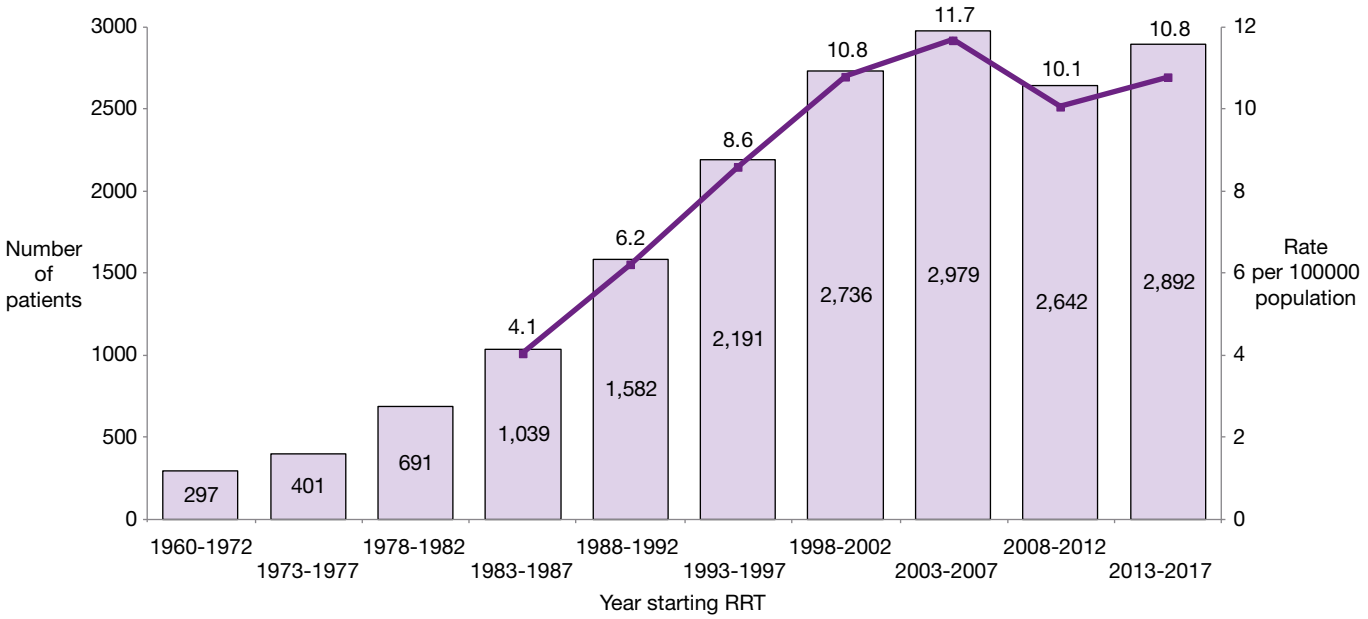
http://www.srr.scot.nhs.uk

SECTION A INCIDENCE

This section's data are available on-line in Tableau format which enables interaction with the data: http://www.srr.scot.nhs.uk/publications/Dashboards/Incidence.html.

A1 Incidence of new patients starting RRT

A1.1 Incidence of new patients starting RRT 1960-2017



A1.2 Annual incidence per 100000 population of new patients starting RRT 1983-2017

Year	Number starting RRT	Population of Scotland	Incidence per 100000
1983-1987	1039	5,125,134*	4.1
1988-1992	1582	5,081,170*	6.2
1993-1997	2191	5,094,778*	8.6
1998-2002	2736	5,068,432*	10.8
2003-2007	2979	5,113,220	11.7
2008	548	5,202,900	10.6
2009	542	5,231,900	10.4
2010	520	5,262,200	9.9
2011	505	5,299,900	9.5
2012	527	5,313,600	10.0
2013	510	5,327,700	9.6
2014	554	5,347,600	10.4
2015	619	5,373,000	11.5
2016	571	5,404,700	10.6
2017	638	5,424,800	11.8

Population figures are from National Records for Scotland. They are population estimates for the 30 June each year. http://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/mid-year-population-estimates

* The population estimates shown for the five year bands between 1983 and 2007 are the arithmetical mean of the mid-year population estimates for each of the five years in question, the annual incidence of new patients is averaged over the five year periods.

A1.3 Incidence of patients starting RRT 2013-2017 by NHS Health Board area of residence standardised for age, sex and social deprivation

NHS Health Board	Number starting RRT	Incidence per 100000 population	Standardised incidence per 100000 population
A&A	248	13.4	11.7
BORD	52	9.3	9.4
D&G	78	10.4	9.5
FIFE	213	11.6	11.2
FV	153	10.3	10.1
GG&C	688	9.8	11.6
GRAM	286	11.9	11.7
HIGH	149	9.3	9.5
LAN	381	11.6	11.5
LOTH	352	8.1	9.3
ORKN	8	7.4	4.3
SHET	11	9.5	8.5
TAY	247	11.9	11.5
WI	25	18.4	10.3
SCOT	**2891**	**10.8**	**10.8**

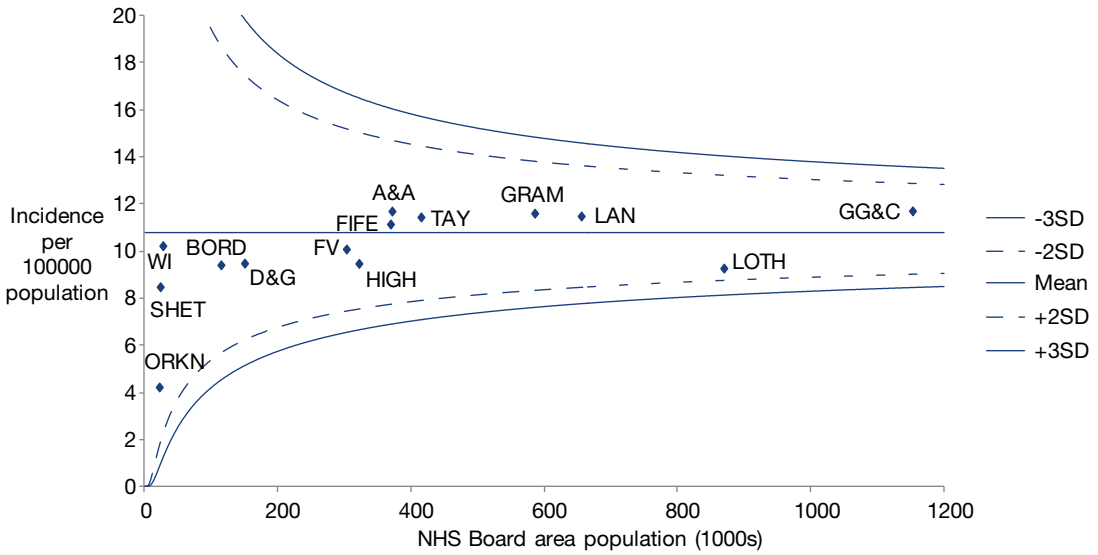
Note: One patient started RRT in Scotland with a postcode of residence outwith Scotland. Data for this patient is excluded from this Table.

The incidence of new patients starting RRT in each NHS Health Board area of residence has been standardised to take into account differences in the age, sex and multiple deprivation distribution of residents to allow direct comparison between areas. Patients' postcode of residence when starting RRT was used to derive a Scottish Index of Multiple Deprivation (SIMD) score. The Scottish Index of Multiple Deprivation (SIMD) identifies small area concentrations of multiple deprivation across all of Scotland in a consistent way and ranks small areas (datazones) from most deprived (ranked 1) to least deprived (ranked 6505). SRR data have previously shown an association between SIMD and RRT use: http://www.srr.scot.nhs.uk/Projects/Projects3.html#simd

The age, sex, SIMD standardised incidence is the total number of residents who would be expected to start RRT in an NHS Health Board area population, if the age, sex, SIMD structure of the Board area was the same as that of Scotland as a whole.

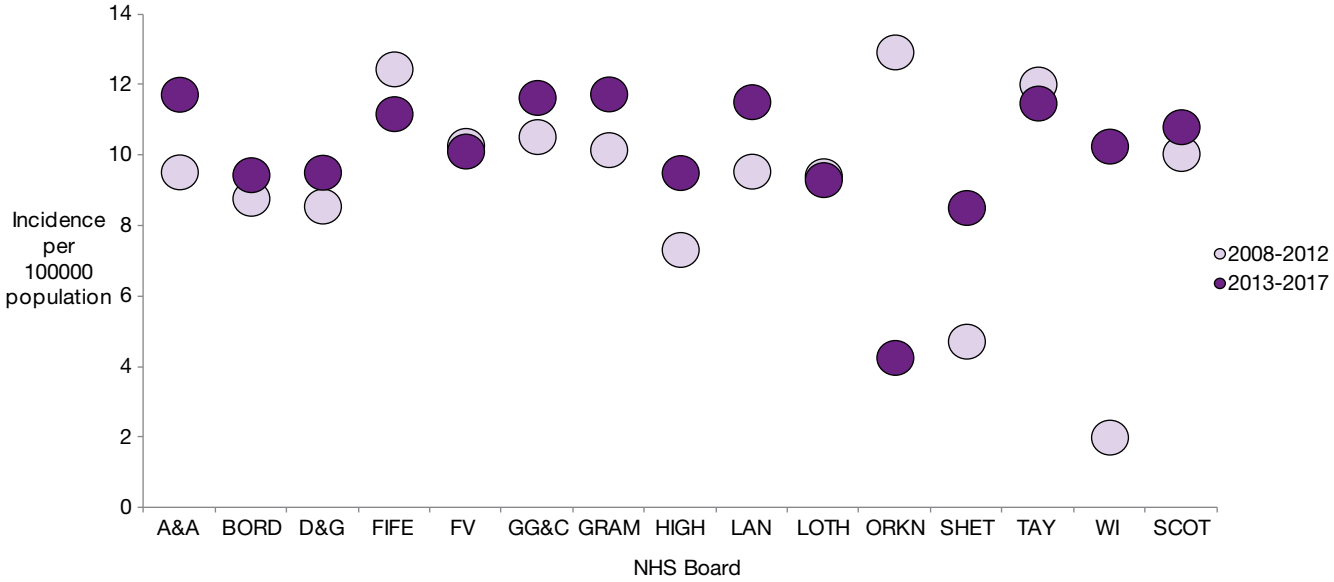
A five year incident period from 2013 to 2017 has been used to minimise the impact of year to year fluctuations in numbers of patients.

A1.4 Incidence of new patients starting RRT 2013-2017 by NHS Health Board area of residence standardised for age, sex and social deprivation



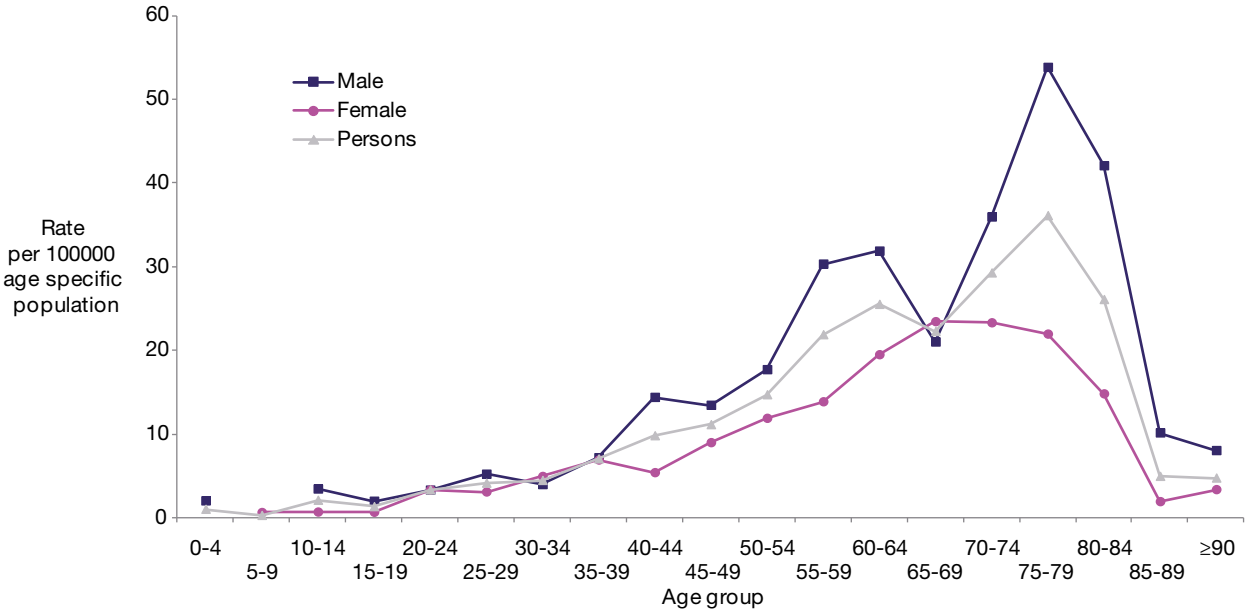
There were no outliers beyond 3SD for the whole population or in the subgroup of those >65 years old when starting RRT.

A1.5 Incidence of new patients starting RRT 2008-2012 and 2013-2017 by NHS Health Board of residence standardised for age, Sex and social deprivation

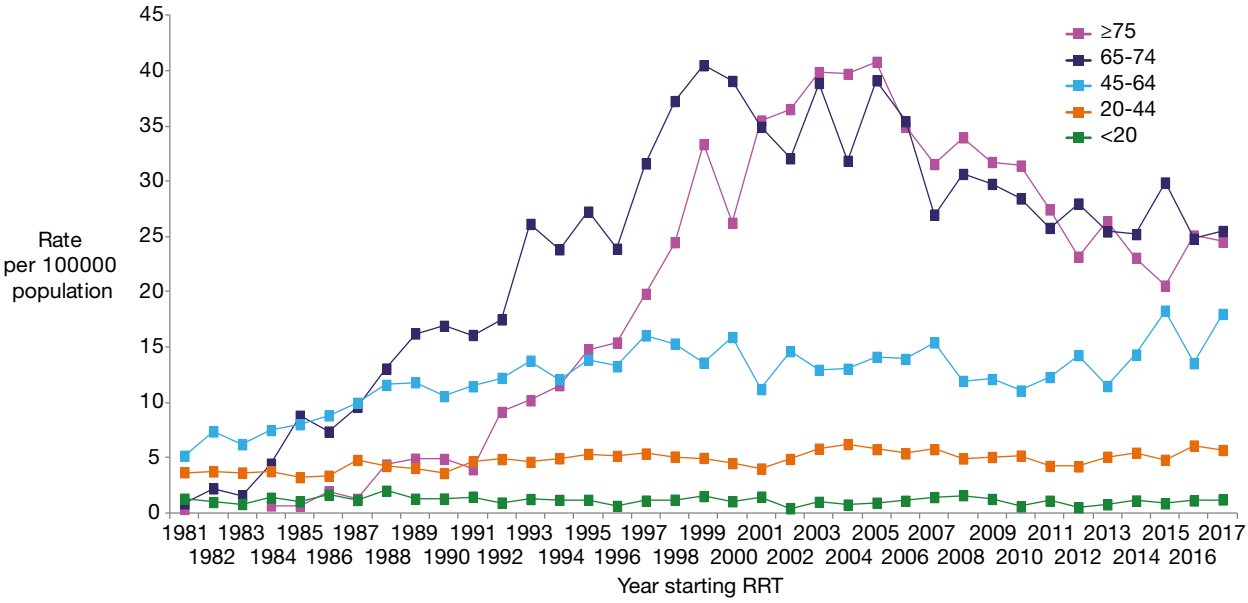


A2 General population and incident RRT population 2017

A2.1 Age specific incidence of new patients starting RRT 2017 per 100000 population



A2.2 Age specific incident RRT population 1981 to 2017 per 100000 population



A2.3 Incidence per 100000 population of patients aged 65 and over starting RRT 2013-2017 by NHS Health Board: standardised for age, sex and social deprivation

NHS Health Board	2013	2014	2015	2016	2017	Standardised incidence per 100000 population 2013-2017	95% Confidence Intervals
A&A	33	19	23	29	33	27	(22,32)
BORD	4	11	26	11	29	16	(10,24)
D&G	9	31	11	22	24	19	(13,26)
FIFE	38	39	33	26	21	31	(25,37)
FV	40	33	25	9	16	24	(18,30)
GRAM	28	16	27	23	18	22	(18,27)
GG&C	28	29	30	37	27	30	(27,34)
HIGH	15	10	21	18	21	17	(13,21)
LAN	35	20	30	28	27	28	(23,32)
LOTH	14	19	14	21	26	19	(15,22)
ORKN	44	-	42	-	20	21	(6,48)
SHET	49	47	23	-	22	28	(10,60)
TAY	22	32	31	24	29	28	(22,32)
WI	32	78	61	15	15	40	(21,68)
Scotland	**26**	**24**	**26**	**25**	**25**	**25**	**(24,27)**

A3 Age distribution of patients when starting RRT

A3.1 Number of patients in each age group and median age when starting RRT 1960-2017

Year starting RRT	<20		20-44		45-64		65-74		≥75		Median age
	n	%	n	%	n	%	n	%	n	%	
1960-1972	45	**15**	202	**68**	48	**16**	2	**1**	0	**0**	33
1973-1977	56	**14**	227	**57**	117	**29**	1	**0**	0	**0**	36
1978-1982	81	**12**	271	**39**	313	**45**	25	**4**	1	**0**	44
1983-1987	86	**8**	343	**33**	458	**44**	138	**13**	14	**1**	49
1988-1992	92	**6**	404	**26**	646	**41**	351	**22**	89	**6**	55
1993-1997	68	**3**	475	**22**	811	**37**	598	**27**	239	**11**	60
1998-2002	70	**3**	423	**15**	867	**32**	820	**30**	556	**20**	65
2003-2007	62	**2**	512	**17**	918	**31**	786	**26**	701	**24**	64
2008-2012	60	**2**	416	**16**	883	**33**	687	**26**	596	**23**	64
2013-2017	59	**2**	475	**16**	1,122	**39**	713	**25**	523	**18**	61
Total	**679**	**4**	**3748**	**21**	**6183**	**35**	**4121**	**24**	**2719**	**16**	**59**

A3.2 Number and median age of patients starting RRT 2013-2017 by renal unit

Renal unit	Number starting RRT 2013-2017	Median Age 2013-2017	Number starting RRT 2017	Median Age 2017
ARI	281	62	55	60
XH	214	64	48	66
DGRI	71	64	16	68
GLAS	969	60	202	59
MONK	294	61	65	61
NINE	234	65	53	64
RAIG	121	63	25	64
RHC	49	9	11	11
RIE	469	58	123	61
VHK	190	67	40	64
Scotland	**2892**	**61**	**638**	**61**

A3.3 Number of patients in each age group and median age when starting RRT 2013-2017 by NHS Health Board area of residence

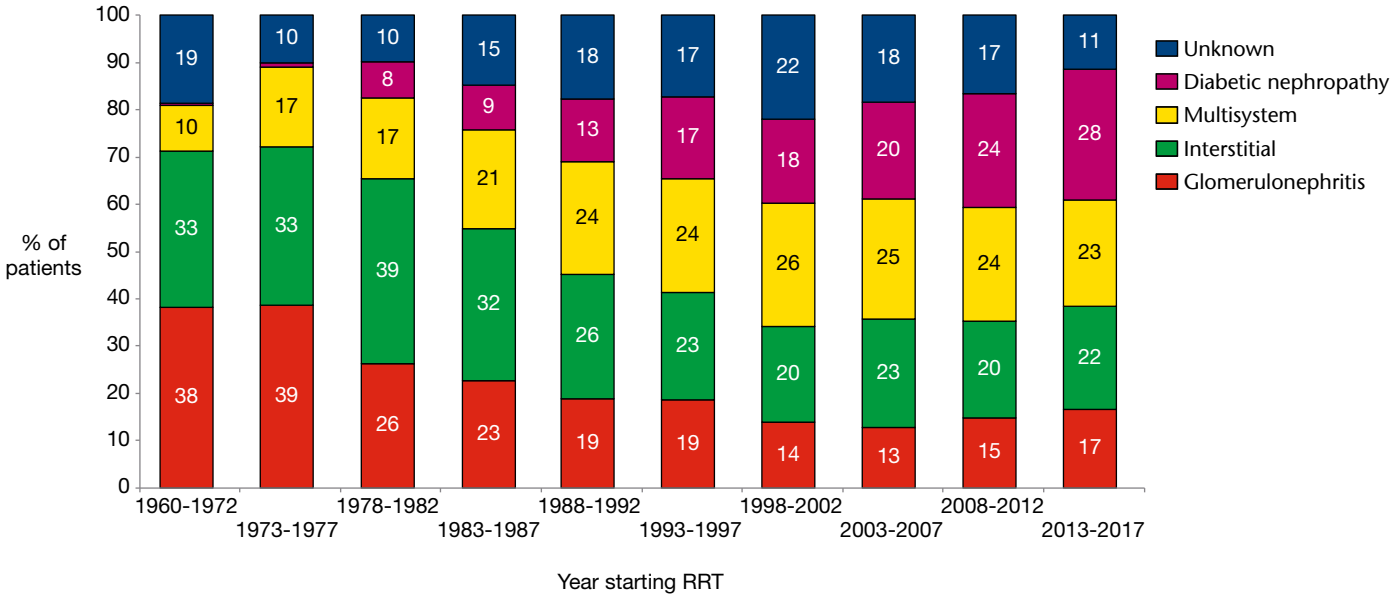
NHS Health Board	<20	20-44	45-64	65-74	≥75	Number starting RRT 2013-2017	Median Age
A&A	6	33	101	53	55	248	62
BORD	1	8	21	15	7	52	62
D&G	1	12	30	16	19	78	63
FIFE	4	25	71	62	51	213	65
FV	5	20	61	38	29	153	61
GRAM	5	58	111	72	41	287	60
GG&C	17	119	265	163	123	687	60
HIGH	0	34	55	42	18	149	60
LAN	11	61	150	83	76	381	60
LOTH	4	66	151	87	44	352	59
ORKN	0	0	3	2	3	8	69
SHET	0	1	4	4	2	11	66
TAY	4	34	92	65	52	247	64
WI	1	4	7	10	3	25	67
Scotland	**59**	**475**	**1122**	**712**	**523**	**2891**	**61**

Note: One patient started RRT in Scotland with a postcode of residence outwith Scotland. Data for this patient is excluded from this Table.

A4 Primary renal diagnosis of patients starting RRT

ERA-EDTA Primary Renal Diagnoses (PRD) codes and groupings used in SRR reports are available on the SRR website: http://www.srr.scot.nhs.uk/Projects/Methods.html

A4.1 Percentage of patients in each diagnosis group starting RRT 1960-2017



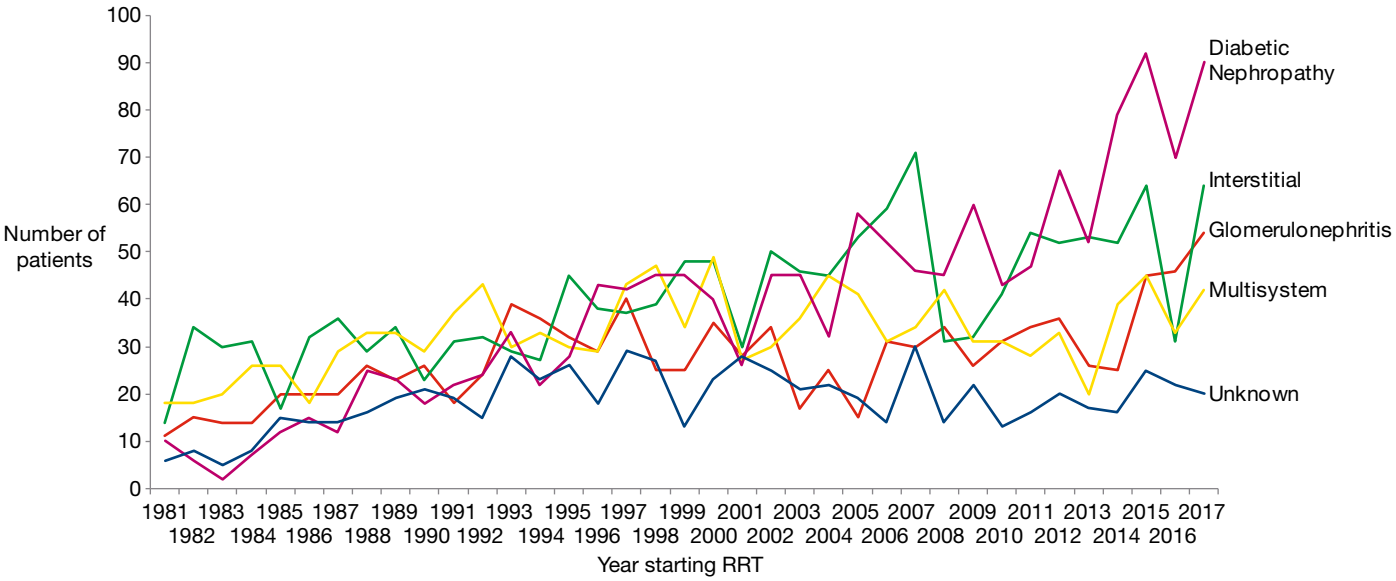
Since 2014 the updated (2012) ERA-EDTA PRD are available for all patients with diabetic nephropathy. These codes differentiate between type I and type II diabetes within the diabetic nephropathy diagnosis group.

Of those patients who started RRT with a primary diagnosis of diabetic nephropathy between 2014 and 2017 (n=681), 65% are attributed to type II diabetes.

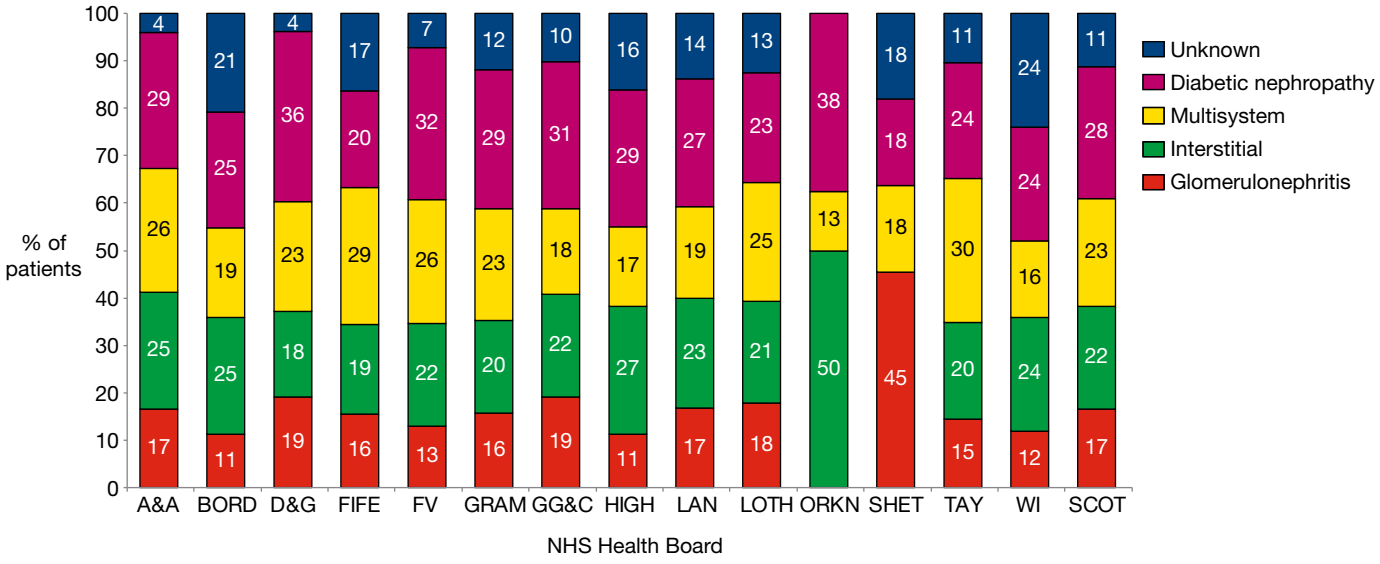
The median age when starting RRT attributed to type I is 46 years (IQR 38,54) and 64 years (IQR 58,71) for type II.

The increase in number of patients starting RRT with a PRD of diabetic nephropathy is mainly due to the increase in those in the 45-64 age group.

A4.2 Number of patients in 45-64 age group when starting RRT 1981-2017 by Primary Renal Diagnosis Group



A4.3 Percentage of patients in each diagnosis group by NHS Health Board of residence 2013-2017



A4.4 Number of patients in each diagnosis group starting RRT 1960-2017

Year starting RRT	Glomerulo-nephritis		Interstitial		Multisystem		Diabetic nephropathy		Unknown		Missing		Total
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n
1960-1972	113	**38**	97	**33**	29	**10**	1	**0**	55	**19**	2	1	297
1973-1977	155	**39**	134	**33**	68	**17**	4	**1**	40	**10**	0	0	401
1978-1982	181	**26**	267	**39**	118	**17**	52	**8**	68	**10**	5	1	691
1983-1987	235	**23**	334	**32**	217	**21**	98	**9**	153	**15**	2	0	1039
1988-1992	296	**19**	417	**26**	374	**24**	211	**13**	278	**18**	6	0	1582
1993-1997	407	**19**	499	**23**	525	**24**	378	**17**	377	**17**	5	0	2191
1998-2002	381	**14**	555	**20**	713	**26**	482	**18**	603	**22**	2	0	2736
2003-2007	380	**13**	684	**23**	756	**25**	606	**20**	546	**18**	7	0	2979
2008-2012	394	**15**	538	**20**	636	**24**	635	**24**	438	**17**	1	0	2642
2013-2017	480	**17**	629	**22**	654	**23**	799	**28**	330	**11**	1	0	2893
Total	3022	**17**	4154	**24**	4090	**23**	3266	**19**	2888	**17**	31	0	17451

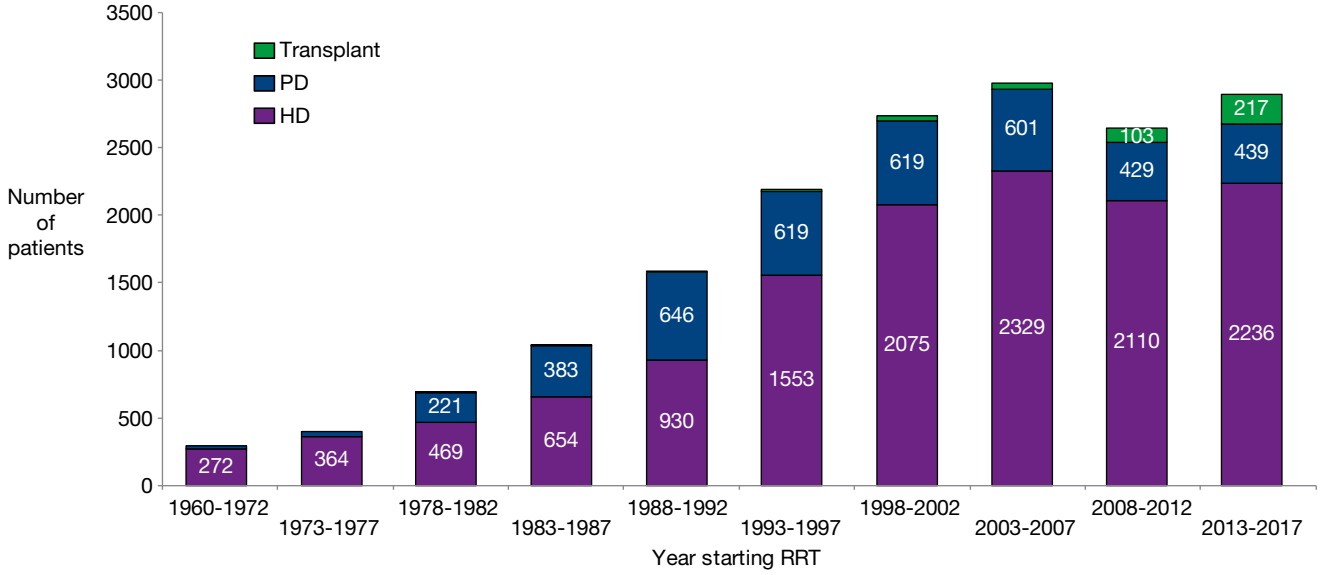
Please see primary renal diagnoses section on page x for details of the missing diagnoses.

A5 Modality of RRT

There are three principal types of RRT: Haemodialysis (HD); Peritoneal dialysis (PD); Kidney Transplantation.

Patients who have received a kidney transplant as their first mode of RRT are termed as receiving a pre-emptive transplant.

A5.1 Mode of first RRT 1960-2017



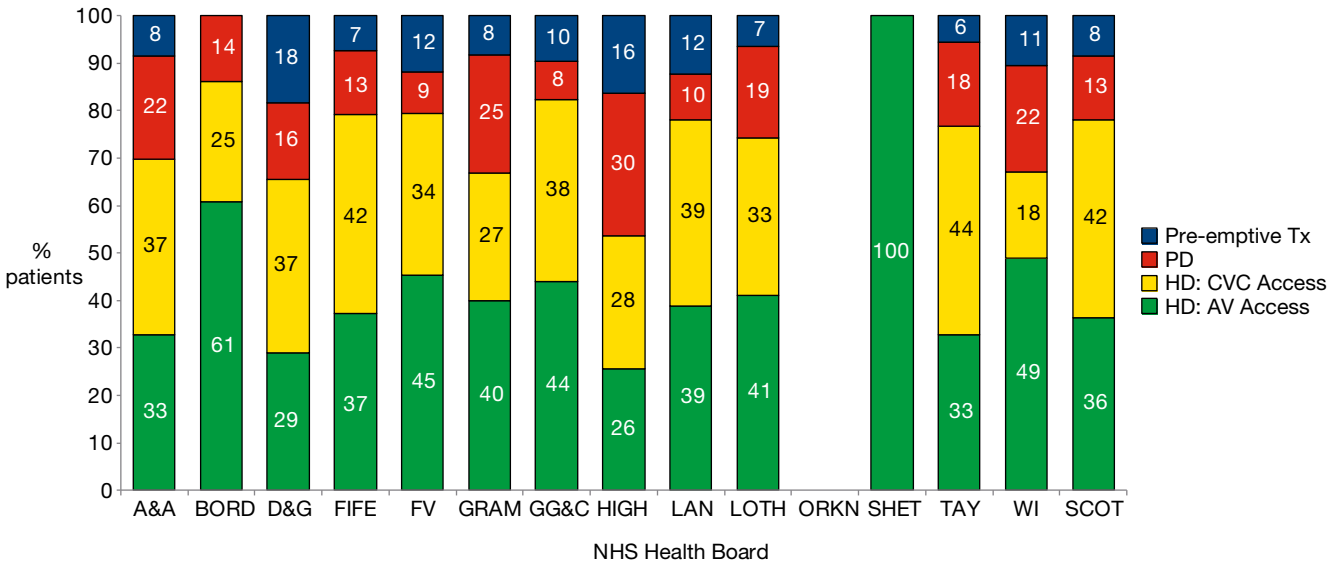
A5.2 Mode of first RRT 1960-2017

Year starting RRT	HD		PD		Transplant		Total
	n	%	n	%	n	%	
1960-1972	272	**92**	25	**8**	0	**0**	297
1973-1977	364	**91**	37	**9**	0	**0**	401
1978-1982	469	**68**	221	**32**	1	**0**	691
1983-1987	654	**63**	383	**37**	2	**0**	1039
1988-1992	930	**59**	646	**41**	6	**0**	1582
1993-1997	1553	**71**	619	**28**	19	**1**	2191
1998-2002	2075	**76**	619	**23**	42	**2**	2736
2003-2007	2329	**78**	601	**20**	49	**2**	2979
2008	436	**80**	92	**17**	20	**4**	548
2009	445	**82**	83	**15**	14	**3**	542
2010	419	**81**	89	**17**	12	**2**	520
2011	395	**78**	89	**18**	21	**4**	505
2012	415	**79**	76	**14**	36	**7**	527
2013	399	**78**	74	**15**	37	**7**	510
2014	429	**77**	84	**15**	41	**7**	554
2015	475	**77**	92	**15**	52	**8**	619
2016	435	**76**	103	**18**	33	**6**	571
2017	498	**78**	86	**13**	54	**8**	638

A5.3 First Mode of incident patients and vascular access at first HD by NHS Health Board of residence

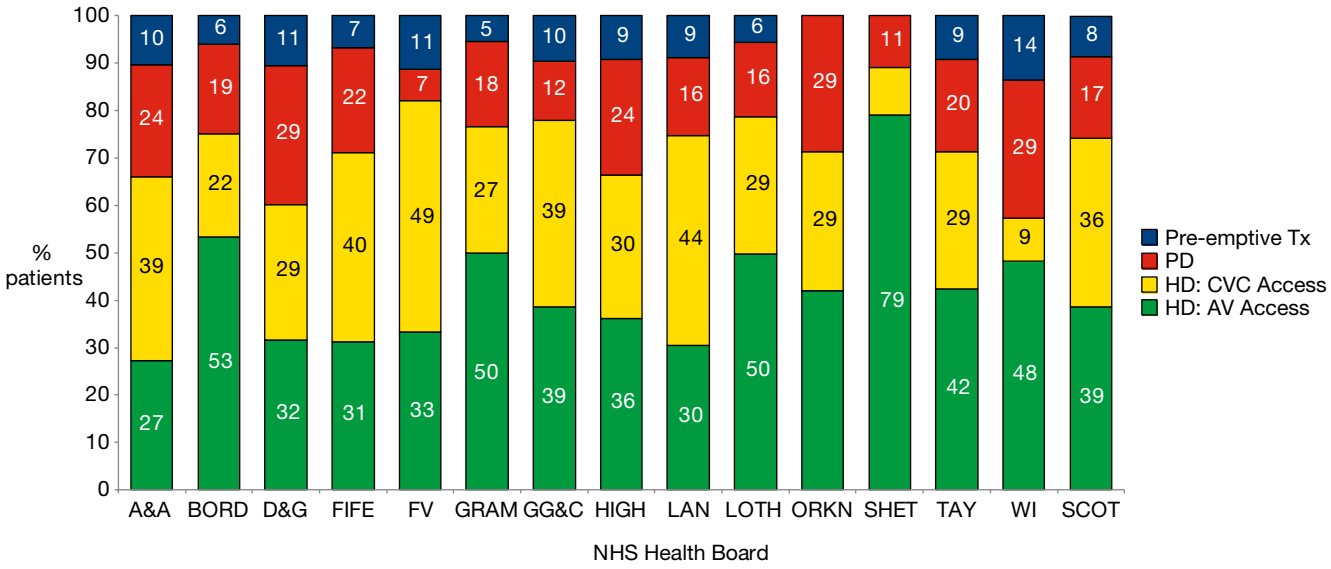
NHS Health Board	HD: AV Access		HD: CVC Access		PD		Pre-emptive Tx		Total
	n	%	n	%	n	%	n	%	
A&A	15	**27**	27	**49**	10	**18**	3	**5**	55
BORD	11	**58**	6	**32**	2	**11**	0	**0**	19
D&G	7	**37**	6	**32**	3	**16**	3	**16**	19
FIFE	14	**32**	23	**52**	5	**11**	2	**5**	44
FV	12	**46**	9	**35**	2	**8**	3	**12**	26
GRAM	18	**31**	24	**41**	13	**22**	4	**7**	59
GG&C	62	**42**	60	**40**	12	**8**	15	**10**	149
HIGH	8	**25**	10	**31**	9	**28**	5	**16**	32
LAN	31	**37**	35	**42**	8	**10**	10	**12**	84
LOTH	33	**38**	36	**41**	13	**15**	5	**6**	87
ORKN	0	**0**	1	**100**	0	**0**	0	**0**	1
SHET	1	**100**	0	**0**	0	**0**	0	**0**	1
TAY	18	**32**	28	**49**	8	**14**	3	**5**	57
WI	2	**40**	1	**20**	1	**20**	1	**20**	5
Scotland	**232**	**36**	**266**	**42**	**86**	**13**	**54**	**8**	**638**

A5.4 Incident patients first mode of RRT and vascular access for first HD by NHS Health Board of residence 2017, standardised for age, sex and PRD group



68 patients started HD within 90 days of presenting to a nephrologist and have been excluded from this graph.

A5.5 Incident patients first mode of RRT and vascular access for first HD by NHS Health Board of residence between 2013-2017, standardised for age, sex and PRD group



335 patients started HD within 90 days of presenting to a nephrologist and have been excluded from this graph.

The UK Renal Association guideline on initiation of RRT suggests that patients known to nephrology services for 3 months or more and who are planned to have renal support should start RRT using an established access (arteriovenous fistula [AVF], arteriovenous graft [AVG], PD catheter) or by pre-emptive renal transplantation.

Analyses of SRR data have previously demonstrated that the attainment of AV access for haemodialysis is influenced by patients' age, sex and primary renal diagnosis.

To take account of differing case mix of incident patients in each NHS Health Board area the data in A5.4 and A5.5 are adjusted for these variables by an indirect standardisation using the Scottish incident population as the standard.

For each NHS Health Board area the standardised incidence ratios for each modality are then multiplied by the respective Scotland counts to obtain the standardised distribution of incident patients across modalities.

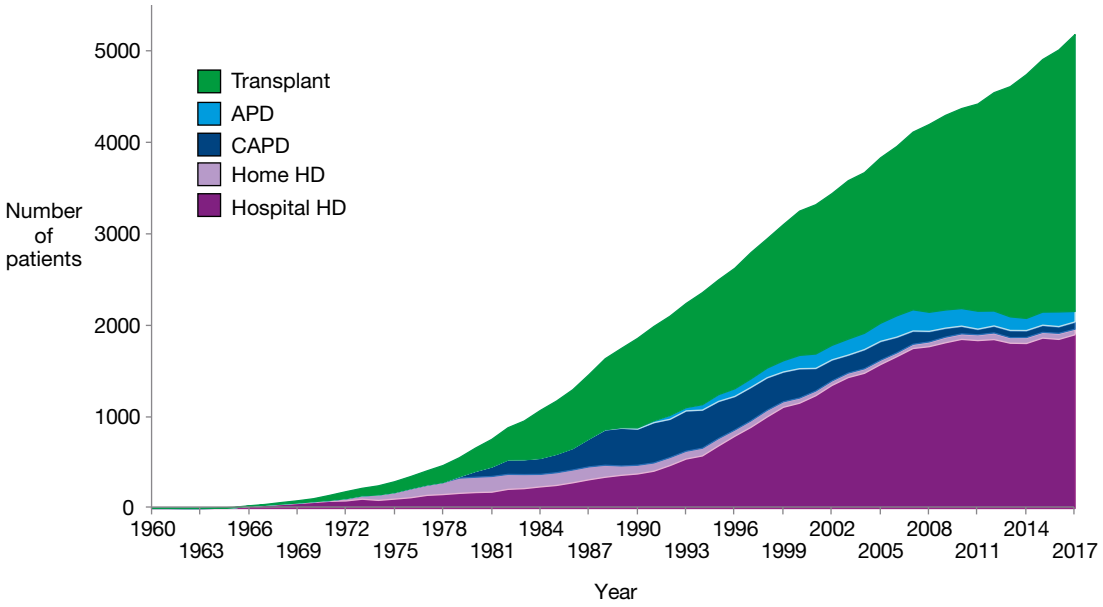
Incident patients not known to nephrology services for at least three months from the analyses have been excluded from the analysis to allow comparison with the UK Renal Association guidance.

SECTION B PREVALENCE

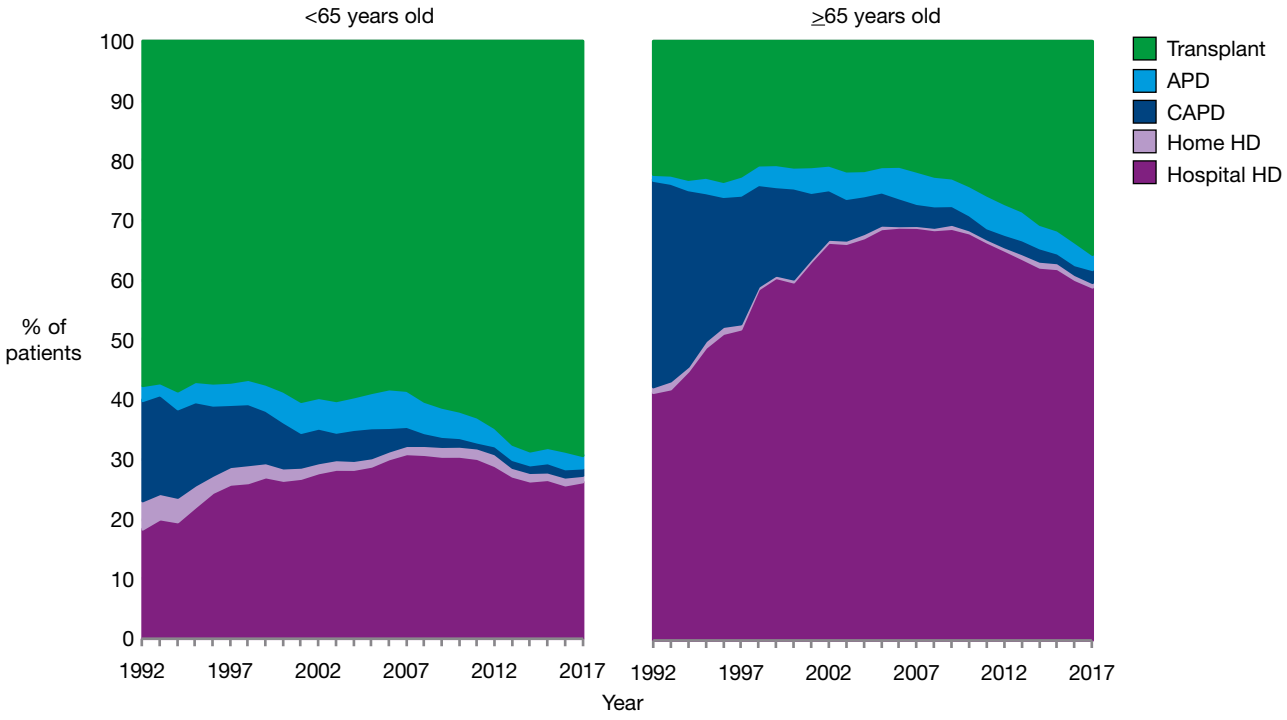
This section's data are available on-line in Tableau format which enables interaction with the data: http://www.srr.scot.nhs.uk/publications/Dashboards/Prevalence.html.

B1 Patients receiving RRT in Scotland according to modality of treatment on 31 December

B1.1 Prevalent patients on 31 December between 1960 – 2017



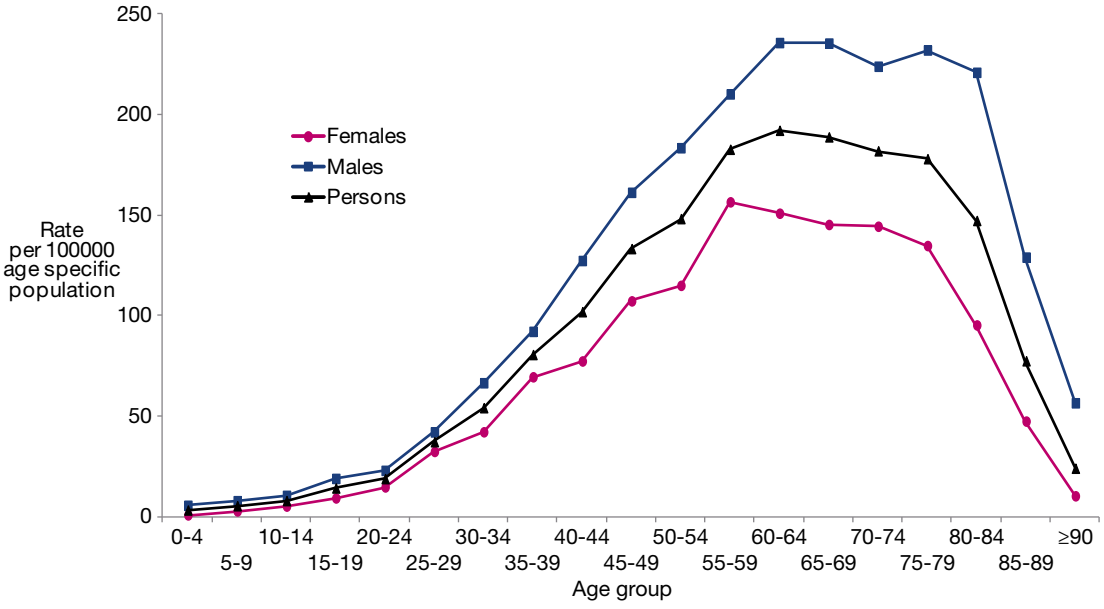
B1.2 Prevalent patients by modality and age group on 31 December each year 1992-2017



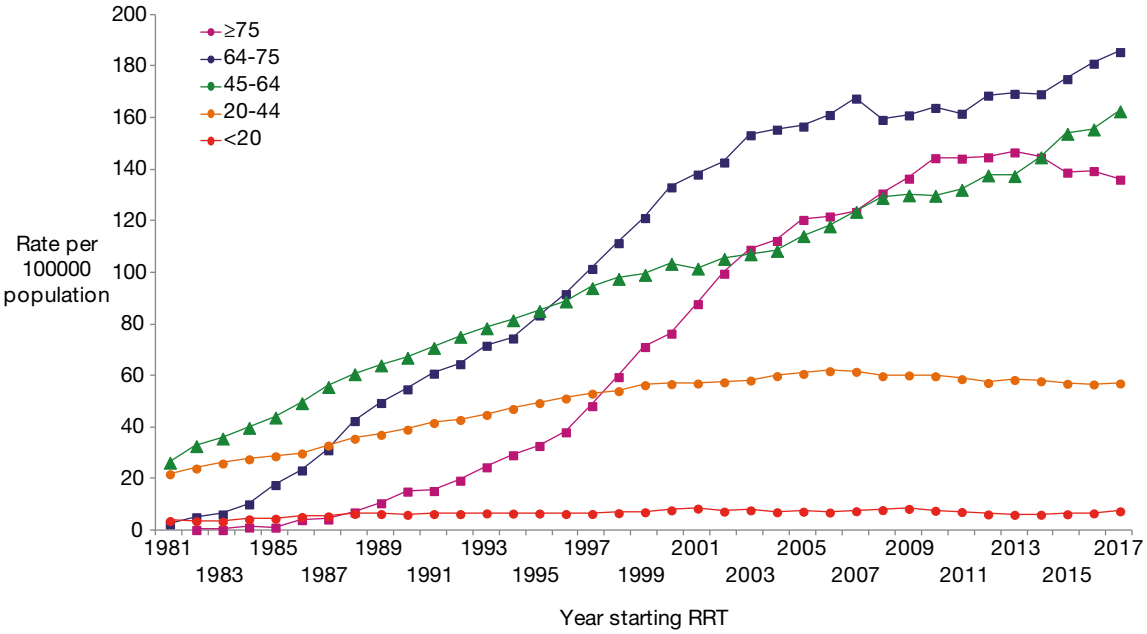
B1.3 Prevalent Patients on 31 December between 1960 – 2017

Year	Hospital HD		Home HD		CAPD		APD		Transplant		Total
	n	%	n	%	n	%	n	%	n	%	
1960	1	**50**	0	-	0	-	0	-	1	**50**	2
1965	7	**58**	0	-	0	-	0	-	5	**42**	12
1970	67	**63**	7	**7**	1	**1**	0	-	32	**30**	107
1975	103	**35**	69	**24**	2	**1**	0	-	119	**41**	293
1980	175	**26**	167	**25**	64	**10**	0	-	256	**39**	662
1985	253	**21**	138	**12**	202	**17**	0	-	584	**50**	1177
1990	379	**20**	94	**5**	393	**21**	17	**1**	980	**53**	1863
1995	687	**27**	78	**3**	403	**16**	79	**3**	1257	**50**	2504
2000	1156	**35**	52	**2**	317	**10**	152	**5**	1580	**49**	3257
2005	1580	**41**	42	**1**	201	**5**	206	**5**	1812	**47**	3841
2010	1856	**42**	54	**1**	79	**2**	201	**5**	2190	**50**	4380
2013	1813	**39**	56	**1**	73	**2**	157	**3**	2521	**55**	4620
2014	1810	**38**	60	**1**	71	**1**	141	**3**	2670	**56**	4752
2015	1867	**38**	58	**1**	73	**1**	152	**3**	2766	**56**	4916
2016	1856	**37**	60	**1**	68	**1**	169	**3**	2869	**57**	5022
2017	1907	**37**	54	**1**	74	**1**	123	**2**	3033	**58**	5191

B1.4 Age specific prevalence of RRT patients on 31 December 2017 per 100000 population



B1.5 Age specific prevalent RRT population 1981-2017 per 100000 population



The graph shows the age specific prevalence of RRT patients on 31 December of each of the years shown.

B1.6 Number and percentage of patients, median age and age range on each mode of RRT by age group on 31 December 2017

Age	Hospital HD		Home HD		CAPD		APD		Transplant		Total
	n	%	n	%	n	%	n	%	n	%	
≥75	462	**24**	3	**6**	14	**19**	28	**23**	103	**3**	**610**
65-74	513	**27**	12	**22**	22	**30**	16	**13**	485	**16**	**1048**
45-64	711	**37**	29	**54**	27	**36**	52	**42**	1621	**53**	**2440**
20-44	212	**11**	7	**13**	10	**14**	19	**15**	757	**25**	**1005**
<20	9	**0**	3	**6**	1	**1**	8	**7**	67	**2**	**88**
Total	**1907**		**54**		**74**		**123**		**3033**		**5191**
Median age	65		56		64		59		53		**57**
Age range	2-92		7-80		19-87		0-87		2-89		**0-92**

* Zero refers to patients aged less than one year old on RRT on 31 December 2017.

B2 Prevalent patients at each renal unit

The number of patients treated at each renal unit differs considerably. Detailed information about each renal unit is given on the SRR website: http://www.srr.scot.nhs.uk/Renal_Units/clinics.htm

B2.1 Number and percentage of patients in each age group receiving RRT at each renal unit on 31 December 2017

Unit	<20		20-44		45-64		65-74		≥75		Total	Median age	IQR
	n	%	n	%	n	%	n	%	n	%			
ARI	4	**1**	143	**25**	241	**42**	117	**21**	64	**11**	569	57	44 - 67
XH	0	**0**	52	**15**	175	**51**	72	**21**	43	**13**	342	59	49 - 69
DGRI	0	**0**	20	**15**	60	**44**	33	**24**	22	**16**	135	59	51 - 70
GLAS	8	**0**	363	**20**	884	**49**	348	**19**	185	**10**	1788	57	47 - 67
MONK	3	**1**	96	**20**	223	**47**	86	**18**	66	**14**	474	56	46 - 69
NINE	3	**1**	66	**15**	194	**44**	103	**23**	73	**17**	439	59	48 - 71
RAIG	0	**0**	56	**21**	121	**46**	57	**22**	31	**12**	265	57	47 - 68
RHC	66	**100**	0	**0**	0	**0**	0	**0**	0	**0**	66	11	8 - 15
RIE	2	**0**	161	**20**	418	**51**	165	**20**	79	**10**	825	57	48 - 67
VHK	2	**1**	48	**17**	124	**43**	67	**23**	47	**16**	288	61	49 - 71
Scotland	**88**	**2**	**1005**	**19**	**2440**	**47**	**1048**	**20**	**610**	**12**	**5191**	**57**	**47 - 68**

B2.2 Number and percentage of patients on each mode of RRT and renal unit providing treatment on 31 December 2017

	Hospital HD		Home HD		CAPD		APD		Transplant		Total
	n	%	n	%	n	%	n	%	n	%	
ARI	228	**40**	4	**1**	17	**3**	5	**1**	315	**55**	569
XH	145	**42**	10	**3**	2	**1**	23	**7**	162	**47**	342
DGRI	51	**38**	2	**1**	2	**1**	4	**3**	76	**56**	135
GLAS	568	**32**	17	**1**	10	**1**	37	**2**	1156	**65**	1788
MONK	197	**42**	0	**0**	9	**2**	8	**2**	260	**55**	474
NINE	178	**42**	9	**1**	18	**4**	0	**0**	234	**53**	439
RAIG	83	**31**	5	**2**	10	**4**	0	**0**	167	**63**	265
RHC	7	**11**	3	**5**	0	**0**	8	**12**	48	**73**	66
RIE	305	**37**	4	**0**	5	**1**	28	**3**	483	**59**	825
VHK	145	**50**	0	**0**	1	**0**	10	**3**	132	**46**	288
Scotland	**1907**	**37**	**54**	**1**	**74**	**1**	**123**	**2**	**3033**	**58**	**5191**

B3 Prevalent patients in each NHS Health Board area

Abbreviations for NHS Health Boards are given in Appendix 1.

B3.1 Number of patients in each age group, median age and inter-quartile range by NHS Health Board of residence on 31 December 2017

NHS Health Board	<20		20-44		45-64		65-74		≥75		Total	Median age	IQR
	n	%	n	%	n	%	n	%	n	%			
A&A	7	**2**	66	**16**	206	**50**	85	**21**	45	**11**	409	58	48-68
BORD	1	**1**	21	**19**	48	**43**	26	**23**	15	**14**	111	59	49-69
D&G	1	**1**	21	**15**	63	**44**	35	**25**	22	**15**	142	58	51-70
FIFE	7	**2**	57	**17**	146	**43**	80	**23**	52	**15**	342	60	48-71
FV	7	**3**	42	**16**	137	**51**	50	**19**	33	**12**	269	58	47-67
GRAM	10	**2**	137	**25**	230	**42**	112	**20**	62	**11**	551	57	43-67
GG&C	22	**2**	247	**20**	605	**49**	226	**18**	127	**10**	1227	57	46-66
HIGH	2	**1**	67	**22**	143	**46**	64	**21**	33	**11**	309	56	46-67
LAN	18	**3**	141	**21**	306	**46**	124	**19**	80	**12**	669	56	46-67
LOTH	5	**1**	135	**20**	350	**51**	137	**20**	62	**9**	689	57	47-66
ORKN	1	**7**	1	**7**	9	**60**	1	**7**	3	**20**	15	54	51-72
SHET	0	**0**	4	**25**	5	**31**	7	**44**	0	**0**	16	64	46-71
TAY	6	**1**	60	**15**	184	**45**	93	**23**	70	**17**	413	59	49-71
WI	1	**3**	6	**21**	8	**28**	8	**28**	6	**21**	29	59	45-73
Scotland	**88**	**2**	**1005**	**19**	**2440**	**47**	**1048**	**20**	**610**	**12**	**5191**	**57**	**47-68**

B3.2 Number of patients on each mode of RRT in each NHS Health Board of residence on 31 December 2017

NHS Health Board	Hospital HD		Home HD		PD		Transplant		Total
	n	%	n	%	n	%	n	%	
A&A	151	**37**	12	**3**	27	**7**	219	**54**	409
BORD	39	**35**	0	**0**	4	**4**	68	**61**	111
D&G	51	**36**	2	**1**	6	**4**	83	**58**	142
FIFE	152	**44**	1	**0**	12	**4**	177	**52**	342
FV	88	**33**	4	**1**	4	**1**	173	**64**	269
GRAM	216	**39**	4	**1**	21	**4**	310	**56**	551
GG&C	424	**35**	4	**0**	39	**3**	760	**62**	1227
HIGH	90	**29**	8	**3**	10	**3**	201	**65**	309
LAN	227	**34**	7	**1**	20	**3**	415	**62**	669
LOTH	266	**39**	4	**1**	29	**4**	390	**57**	689
ORKN	5	**33**	0	**0**	3	**20**	7	**47**	15
SHET	9	**56**	0	**0**	1	**6**	6	**38**	16
TAY	176	**43**	8	**2**	18	**4**	211	**51**	413
WI	13	**45**	0	**0**	3	**10**	13	**45**	29
Scotland	**1907**	**37**	**54**	**1**	**197**	**4**	**3033**	**58**	**5191**

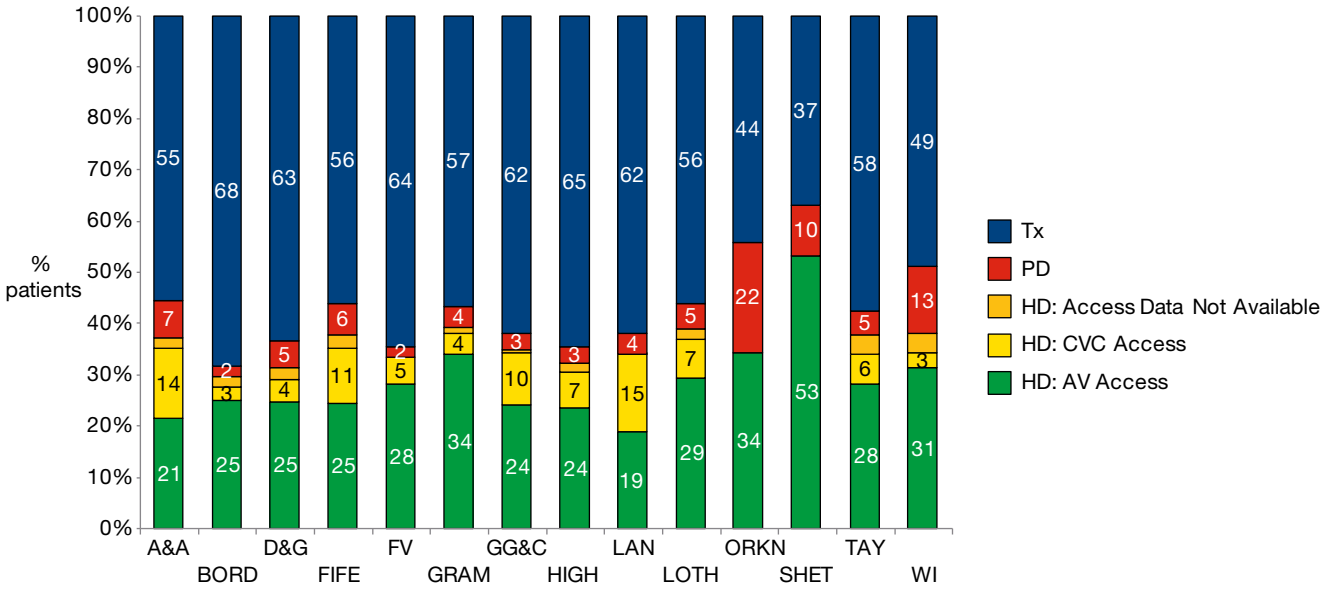
B3.3 RRT modality and vascular access type by NHS Health Board of residence on 01 May 2017

NHS Health Board	HD: AV Access		HD: CVC Access		HD: Access Data Not Available*		PD		Tx		Total
	n	%	n	%	n	%	n	%	n	%	
A&A	82	**22**	51	**14**	8	**2**	26	**7**	207	**55**	374
BORD	24	**25**	3	**3**	2	**2**	2	**2**	64	**67**	95
D&G	37	**28**	6	**5**	3	**2**	7	**5**	78	**60**	131
FIFE	81	**25**	37	**12**	9	**3**	20	**6**	171	**54**	318
FV	71	**28**	14	**6**	0	**0**	5	**2**	161	**64**	251
GRAM	174	**34**	20	**4**	6	**1**	22	**4**	289	**57**	511
GG&C	266	**24**	112	**10**	4	**0**	37	**3**	711	**63**	1130
HIGH	65	**22**	19	**7**	5	**2**	9	**3**	194	**66**	292
LAN	111	**18**	89	**15**	1	**0**	25	**4**	383	**63**	609
LOTH	180	**29**	43	**7**	13	**2**	30	**5**	365	**58**	631
ORKN	5	**36**	0	**0**	0	**0**	3	**21**	6	**43**	14
SHET	9	**56**	0	**0**	0	**0**	1	**6**	6	**38**	16
TAY	119	**31**	25	**7**	16	**4**	19	**5**	204	**53**	383
WI	9	**35**	1	**4**	1	**4**	4	**15**	11	**42**	26
Scotland	**1233**	**26**	**420**	**9**	**68**	**1**	**210**	**4**	**2850**	**60**	**4781**

One patient lived outside of Scotland and was receiving treatment within Scottish renal units on 01 May 2017.

* 68 (1%) patients do not have vascular access for haemodialysis recorded for May 2017. In some cases this is due to the patient being counted as prevalent on 01 May 2017 but no longer receiving haemodialysis on the census day, in some cases the vascular access details were not recorded at the time the census took place or the patient did not attend their dialysis unit when the census was being undertaken due to holiday or hospital admission.

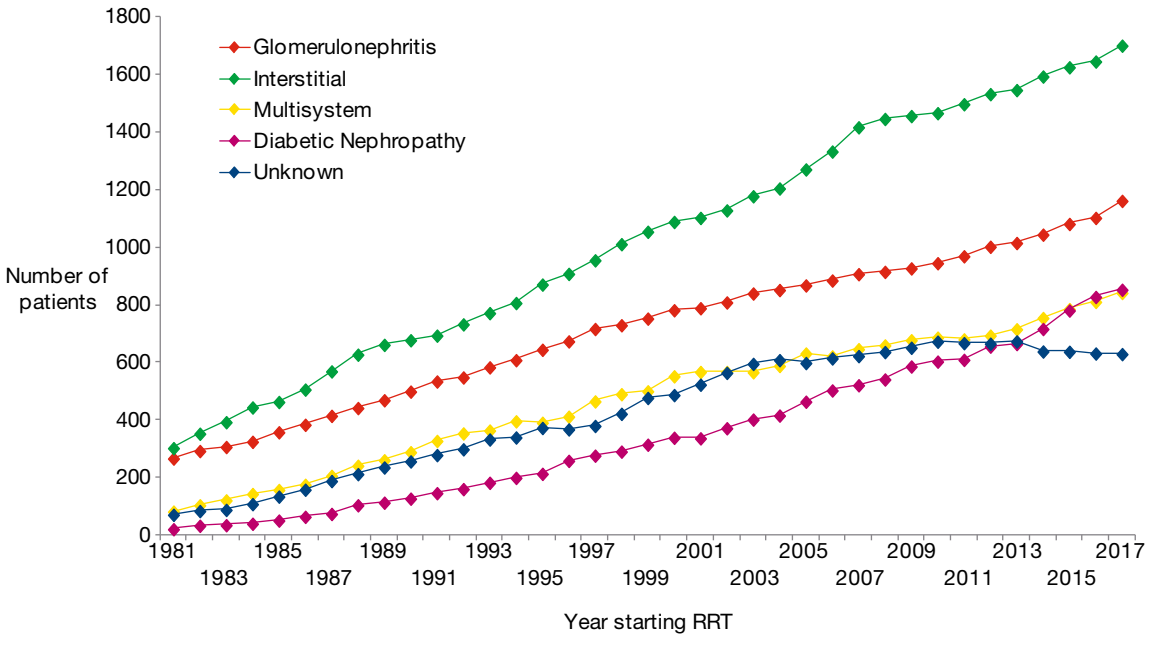
B3.4 RRT modality and vascular access type by NHS Health Board of residence on 01 May 2017 standardised for age, sex and PRD group



Prevalent numbers are correct as of 01 May 2017. Details of the vascular access used for haemodialysis are derived from the May 2017 census.

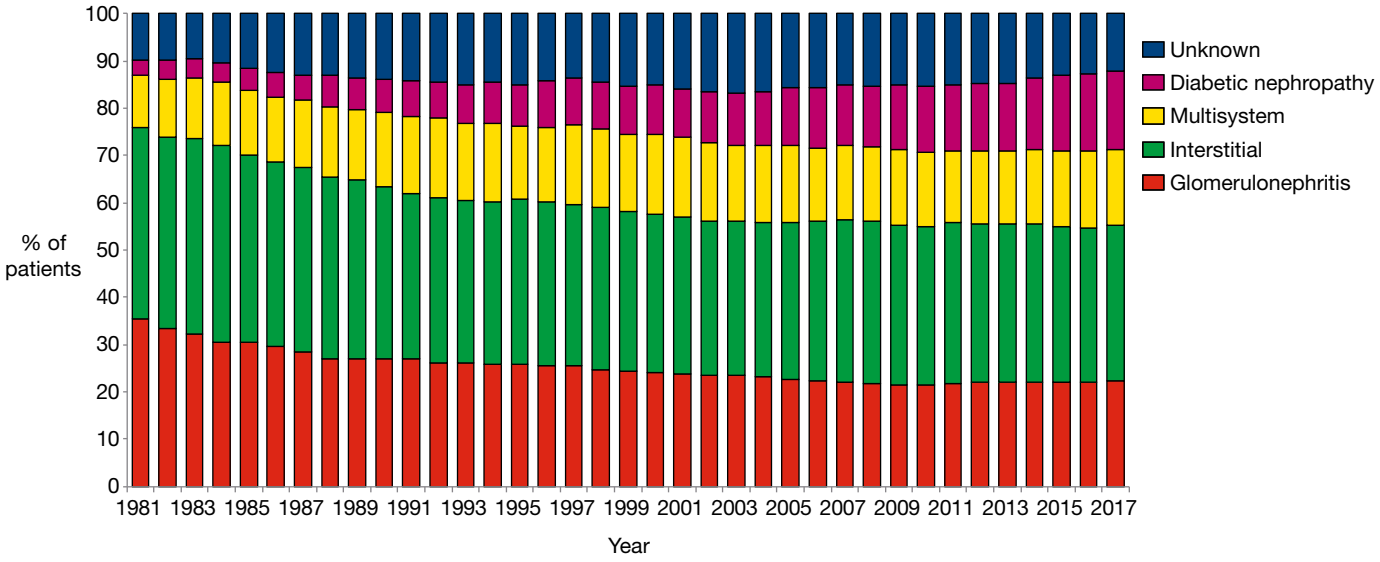
Where the access data is not available this may be for several reasons; the patient started RRT after the census for the unit had taken place, the vascular access details were not recorded at the time the census took place or the patient did not attend when the unit were undertaking the census e.g. on holiday or in hospital.

B3.5 Prevalence of patients receiving RRT 1981 - 2017 by Primary Renal Diagnosis

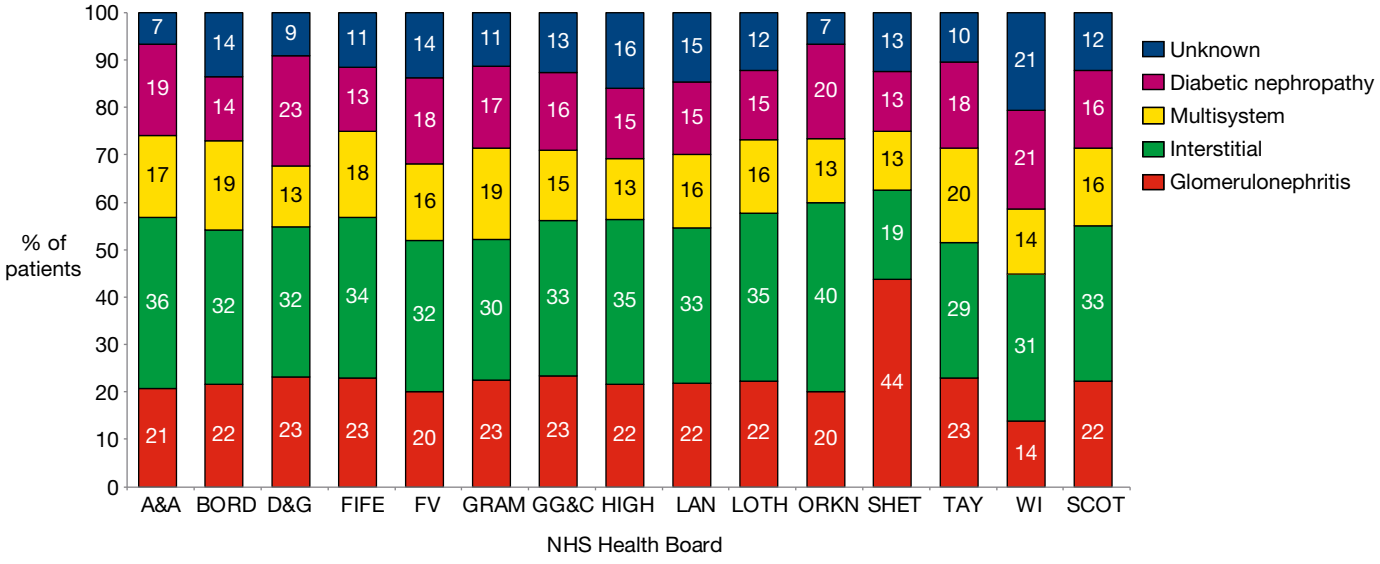


Patients with a missing PRD are not included in this chart.

B3.6 Percentage of patients in each PRD group on 31 December 1981-2017



B3.7 Percentage of patients in each PRD group and their NHS Health Board area of residence 31 December 2017

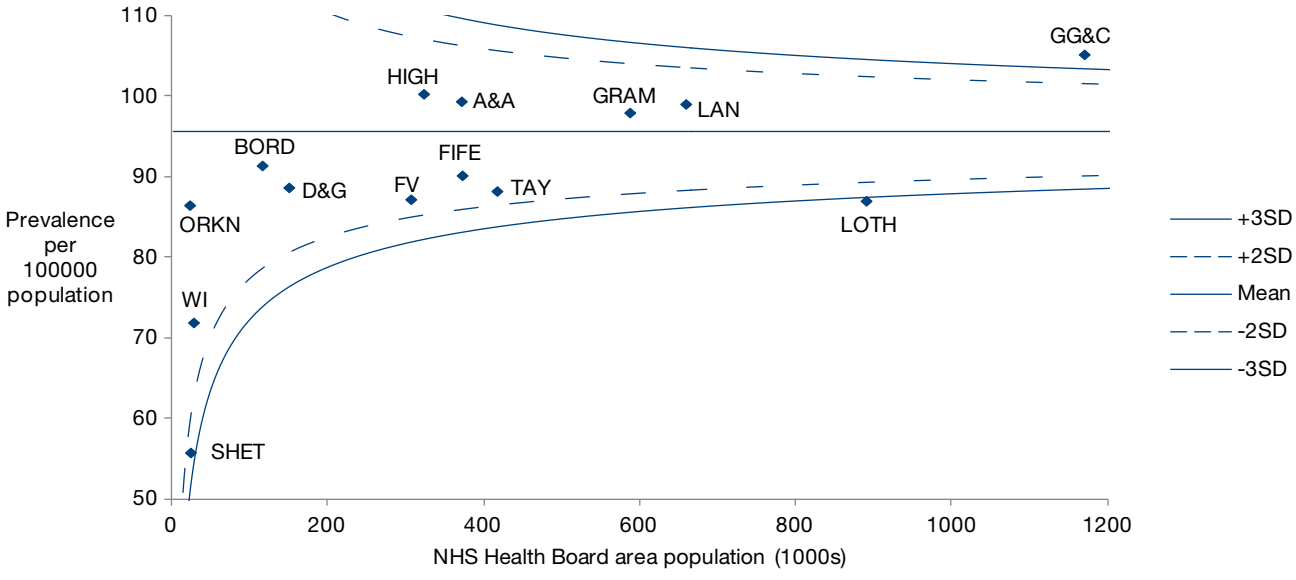


B3.8 Prevalence of patients receiving RRT on 31 December 2017 by NHS Health Board of residence: standardised for age, sex and social deprivation

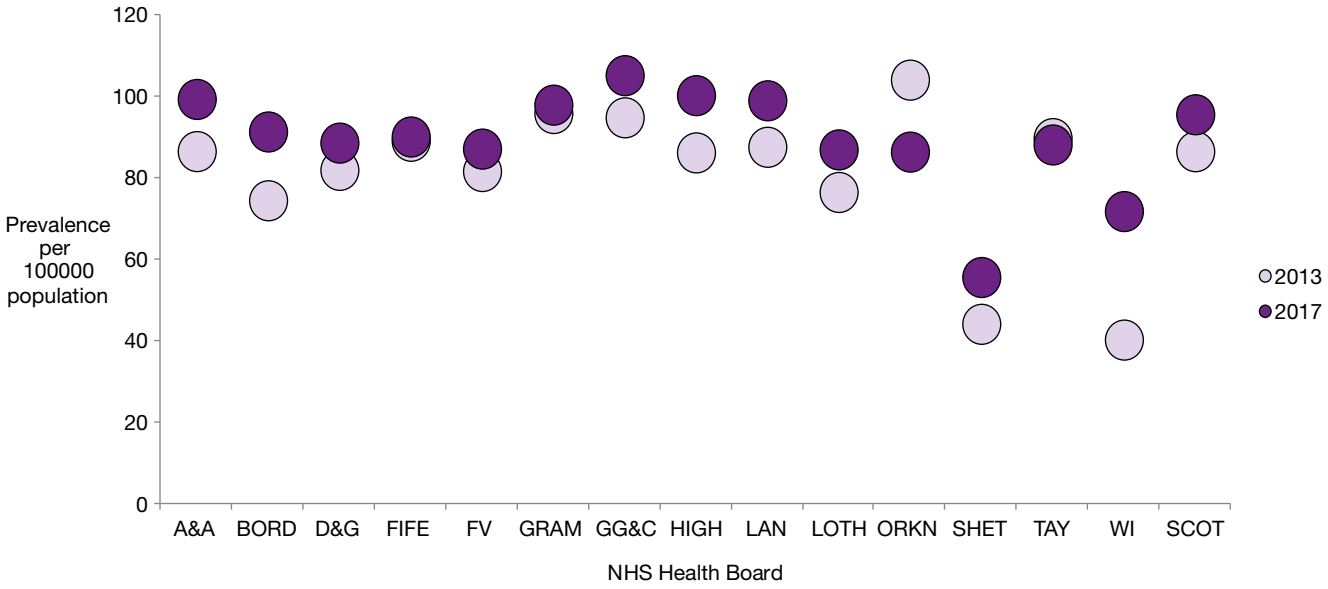
NHS Health Board	Population on 30 June 2017*	RRT population 31 December 2017	Prevalence per 100000 population	Standardised prevalence per 100000 population
A&A	370410	409	110.4	99.5
BORD	115020	111	96.5	91.5
D&G	149200	142	95.2	88.8
FIFE	371410	342	92.1	90.3
FV	305580	269	88.0	87.3
GRAM	586380	551	94.0	98.1
GG&C	1169110	1227	105.0	105.3
HIGH	321990	309	96.0	100.4
LAN	658130	669	101.7	99.1
LOTH	889450	689	77.5	87.1
ORKN	22000	15	68.2	86.6
SHET	23080	16	69.3	55.8
TAY	416090	413	99.3	88.3
WI	26950	29	107.6	72.0
Scotland	**5424800**	**5191**	**95.7**	**95.7**

* National Records of Scotland Mid-year estimates.

B3.9 Prevalence of patients receiving RRT on 31 December 2017 by NHS Health Board of residence: standardised for age, sex and social deprivation



B3.10 Prevalence of patients receiving RRT on 31 December 2013 and 31 December 2017 by NHS Health Board of residence: standardised for age, sex and social deprivation



SECTION C SURVIVAL

This section's data are available on-line in Tableau format which enables interaction with the data: http://www.srr.scot.nhs.uk/publications/Dashboards/Survival.html.

C1 Survival analyses

C1.1 Proportion of patients starting RRT 1997 - 2016 surviving at one, two, five and ten years by age and primary renal diagnosis group

Age group (years)	Diagnosis group	1 year survival			2 year survival			5 year survival			10 year survival		
		Number starting RRT (1997-2016)	n	%	Number starting RRT (1997-2015)	n	%	Number starting RRT (1997-2012)	n	%	Number starting RRT (1997-2007)	n	%
≥75	Unknown	681	442	**65**	663	305	**46**	602	106	**18**	422	8	**2**
	Diabetic nephropathy	309	205	**66**	284	137	**48**	232	34	**15**	150	2	**1**
	Multisystem	821	494	**60**	779	328	**42**	663	77	**12**	459	3	**1**
	Interstitial	286	205	**72**	272	143	**53**	238	53	**22**	166	3	**2**
	Glomerulonephritis	226	145	**64**	209	96	**46**	171	30	**18**	113	5	**4**
	All Diagnoses	2323	1491	**64**	2207	1009	**46**	1906	300	**16**	1310	21	**2**
65-74	Unknown	573	427	**75**	559	335	**60**	507	159	**31**	381	28	**7**
	Diabetic nephropathy	661	488	**74**	615	345	**56**	506	111	**22**	325	6	**2**
	Multisystem	968	620	**64**	932	445	**48**	793	164	**21**	586	23	**4**
	Interstitial	456	378	**83**	422	296	**70**	347	138	**40**	252	30	**12**
	Glomerulonephritis	329	273	**83**	313	218	**70**	253	96	**38**	178	23	**13**
	All Diagnoses	2987	2186	**73**	2841	1639	**58**	2406	668	**28**	1722	110	**6**
45-64	Unknown	414	352	**85**	389	291	**75**	330	185	**56**	249	84	**34**
	Diabetic nephropathy	1028	869	**85**	956	678	**71**	731	243	**33**	471	54	**11**
	Multisystem	711	544	**77**	675	441	**65**	571	242	**42**	410	91	**22**
	Interstitial	932	869	**93**	899	790	**88**	725	532	**73**	519	270	**52**
	Glomerulonephritis	603	558	**93**	557	482	**87**	457	311	**68**	296	137	**46**
	All Diagnoses	3688	3192	**87**	3476	2682	**77**	2814	1513	**54**	1945	636	**33**
20-44	Unknown	226	215	**95**	213	192	**90**	188	156	**83**	144	106	**74**
	Diabetic nephropathy	439	398	**91**	410	341	**83**	339	224	**66**	230	113	**49**
	Multisystem	204	186	**91**	191	167	**87**	160	127	**79**	112	77	**69**
	Interstitial	541	527	**97**	511	487	**95**	426	374	**88**	310	237	**76**
	Glomerulonephritis	399	392	**98**	372	359	**97**	303	279	**92**	212	179	**84**
	All Diagnoses	1809	1718	**95**	1697	1546	**91**	1416	1160	**82**	1008	712	**71**
<20	Unknown	23	23	**100**	22	22	**100**	21	21	**100**	15	15	**100**
	Diabetic nephropathy	1	0	**0**	1	0	**0**	1	0	**0**	1	0	**0**
	Multisystem	31	31	**100**	27	27	**100**	24	21	**88**	17	14	**82**
	Interstitial	158	154	**97**	152	148	**97**	130	121	**93**	87	77	**89**
	Glomerulonephritis	37	36	**97**	35	34	**97**	28	26	**93**	22	19	**86**
	All Diagnoses	250	244	**98**	237	231	**97**	204	189	**93**	142	125	**88**

Age group (years)	Diagnosis group	1 year survival			2 year survival			5 year survival			10 year survival		
		Number starting RRT (1997-2016)	n	%	Number starting RRT (1997-2015)	n	%	Number starting RRT (1997-2012)	n	%	Number starting RRT (1997-2007)	n	%
All ages	Unknown	1917	1459	76	1846	1145	62	1628	606	37	1211	241	20
	Diabetic nephropathy	2438	1960	80	2266	1501	66	1829	633	35	1177	175	15
	Multisystem	2735	1875	69	2604	1408	54	2211	631	29	1584	208	13
	Interstitial	2373	2133	90	2256	1864	83	1866	1218	65	1334	617	46
	Glomerulonephritis	1594	1404	88	1486	1189	80	1212	742	61	821	363	44
	All Diagnoses	11057	8831	80	10458	7107	68	8746	3830	44	6127	1604	26

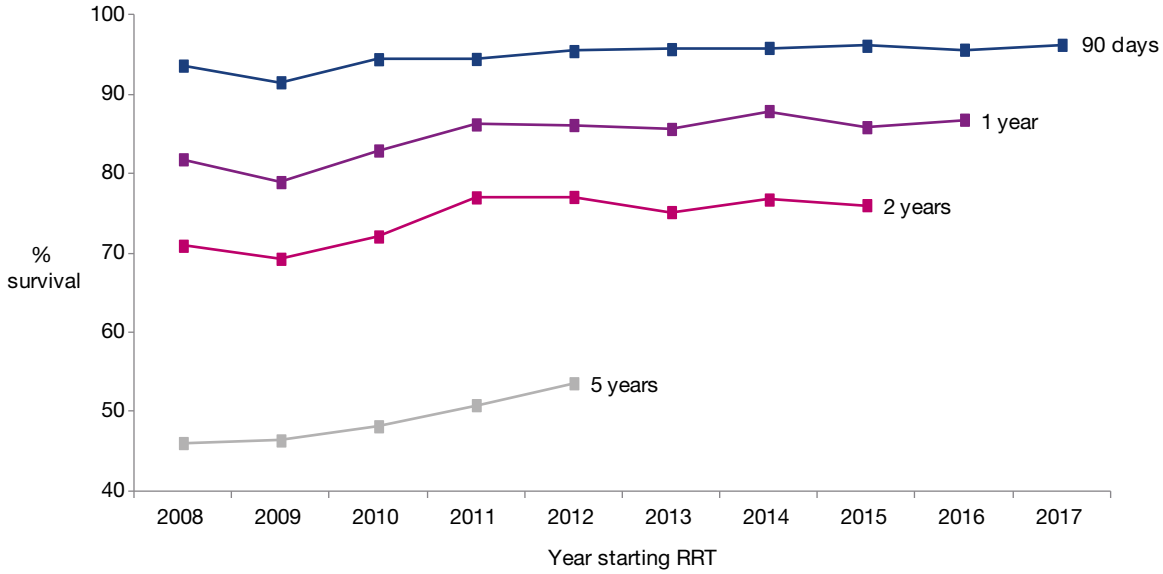
C1.2 Survival of patients by year of start of RRT 2008-2017

Year starting RRT	% surviving 90 days	% surviving 1 year	% surviving 1 year + 90 days	% surviving 2 years	% surviving 2 years + 90 days	% surviving 5 years	% surviving 5 years+ 90 days
2008	93.6	81.8	78.9	70.9	67.4	46.0	45.3
2009	91.5	78.9	77.3	69.3	66.6	46.4	44.5
2010	94.4	82.9	79.3	72.1	68.9	48.1	47.7
2011	94.5	86.2	83.8	77.0	73.8	50.8	48.8
2012	95.4	86.1	83.8	77.1	75.0	53.6	51.3
2013	95.7	85.6	82.4	75.1	72.6		
2014	95.8	87.9	85.9	76.7	75.1		
2015	96.1	85.9	83.5	76.0	72.8		
2016	95.6	86.8	84.2				
2017	96.2						

Note: Censored patients are excluded from this table.

Patients with insufficient follow-up and those who recovered within 90 days or who were lost to follow-up within the relevant period have been excluded.

C1.3 Trends in survival of patients starting RRT 2008-2017



Trend in 90 days survival: year to year OR is 1.09 (95% CI 1.04 -1.13)

Trend in 1 year survival: year to year OR is 1.07 (95% CI is 1.04 - 1.10).

Trend in 2 years survival: year to year OR is 1.05 (95% CI is 1.02 -1.09).

Trend in 5 years survival: year to year OR is 1.08 (95% CI is 1.02-1.14).

There is a statistically significant trend of improving survival at 90 days, 1 year, 2 years and 5 years after starting RRT.

C1.4 Proportion of patients starting RRT 2008-2016 surviving at 90 days and 1 year, by NHS Health Board area of residence

NHS Health Board	Number of patients	90 day survival		1 year survival	
		n	%	n	%
A&A	398	370	**93**	333	**84**
BORD	93	91	**98**	87	**94**
D&G	141	134	**95**	123	**87**
FIFE	401	374	**93**	336	**84**
FV	276	263	**95**	231	**84**
GRAM	493	473	**96**	430	**87**
GG&C	1129	1070	**95**	949	**84**
HIGH	245	234	**96**	209	**85**
LAN	616	593	**96**	527	**86**
LOTH	606	563	**93**	478	**79**
ORKN	20	18	**90**	17	**85**
SHET	15	14	**93**	12	**80**
TAY	434	414	**95**	367	**85**
WI	28	28	**100**	25	**89**
Scotland	**4895**	**4639**	**95**	**4124**	**84**

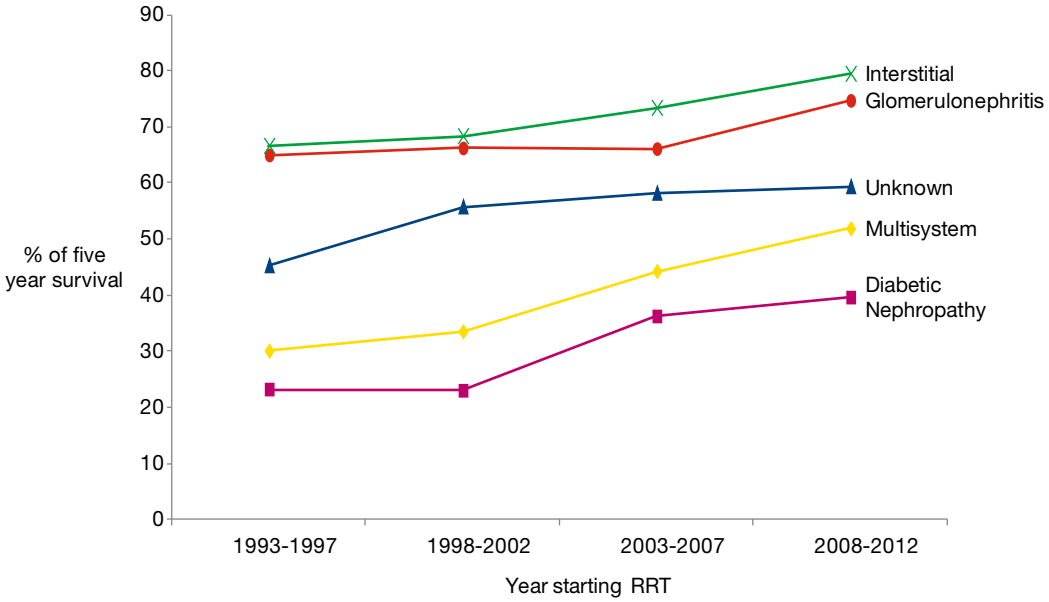
C2 Survival analyses

The trend in survival was calculated to investigate whether survival has improved over time for patients who started RRT aged between 45 and 64 years old.

This age group account for 34% of the whole RRT population between 1993-2012.

Data relating to patients starting RRT after 2012 are excluded to ensure a minimum available follow up period of 5 years.

C2.1 Trend in 5 year survival from starting RRT 1993-2012 for patients aged 45-64 for each PRD group



Glomerulonephritis - there is an increasing trend in survival (OR 1.14, 95% CI 1.02 to 1.39, p = 0.07).

Interstital - there is an increasing trend in survival which is statistically significant (OR 1.246, 95% CI 1.08 to 1.44, p = 0.002).

Multisystem - there is an increasing trend in survival which is statistically significant (OR 1.38, 95% CI 1.2 to 1.6, p < 0.001).

Diabetic nephropathy - there is an increasing trend in survival which is statistically significant (OR 1.35, 95% CI 1.18 to 1.55, p < 0.001).

Unknown PRD - there is an increasing trend in survival which is statistically significant (OR 1.21, 95% CI 1.02 to 1.45, p = 0.033).

C3 Survival by NHS Health Board area of residence

The standardised mortality ratio (SMR) is the number of deaths in every NHS Health Board or unit divided by the number of expected deaths in that NHS Health Board or unit.

This makes the SMR a measure of case-mix adjusted mortality (hence the label 'standardised').

The expected number of deaths is based on a logistic regression comprising patient's age, sex, SIMD and primary renal diagnosis group.

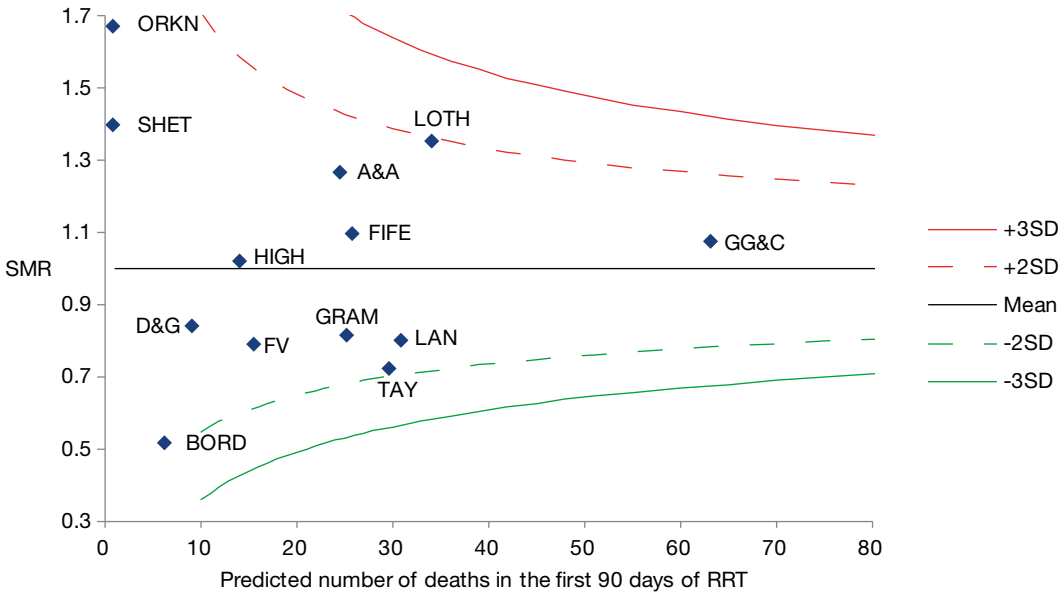
A SMR close to one means that the observed number of deaths is close to the expected number.

A SMR higher than one means that the observed number of deaths is higher than the expected number.

The units within the outer control limits (-3SD, +3SD) are considered equivalent and different only by chance.

The control limits are calculated via the Poisson probability distribution.

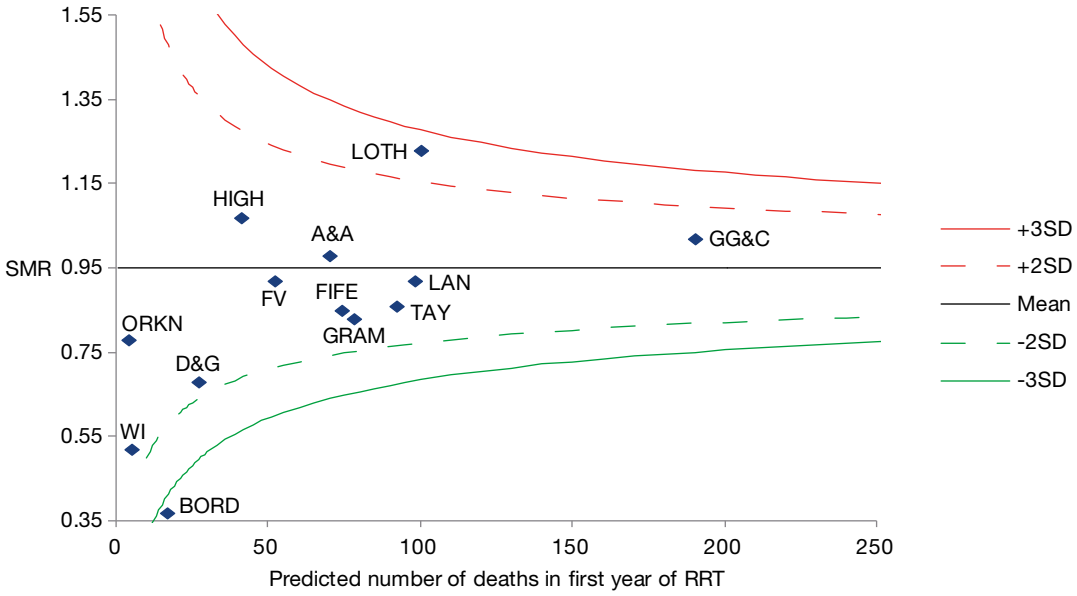
C3.1 90 day standardised mortality ratio for patients starting RRT 2008-2017 by NHS Health Board area of residence



All NHS Health Board areas fall within 3 standard deviations of the mean.

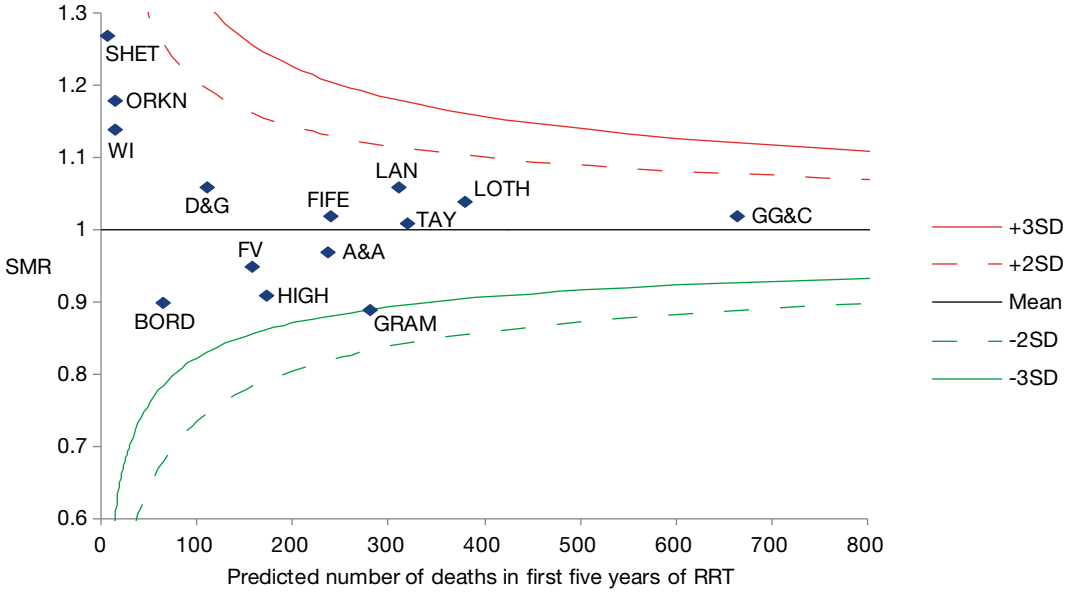
The mortality in the first 90 days of RRT for patients starting RRT in the ten years 2008-2017 was 6.2%.

C3.2 One year standardised mortality ratio for patients starting RRT 2007-2016 by NHS Health Board area of residence



The mortality in first year of RRT for patients starting RRT in the ten years 2006-2015 was 15.6%.

C3.3 Five year standardised mortality ratio for patients starting RRT 2003-2012 by NHS Health Board area of residence

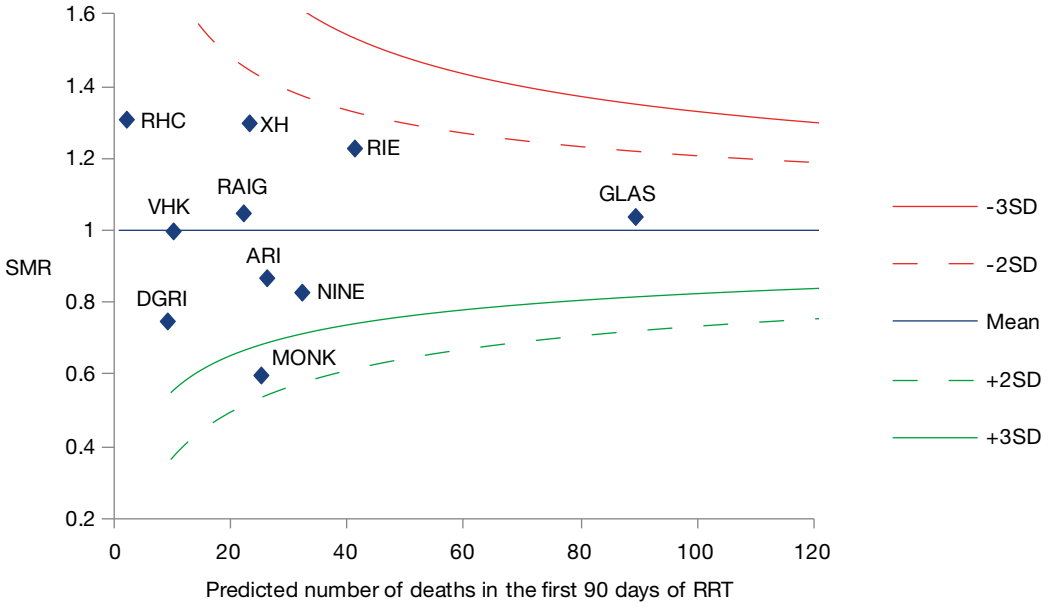


All NHS Health Board areas fall within 3 standard deviations of the mean.

The mortality in first five years of RRT for patients starting RRT in the ten years 2003 - 2012 was 53.5%.

C4 Survival by renal unit providing first RRT

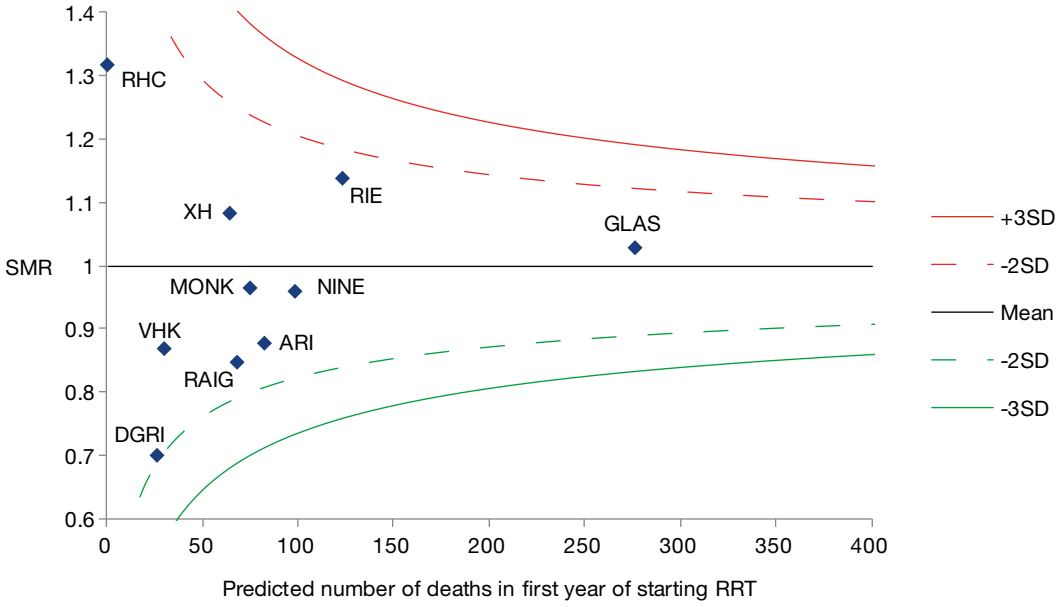
C4.1 90 day standardised mortality ratio by renal unit providing first RRT for patients starting RRT 2008-2017



Expected mortality is based on sex, age group, SIMD and primary renal diagnosis group.

The mortality in the first 90 days of RRT for patients starting RRT in the ten years 2008-2017 was 6.2%.

C4.2 One year standardised mortality ratio by renal unit providing first RRT for patients starting RRT 2007-2016

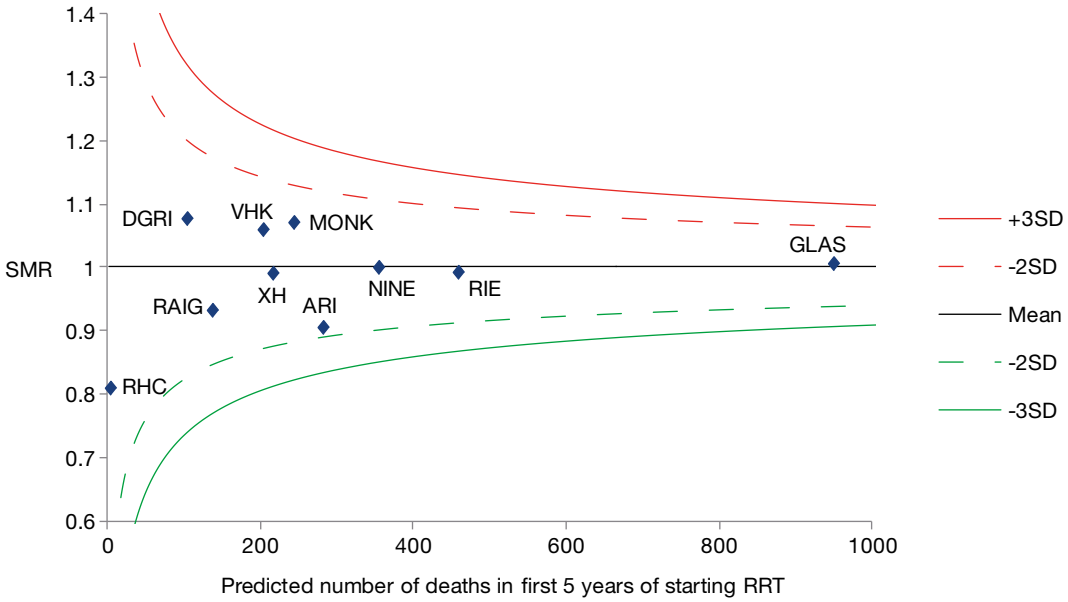


All units fall within three standard deviations of the mean.

Expected mortality is based on sex, age group, SIMD and primary renal diagnosis group.

The mortality in first year of RRT for patients starting RRT in the ten years 2007-2016 was 15.6%.

C4.3 Five year standardised mortality ratio by renal unit providing first RRT for patients starting RRT 2003-2012



All units fall within 3 standard deviations of the mean.

Expected mortality is based on sex, age group, SIMD and primary renal diagnosis group.

The mortality in first five years of RRT for patients starting RRT in the ten years 2003 - 2012 was 53.5%.

SECTION D CAUSE OF DEATH

This section's data are available on-line in Tableau format which enables interaction with the data: http://www.srr.scot.nhs.uk/publications/Dashboards/Cause-of-Death.html.

Please see Summary of Data section of the report for details on the inclusion/exclusion of patients.

D1 Death in the prevalent RRT population 2008-2017

Year of death	Number of deaths	% of deaths in RRT population*	Age at death		Age when Starting RRT (Years)		Time on RRT before death (Years)	
			Median	IQR	Median	IQR	Median	IQR
2008-2012**	2164	**9.0**	71	(61,78)	66	(53,75)	3	(1,7)
2013	446	**8.8**	71	(61,79)	65	(53,75)	4	(1,9)
2014	429	**8.3**	72	(63,79)	66	(53,74)	3	(1,8)
2015	460	**8.6**	71	(61,78)	66	(53,74)	4	(1,9)
2016	470	**8.6**	70	(59,78)	62	(50,73)	4	(1,9)
2017	487	**8.6**	71	(62,79)	66	(52,74)	4	(1,9)

* Percentage of deaths is expressed as: number of deaths in given year/number of patients starting RRT in given year + number prevalent on 31 December of previous year.

** Average taken over 5 year period.

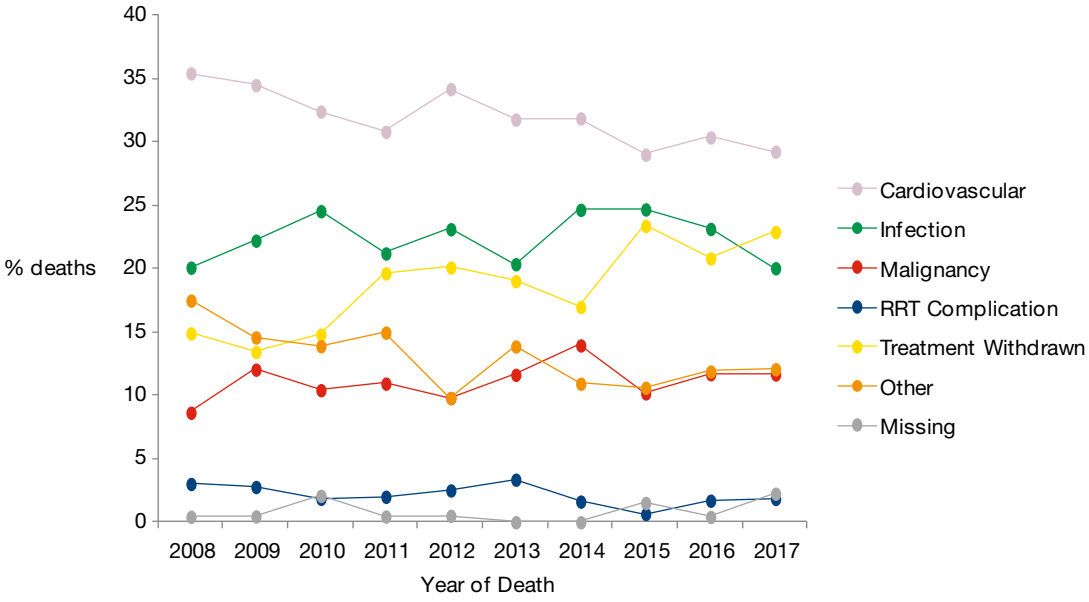
D2 Cause of death group by year 2008-2017

Cause of death	2008-2012		2013		2014		2015		2016		2017		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Cardiovascular	727	**34**	142	**32**	137	**32**	134	**29**	143	**30**	143	**29**	1426	**32**
Infection	481	**22**	91	**20**	106	**25**	113	**25**	109	**23**	98	**20**	998	**22**
Malignancy	225	**10**	51	**11**	60	**14**	47	**10**	55	**12**	57	**12**	495	**11**
Other	310	**14**	62	**14**	47	**11**	48	**10**	56	**12**	59	**12**	582	**13**
RRT Complication	53	**2**	15	**3**	7	**2**	3	**1**	8	**2**	9	**2**	95	**2**
Treatment Withdrawn	355	**16**	85	**19**	72	**17**	108	**23**	98	**21**	112	**23**	830	**19**
Missing	13	**1**	0	**0**	0	**0**	7	**2**	1	**0**	9	**2**	30	**1**
Total	**2164**		**446**		**429**		**460**		**470**		**487**		**4456**	

Cause of death has been collected as part of the Scottish Mortality Audit of Renal Replacement Therapy (SMARRT) since January 2008. Cause of death was available for just 72% of those dying between 1990 and 1999, 51% between 2000 and 2007 and 99% since 2008 and the creation of SMARRT.

ERA-EDTA Cause of death codes and the groupings used in SRR reports are available on the SRR website: http://www.srr.scot.nhs.uk/Projects/Methods.html.

D3 Trends in cause of death group by year 2008-2017



D4 Cause of death group and modality of RRT at death 2008-2017

Cause of death	Modality								
	HD		PD		Tx		RRT stopped*		All
	n	%	n	%	n	%	n	%	n
Cardiovascular	1126	**35**	103	**38**	172	**26**	25	**7**	1426
Infection	733	**23**	45	**17**	189	**28**	31	**9**	998
Malignancy	256	**8**	23	**9**	163	**24**	53	**15**	495
Other	399	**13**	47	**17**	114	**17**	22	**7**	582
RRT Complication	65	**2**	18	**7**	7	**1**	5	**1**	95
Treatment Withdrawn	577	**18**	31	**12**	21	**3**	201	**58**	830
Missing	21	**1**	1	**1**	7	**1**	1	**2**	30
Total	**3177**		**268**		**673**		**338**		**4456**

* This group were recorded on the SRR as having stopped RRT with no recovery of renal function, prior to death.

Of those patients who died within 90 days after stopping RRT between 2008-2017 the median, IQR and range between stopping RRT and death was 7 days, 4-12 days and 0-88 days respectively.

Over the time period 2008-2017 15 patients stopped RRT and then survived for more than 90 days. They had received RRT for a median of 245 days, range 5-2734 days before stopping RRT.

D5 Cause of death by age group 2008-2017

Cause of death	Age group										Total	Median Age
	<20		20-44		45-64		65-74		≥75			
	n	%	n	%	n	%	n	%	n	%		
Cardiovascular	2	**29**	73	**32**	458	**38**	418	**32**	475	**28**	**1426**	**69**
Infection	1	**14**	42	**19**	258	**22**	317	**24**	380	**22**	**998**	**71**
Malignancy	0	**0**	21	**9**	150	**13**	169	**13**	155	**9**	**495**	**69**
Other	1	**14**	49	**22**	172	**14**	166	**13**	194	**11**	**582**	**67**
RRT Complication	2	**29**	18	**8**	21	**2**	30	**2**	24	**1**	**95**	**76**
Treatment Withdrawn	1	**14**	18	**8**	131	**11**	201	**15**	479	**28**	**830**	**69**
Missing	0	**0**	4	**2**	6	**1**	8	**1**	12	**1**	**30**	**69**
Total	**7**		**225**		**1196**		**1309**		**1719**		**4456**	**71**

D6 Cause of death by primary renal diagnosis 2008-2017

Cause of death	PRD Group										Total
	Glomerulo-nephritis		Interstitial		Multisystem		Diabetic nephropathy		Unknown		
	n	%	n	%	n	%	n	%	n	%	
Cardiovascular	181	**29**	258	**29**	323	**30**	464	**42**	200	**26**	**1426**
Infection	145	**24**	223	**25**	232	**21**	222	**20**	175	**23**	**997**
Malignancy	88	**14**	133	**15**	160	**15**	42	**4**	72	**9**	**495**
Other	89	**14**	129	**15**	109	**10**	148	**13**	107	**14**	**582**
RRT Complication	15	**2**	20	**2**	22	**2**	17	**2**	21	**3**	**95**
Treatment Withdrawn	94	**15**	116	**13**	234	**22**	204	**18**	182	**24**	**830**
Missing	4	**1**	4	**0**	7	**1**	12	**1**	3	**0**	**30**
Total	**616**		**883**		**1087**		**1109**		**760**		**4455**

There is one patient with a missing PRD code.

SECTION E SCOTTISH MORTALITY AUDIT RENAL REPLACEMENT THERAPY (SMARRT)

Data regarding all deaths of adult patients receiving RRT in Scotland are submitted to the SRR via the Scottish Mortality Audit of Renal Replacement Therapy (SMARRT). Cause and contributors to death as well as location of death are recorded. In addition, the clinicians responsible for a patient's care are asked to comment on the presence or absence of areas of clinical concern in patient management prior to death.

A five point scale is used:

1. **There were no areas of concern or for consideration in the management of this patient**
2. **There were areas for consideration but they made no difference to the eventual outcome**
3. **There were areas of concern but they made no difference to the eventual outcome**
4. **There were areas of concern which may have contributed to this patient's death**
5. **There were areas of concern which CAUSED the death of this patient who would have been expected to survive**

Those deaths classed as category 4 or 5 are further assessed through a process which may include a review of case note records, discussion at local morbidity and mortality meetings, critical incident review reports or procurator fiscal reports. From analysis of this additional information several recurring themes have emerged.

These themes are:

- **Hyperkalaemia**

Death due to hyperkalaemic arrest. Patient non-concordance with treatment is noted to contribute in >50% of cases.

- **Prescribing**

Death attributed to adverse drug effects - inappropriate drug choices, combinations or monitoring. Most cases involve the use of common drugs including antiplatelet agents/ anticoagulants, opioid analgesics or immunosuppressant medication.

- **Systems of care**

Deaths attributed to failures of communication, inadequate out of hours cover, delays in specialist renal input or inadequate staff training.

- **Infection**

Deaths attributed to severe infection due to delays in its recognition or management, sepsis in the context of immunosuppressive drugs or due to vascular access related infection.

- **Vascular Access**

Deaths attributed to complications of vascular access. Examples include fatal blood loss (intentional and accidental), inadequate dialysis following failure to address poor vascular access or cardiovascular compromise from AVF formation.

- **Interventions**

Deaths attributed as a direct consequence of an operation or procedure. Examples include recognised bleeding complications of angiography and viscus perforation during endoscopic procedures.

- **Other**

Deaths following a fall-related fracture, unexpected deterioration during dialysis or noncompliance.

E1 Categories of deaths by year 2008-2017

Year	Cat 1		Cat 2		Cat 3		Cat 4		Cat 5		Missing	
	n	%	n	%	n	%	n	%	n	%	n	%
2008-2012	1806	**83.5**	228	**10.5**	38	**1.8**	71	**3.3**	12	**0.6**	9	**0.4**
2013	350	**78.1**	56	**12.5**	20	**4.5**	15	**3.3**	6	**1.3**	1	**0.2**
2014	336	**78.0**	42	**9.7**	21	**4.9**	23	**5.3**	6	**1.4**	3	**0.7**
2015	353	**76.7**	62	**13.5**	25	**5.4**	15	**3.3**	3	**0.7**	2	**0.4**
2016	370	**78.9**	62	**13.2**	23	**4.9**	11	**2.3**	1	**0.2**	2	**0.4**
2017	369	**75.6**	67	**13.7**	18	**3.7**	17	**3.5**	4	**0.8**	13	**2.7**
Total	**3584**	**80.4**	**517**	**11.6**	**145**	**3.3**	**152**	**3.4**	**32**	**0.7**	**30**	**0.7**

E2 Themes of category 4 and 5 deaths by year 2008- 2017

Year	Hyper-kalaemia		Prescrib-ing		Systems of Care		Infection		Vascular Access		Interven-tion		Other		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
2008-2012	4	**4.8**	13	**15.7**	19	**22.9**	28	**33.7**	10	**12.0**	7	**8.4**	2	**2.4**	**83**
2013	2	**9.5**	0	**0.0**	9	**42.9**	3	**14.3**	1	**4.8**	4	**19.0**	2	**9.5**	**21**
2014	0	**0.0**	0	**0.0**	7	**24.1**	11	**37.9**	5	**17.2**	2	**6.9**	4	**13.8**	**29**
2015	0	**0.0**	4	**22.2**	5	**27.8**	6	**33.3**	0	**0.0**	1	**5.6**	2	**11.1**	**18**
2016	1	**8.3**	1	**8.3**	2	**16.7**	6	**50.0**	0	**0.0**	0	**0.0**	2	**16.7**	**12**
2017	2	**9.5**	1	**4.8**	6	**28.6**	7	**33.3**	4	**19.0**	0	**0.0**	1	**4.8**	**21**
Total	**9**	**4.9**	**19**	**10.3**	**48**	**26.1**	**61**	**33.2**	**20**	**10.9**	**14**	**7.6**	**13**	**7.1**	**184**

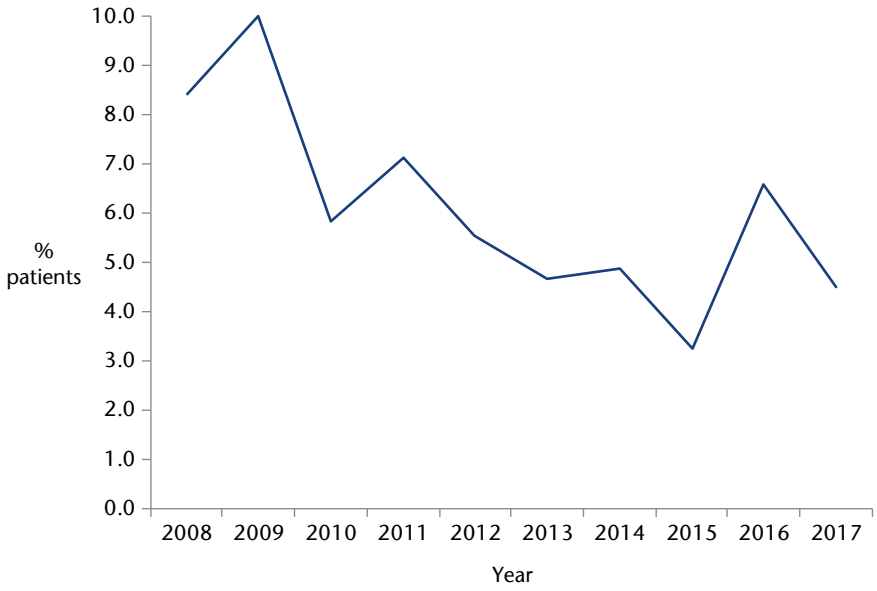
E3 Location of death by year 2008-2017

Year	Usual Residence		Hospital		Hospice		Community Hospital		Other		Unknown		Missing	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
2008-2012	468	**21.6**	1489	**68.8**	46	**2.1**	49	**2.3**	35	**1.6**	19	**0.9**	58	**2.7**
2013	98	**21.9**	317	**70.8**	11	**2.5**	13	**2.9**	5	**1.1**	2	**0.4**	2	**0.4**
2014	85	**19.7**	303	**70.3**	17	**3.9**	10	**2.3**	3	**0.7**	0	**0.0**	13	**3.0**
2015	105	**22.8**	299	**65.0**	17	**3.7**	16	**3.5**	3	**0.7**	1	**0.2**	19	**4.1**
2016	101	**21.5**	310	**66.1**	21	**4.5**	11	**2.3**	4	**0.9**	1	**0.2**	21	**4.5**
2017	115	**23.6**	322	**66.0**	18	**3.7**	5	**1.0**	0	**0.0**	0	**0.0**	28	**5.7**
Total	**972**	**21.8**	**3040**	**68.2**	**130**	**2.9**	**104**	**2.3**	**50**	**1.1**	**23**	**0.5**	**141**	**3.2**

E4 Factors contributing to death 2008-2017

Year	With-drawal		Access failure/ infection		Dialysis compli-cations		Non-compli-ance		Peritoneal Infection		Trans-plant Complica-tion		Health-care As-sociated Infection		Malig-nancy		Missing	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
2008-2012	677	**31.3**	191	**10.6**	117	**6.5**	88	**4.9**	60	**3.3**	126	**7.0**	170	**9.4**	349	**19.3**	32	**1.8**
2013	161	**35.9**	24	**6.2**	23	**6.0**	21	**5.4**	13	**3.4**	32	**8.3**	30	**7.8**	77	**19.9**	5	**1.3**
2014	147	**34.1**	32	**8.3**	19	**4.9**	24	**6.2**	11	**2.9**	35	**9.1**	28	**7.3**	80	**20.8**	9	**2.3**
2015	170	**37.0**	36	**8.8**	18	**4.4**	10	**2.5**	9	**2.2**	41	**10.1**	26	**6.4**	89	**21.9**	8	**2.0**
2016	163	**34.8**	21	**5.7**	23	**6.3**	21	**5.7**	8	**2.2**	24	**6.5**	20	**5.4**	83	**22.6**	5	**1.4**
2017	193	**39.5**	28	**6.5**	24	**5.6**	20	**4.6**	10	**2.3**	24	**5.6**	30	**6.9**	83	**19.2**	20	**4.6**
Total	**1511**	**33.9**	**332**	**8.8**	**224**	**5.9**	**184**	**4.9**	**111**	**2.9**	**282**	**7.4**	**304**	**8.0**	**761**	**20.1**	**79**	**2.1**

E5 Proportion of patients who died within 90 days of starting RRT 2008-2017



Percentage of patients who die at ≤90 days after commencing any form of RRT per year 2008-2017, $p<0.001$ for trend.

E6 Review of SMARRT

This year (2018) marks the 10th anniversary of the inception of SMARRT, and therefore provides an opportunity to reflect on the success of the audit and look forward to how it might evolve over the next ten years. Around 2007, the SRR highlighted between centre variation in the outcomes for those receiving RRT. In order to investigate this, granular data were needed and SMARRT began collecting data the following year.

The nephrology community of Scotland have strongly supported the aims of SMARRT with 4460 individual forms completed to the end of 2017 and >99% completeness. The process has evolved over the years and the allocation of the category of concern is now assigned by the multi-professional renal team at local Morbidity and Mortality meetings and reported to SMARRT.

The audit has led to significant contributions to the literature regarding vascular access type and cause of death[1], adverse events and subsequent mortality[2] and withdrawal from RRT[3]. In addition, seven abstracts have been presented at national and international meetings to broad audiences.

During this 10-year period there have been changes in the legal framework in which healthcare professionals operate, notably the introduction of Duty of Candour legislation. In addition, the demographics of the RRT population have changed with increasing levels of frailty and how we provide conservative kidney management has evolved over the decade to reflect this. Therefore SMARRT must also evolve to remain relevant to its original aims and continue to collect high quality data to ensure we identify areas where safety can be improved. This is a priority for the SMARRT group.

In this era of financial constraints and workload pressures it is a testament to the renal community's drive to provide outstanding care, that commitment to SMARRT remains strong and we would like to thank everyone who has contributed to SMARRT in the past 10 years.

References:

1 B D Bray et al., "Vascular Access Type and Risk of Mortality in a National Prospective Cohort of Haemodialysis Patients.," QJM : Monthly Journal of the Association of Physicians 105, no. 11 (November 1, 2012): 1097–1103, doi:10.1093/qjmed/hcs143.

2 Benjamin D Bray et al., "How Safe Is Renal Replacement Therapy? A National Study of Mortality and Adverse Events Contributing to the Death of Renal Replacement Therapy Recipients.," Nephrology, Dialysis, Transplantation : Official Publication of the European Dialysis and Transplant Association - European Renal Association 29, no. 3 (March 1, 2014): 681–87, doi:10.1093/ndt/gft197.

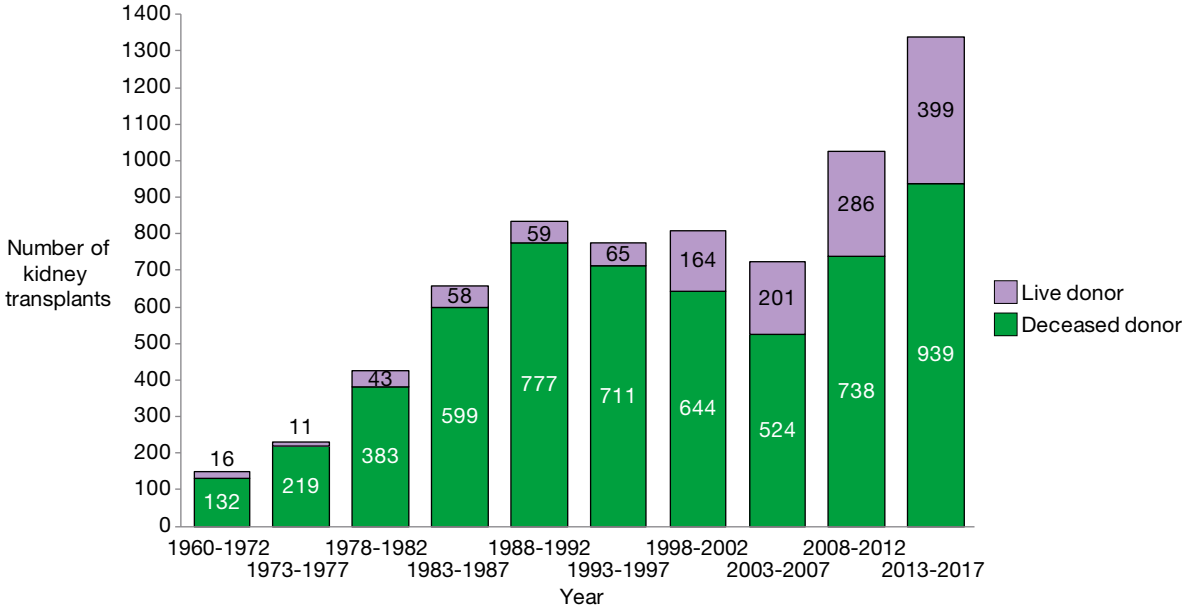
3 Mark D. Findlay et al., "Factors Influencing Withdrawal from Dialysis: A National Registry Study," Nephrology Dialysis Transplantation 31, no. 12 (2016): 2041–48, doi:10.1093/ndt/gfw074.

SECTION F TRANSPLANTATION

This section's data are available on-line in Tableau format which enables interaction with the data: http://www.srr.scot.nhs.uk/publications/Dashboards/Transplant.html.

F1 Frequency of kidney transplantation in Scotland

F1.1 Frequency and donor type, kidney transplants performed in Scotland 1960 - 2017



Between 1960 and 31 December 2017, 6968 kidney transplants were performed in Scotland in 5897 patients with postcode of residence in Scotland at the time of transplantation.

The kidney donor was deceased for 5666 (81%) transplants, 1302 (19%) of transplanted kidneys were donated by live donors.

5865 first kidney transplants were performed, 904 second transplants, 169 third transplants, 27 fourth and 3 fifth kidney transplants.

226 individuals resident in Scotland have received a simultaneous kidney and pancreas transplant, 16 individuals have received a simultaneous kidney and liver transplant.

Kidney transplants performed outside of Scotland are excluded. Transplants performed in Scotland for patients not resident in Scotland are also excluded.

F1.2 Frequency, transplant type and donor type, kidney transplants performed in Scotland 2008-2017

Year of transplant	Deceased donor kidney alone		Live donor kidney		Kidney and pancreas		Kidney and Liver		Total kidney transplants
	n	%	n	%	n	%	n	%	
2008-2012	671	**65.6**	286	**27.9**	61	**6.0**	6	**0.6**	**1024**
2013	166	**62.4**	84	**31.6**	16	**6.0**	0	**-**	**266**
2014	172	**65.6**	74	**28.2**	15	**5.7**	1	**0.4**	**262**
2015	159	**64.1**	77	**31.0**	11	**4.4**	1	**0.4**	**248**
2016	160	**64.5**	73	**29.4**	15	**6.0**	1	**0.4**	**249**
2017	208	**66.5**	91	**29.0**	14	**4.5**	0	**-**	**313**

F1.3a Frequency and donor type of kidney transplants performed in Scotland 2008-2017 by transplanting centre

Year	GLASGOW								
	DBD		DCD		LD		Total	Pre-emptive transplants	
	n	%	n	%	n	%		n	% of total
2008	42	**45.7**	12	**13.0**	38	**41.3**	**92**	9	**9.8**
2009	57	**63.3**	14	**15.6**	19	**21.1**	**90**	6	**6.7**
2010	52	**61.9**	13	**15.5**	19	**22.7**	**84**	5	**6.0**
2011	55	**56.7**	14	**14.4**	28	**28.8**	**97**	11	**11.3**
2012	59	**48.4**	33	**27.0**	30	**24.6**	**122**	19	**15.6**
2013	56	**39.4**	41	**28.9**	45	**31.7**	**142**	21	**14.8**
2014	65	**46.4**	39	**27.9**	36	**25.8**	**140**	25	**17.9**
2015	59	**44.4**	35	**26.3**	39	**29.3**	**133**	26	**19.5**
2016	56	**39.7**	48	**34.0**	37	**26.3**	**141**	19	**13.5**
2017	78	**46.7**	47	**28.1**	42	**25.2**	**167**	31	**18.6**

DBD - Deceased after brain death; DCD - Deceased after circulatory death; LD - Living donor.

F1.3b Frequency and donor type of kidney transplants performed in Scotland 2008-2017 by transplanting centre

Year	RIE								
	DBD*		DCD*		LD		Total	Pre-emptive transplants	
	n	%	n	%	n	%		n	% of total
2008	63	**60.0**	19	**18.1**	23	**21.9**	**105**	8	**7.6**
2009	71	**63.4**	13	**11.6**	28	**25.0**	**112**	6	**5.4**
2010	49	**52.1**	17	**18.1**	28	**29.8**	**94**	5	**5.3**
2011	52	**55.3**	17	**18.1**	25	**26.6**	**94**	10	**10.6**
2012	45	**46.4**	24	**24.7**	28	**28.9**	**97**	15	**15.5**
2013	48	**41.0**	33	**28.2**	36	**30.8**	**117**	14	**12.0**
2014	50	**45.5**	29	**26.4**	31	**28.2**	**110**	13	**11.8**
2015	45	**41.3**	28	**25.7**	36	**33.0**	**109**	23	**21.1**
2016	39	**37.9**	32	**31.1**	32	**31.1**	**103**	13	**12.6**
2017	61	**45.2**	32	**23.7**	42	**31.1**	**135**	19	**14.1**

* Includes combined kidney + pancreas and kidney + liver transplants.
DBD - Deceased after brain death; DCD - Deceased after circulatory death; LD - Living donor.

F1.3c Frequency and donor type of kidney transplants performed in Scotland 2008-2017 by transplanting centre

Year	RHC								
	DBD		DCD		LD		Total	Pre-emptive transplants	
	n	%	n	%	n	%		n	% of total
2008	7	**50.0**	0	**-**	7	**50.0**	**14**	3	**21.4**
2009	4	**57.1**	0	**-**	3	**42.9**	**7**	2	**28.6**
2010	2	**33.3**	0	**-**	4	**66.7**	**6**	2	**33.3**
2011	2	**66.7**	0	**-**	1	**33.3**	**3**	0	**-**
2012	2	**28.6**	0	**-**	5	**71.4**	**7**	2	**28.6**
2013	4	**57.1**	0	**-**	3	**42.9**	**7**	2	**28.6**
2014	5	**41.7**	0	**-**	7	**58.3**	**12**	3	**25.0**
2015	4	**66.7**	0	**-**	2	**33.3**	**6**	3	**50.0**
2016	1	**20.0**	0	**-**	4	**80.0**	**5**	1	**20.0**
2017	4	**36.4**	0	**-**	7	**63.6**	**11**	4	**36.4**

DBD - Deceased after brain death; DCD - Deceased after circulatory death; LD - Living donor.

Since 2005 kidney transplantation for adult patients in Scotland has been undertaken in two units the Glasgow renal and transplant unit (GLAS) and the transplant unit of the Royal Infirmary of Edinburgh (RIE).

F1.4 Age of patients at time of kidney transplantation

Year of transplant	First kidney transplants				Second and subsequent transplants			
	n	Mean Age	SD	Age Range	n	Mean Age	SD	Age Range
1960-1972	139	31.4	12.3	8.0 - 64.8	9	24.3	9.3	11.6 - 40.4
1973-1977	202	34.3	11.7	11.3 - 65.1	28	32.9	10.1	11.6 - 55.2
1978-1982	358	37.1	13.4	8.5 - 68.6	68	34.8	11.4	10.0 - 68.9
1983-1987	533	38.5	15.4	1.5 - 77.6	124	35.8	12.2	3.4 - 63.6
1988-1992	696	42.1	15.7	0.3 - 76.2	140	36.3	13.5	5.1 - 69.5
1993-1997	651	42.4	15.5	2.1 - 76.1	125	37.5	12.8	5.0 - 66.1
1998-2002	669	41.5	15.5	4.0 - 78.4	139	39.0	12.1	5.2 - 71.3
2003-2007	604	43.1	15.0	4.2 - 77.7	121	40.3	10.9	16.4 - 69.2
2008-2012	874	47.0	15.2	2.4 - 79.3	150	44.0	11.7	18.2 - 75.3
2013-2017	1139	48.4	14.8	1.9 - 77.4	199	44.8	12.0	14.4 - 75.5

F1.5 Year of first kidney transplant and primary renal diagnosis group

Year of transplant	Glomerulo-nephritis		Interstitial		Multisystem		Diabetic Nephropathy		Unknown	
	n	%	n	%	n	%	n	%	n	%
1960-1972*	58	**41.7**	42	**30.2**	13	**9.4**	0	**-**	25	**18**
1973-1977	94	**46.5**	68	**33.7**	22	**10.9**	0	**-**	18	**8.9**
1978-1982	120	**33.5**	155	**43.3**	40	**11.2**	11	**3.1**	32	**8.9**
1983-1987	143	**26.8**	218	**40.9**	72	**13.5**	39	**7.3**	61	**11.4**
1988-1992	192	**27.6**	246	**35.3**	114	**16.4**	56	**8**	88	**12.6**
1993-1997	186	**28.6**	237	**36.4**	86	**13.2**	75	**11.5**	67	**10.3**
1998-2002	173	**25.9**	247	**36.8**	82	**12.3**	72	**10.8**	95	**14.2**
2003-2007	138	**22.8**	223	**36.9**	76	**12.6**	89	**14.7**	78	**12.9**
2008-2012	192	**22.0**	347	**39.7**	113	**12.9**	109	**12.5**	113	**12.9**
2013-2017	299	**26.3**	412	**36.2**	136	**11.9**	180	**15.8**	112	**9.8**

* One patient who received a first kidney transplant between 1960-1972 has missing PRD

F2 Transplanted Kidney Survival

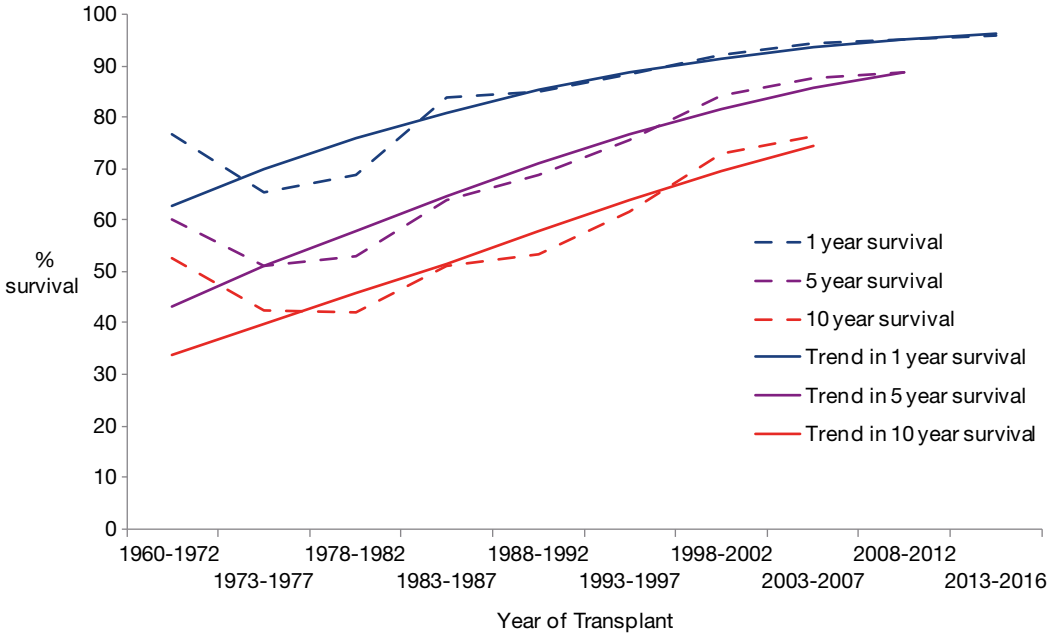
F2.1 Graft survival of first kidney transplants by year of transplantation 1960 - 2016

Year of transplant	Grafts surviving 1 year		Grafts surviving 5 years		Grafts surviving 10 years	
	n	%	n	%	n	%
1960-1972	85	**77**	53	**60**	41	**53**
1973-1977	111	**65**	80	**51**	62	**42**
1978-1982	232	**69**	168	**53**	124	**42**
1983-1987	427	**84**	306	**64**	215	**51**
1988-1992	557	**85**	413	**69**	286	**53**
1993-1997	552	**88**	441	**75**	318	**62**
1998-2002	594	**92**	509	**84**	407	**73**
2003-2007	558	**94**	482	**87**	380	**76**
2008-2012	803	**95**	695	**89**		
2013	212	**97**				
2014	218	**96**				
2015	190	**95**				
2016	204	**97**				

Survival of first kidney transplants (including those as part of combined kidney-liver and kidney-pancreas transplants) for transplants performed in Scotland, are shown in the table.

Grafts with insufficient follow-up have been excluded from the table and those that did not fail in patients dying within the relevant period have been excluded from the table.

F2.2 Trends in first graft survival by year of transplantation 1960-2016



Trend in 1 year survival: year to year OR 1.06 (95% CI 1.06-1.07).

Trend in 5 year survival: year to year OR 1.06 (95% CI 1.05-1.07).

Trend in 10 year survival: year to year OR 1.05 (95% CI 1.04-1.06).

The trends in 1 year, 5 year and 10 year graft survival are all statistically significant. (Wald-statistic, df=1,p<0.001)

F2.3 Graft survival by NHS Health Board of residence at transplantation 2007-2016

	Number of first kidney transplants 2007-2016	Grafts surviving 1 year		Number of first kidney transplants 2007-2016	Grafts surviving 2 years		Number of first kidney transplants 2007-2012	Grafts surviving 5 years	
		n	%		n	%		n	%
A&A	127	122	**96.1**	100	93	**93.0**	50	43	**86.0**
BORD	50	48	**96.0**	42	40	**95.2**	24	23	**95.8**
D&G	48	46	**95.8**	44	41	**93.2**	22	19	**86.4**
FIFE	120	111	**92.5**	112	101	**90.2**	72	58	**80.6**
FV	111	107	**96.4**	98	94	**95.9**	56	53	**94.6**
GRAM	194	186	**95.9**	173	162	**93.6**	97	84	**86.6**
GG&C	439	416	**94.8**	380	350	**92.1**	211	190	**90.0**
HIGH	114	108	**94.7**	101	95	**94.1**	61	55	**90.2**
LAN	265	256	**96.6**	228	212	**93.0**	127	114	**89.8**
LOTH	252	240	**95.2**	227	210	**92.5**	146	123	**84.2**
ORKN	4	4	**100.0**	3	3	**100.0**	2	2	**100.0**
SHET	6	6	**100.0**	4	4	**100.0**	4	4	**100.0**
TAY	116	111	**95.7**	102	97	**95.1**	56	49	**87.5**
WI	7	7	**100.0**	5	5	**100.0**	3	3	**100.0**
Scotland	**1853**	**1768**	**95.4**	**1619**	**1507**	**93.1**	**931**	**820**	**88.1**

Grafts with insufficient follow-up and those that did not fail in dying patients within the relevant period have been excluded from the table.

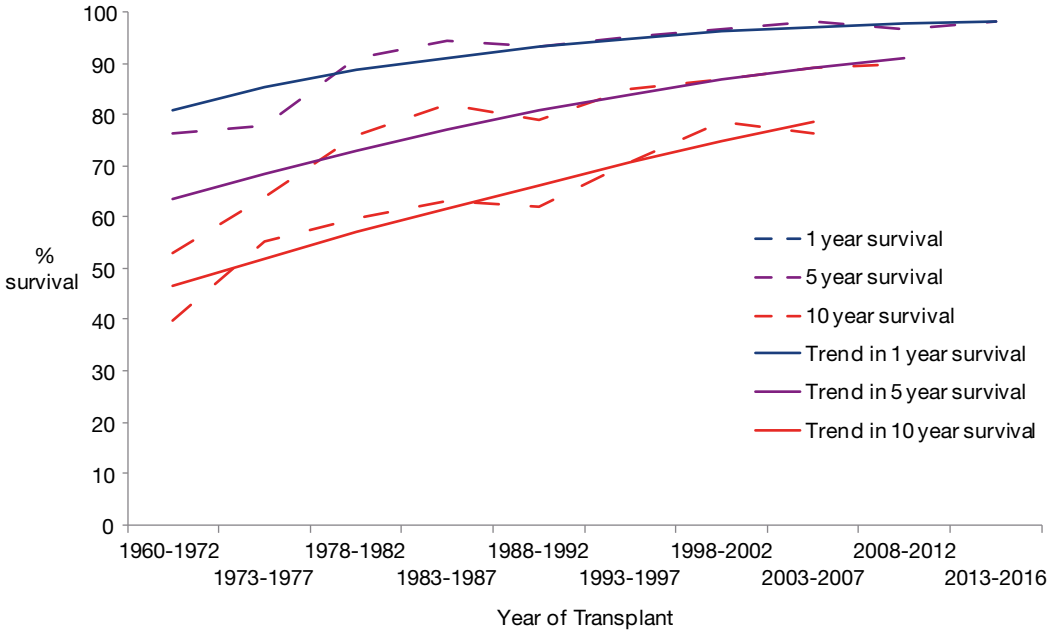
F3 Patient survival after Kidney Transplantation

F3.1 Patient survival after first kidney transplant by year of transplantation 1960-2016

Year of transplant	Patients surviving 1 year		Patients surviving 5 years		Patients surviving 10 years	
	n	%	n	%	n	%
1960-1972	106	**76**	73	**53**	55	**40**
1973-1977	156	**78**	128	**64**	111	**55**
1978-1982	325	**91**	272	**76**	213	**60**
1983-1987	502	**94**	437	**82**	334	**63**
1988-1992	647	**93**	547	**79**	431	**62**
1993-1997	619	**95**	545	**85**	448	**71**
1998-2002	644	**97**	579	**87**	519	**79**
2003-2007	589	**98**	535	**89**	456	**76**
2008-2012	841	**97**	772	**90**		
2013	217	**96**				
2014	227	**98**				
2015	201	**97**				
2016	209	**99**				

Patient survival is reported from the time of first kidney transplant for transplants performed in Scotland. Patients with insufficient follow-up are excluded.

F3.2 Trends in patient survival by year of first kidney transplantation 1960-2016



Trend in 1 year survival: year to year OR 1.06 (95% CI 1.05-1.07).

Trend in 5 year survival: year to year OR 1.05 (95% CI 1.04-1.05).

Trend in 10 year survival: year to year OR 1.04 (95% CI 1.03-1.05).

The trends in 1 year, 5 year and 10 year graft survival are all statistically significant. (Wald-statistic, df=1,p<0.001).

F4 Transplant Kidney Function

F4.1 Transplanted kidney function at one year in adult recipients after first kidney transplant performed 2008-2016

Year	Transplants performed	Surviving patients with functioning graft at 1 year		Patients with creatinine result	Serum creatinine (micromole/L)		eGFR (ml/min)	
		n	%	n	Median	IQR	Median	IQR
2008-2012	834	766	**91.8**	710	118	97 - 146	55.2	42.7 - 69.0
2013	218	206	**94.5**	169	111	88 - 135	58.4	46.8 - 73.0
2014	219	206	**94.5**	186	119	95 - 151	54.4	41.4 - 67.5
2015	201	184	**91.5**	174	113	95 - 152	55.4	42.2 - 72.5
2016	208	199	**95.7**	178	113	90 - 150	58.2	40.2 - 72.8

Patients dying within the first year post transplant are excluded as are those where graft failed within one year.

Patients aged under 18 years at the time of transplantation are excluded.

Kidney transplants performed outside of Scotland are excluded. Transplants performed in Scotland for patients not resident in Scotland are also excluded.

Patients receiving a kidney with a pancreas or liver are included.

F4.2 Transplanted kidney function at five years in adult recipients after first kidney transplant performed 1993-2012

Year	Transplants performed	Surviving patients with functioning graft at 1 year		Patients with creatinine result	Serum creatinine (micromole/L)		eGFR (ml/min)	
		n	%	n	Median	IQR	Median	IQR
1993-1997	607	413	**68.0**	390	144	120 - 184	43.5	31.8 - 54.6
1998-2002	617	465	**75.4**	448	138	114 - 173	46.8	34.6 - 56.8
2003-2007	562	447	**79.5**	425	124	100 - 155	50.9	38.6 - 64.5
2008-2012	834	660	**79.1**	620	122	97 - 156	52.7	38.0 - 65.9

F4.3 Transplanted kidney function at one year in adult recipients after first kidney transplant performed 2008-2016 by primary renal diagnosis group

Recipient primary renal diagnosis group	Transplants performed	Surviving patients with functioning graft at 1 year		Patients with creatinine result	Serum creatinine (micromole/L)		eGFR (ml/min)	
		n	%	n	Median	IQR	Median	IQR
Glomerulone-phritis	409	381	**88.8**	334	123	102 - 156	54.3	40.8 - 67.6
Interstitial	625	592	**94.7**	537	113	93 - 144	55.2	42.5 - 69.2
Multisystem	204	186	**91.2**	169	115	92 - 147	57.1	42.8 - 70.0
Diabetic nephropathy[1]	244	226	**92.6**	216	111	86 - 136	60.6	46.3 - 74.1
Diabetic nephropathy[2]	131	120	**91.6**	113	117	96 - 146	53.8	41.5 - 70.7
Unknown	198	176	**88.9**	161	113	92 - 149	55.1	42.5 - 70.1

1 Includes patients receiving simultaneous kidney and pancreas transplant.
2 Excludes patients receiving simultaneous kidney and pancreas transplant.

F4.4 Transplanted kidney function at one year in adult recipients after first kidney transplant performed 2012-2016 by donor type

Donor type	Transplants performed	Surviving patients with functioning graft at 1 year		Patients with creatinine result	Serum creatinine (micromole/L)		eGFR (ml/min)	
		n	%	n	Median	IQR	Median	IQR
Deceased - DBD	438	408	**93.2**	371	112	88 - 139	57.4	44.2 - 74.4
Deceased - DCD	298	272	**91.3**	252	129	102 - 174	46.6	33.0 - 63.4
Live donor	335	327	**97.6**	281	107	87 - 132	62.6	50.6 - 77.8

F4.5 Transplanted kidney function at one year in adult recipients after first kidney transplant performed 2008-2016 by transplanting unit

Transplant unit	Transplants performed	Surviving patients with functioning graft at 1 year		Patients with creatinine result	Serum creatinine (micromole/L)		eGFR (ml/min)	
		n	%	n	Median	IQR	Median	IQR
GLAS	876	809	**92.4**	698	118	96 - 147	54.9	41.6 - 70.1
RIE	808	755	**93.4**	726	114	93 - 125	56.3	43.5 - 71.2

F5 Biopsy Proven Transplant Kidney Rejection

All adult renal units in Scotland have reported all transplant kidney biopsy procedures to the Scottish Renal Biopsy Registry since 2015.

Biopsies at the time of transplant (implantation/ time zero biopsies) are not included.

We identified all transplant kidney biopsies performed in Scotland the first year following kidney transplantation in Scotland 2015-2016, to determine the incidence of biopsy proven acute rejection episodes in the first twelve months following kidney transplant.

F5.1 Frequency of kidney transplants in adult transplant centres in Scotland 2015 and 2016

Year	Total number adult transplants	Kidney	Kidney Pancreas	Kidney Liver	First kidney transplants	Second kidney transplants	Third and subsequent
2015	242	230	11	1	201	35	6
2016	244	228	15	1	208	28	8

In the two years 2015-2016 a total of 486 kidney transplants were performed in Scotland for 483 adult individuals.

F5.2 Frequency of kidney transplant biopsy in adult patients 2015-2017

Year	Total adult transplant biopsies	Patients undergoing transplant kidney biopsy
2015	351	247
2016	320	229
2017	278	206

In the three years 2015-2017 a total of 949 transplant kidney biopsies were performed in 598 adult kidney transplant patients.

In that time 215 patients had two biopsies, 81 had three biopsies, 35 had 4 and 19 patients had 5 or more biopsies performed.

F5.3 Kidney Biopsy in first 12 months following transplant performed 2015-2016

Year of Transplant	Total number adult transplants	Biopsy in first 12 months post Transplant	
		n	%
2015	242	108	**44.6**
2016	244	93	**38.2**

The proportion of patients under going a transplant kidney biopsy in the first year after transplant was similar for those with kidney alone transplant 188 of 458 patients (41%), or combined kidney and pancreas 12 of 26 patients (46%) or kidney and liver transplant 1 of 2 patients (50%).

F5.4 Kidney Biopsy in first 12 months following transplant performed 2015-2016 by donor type

Donor type	Total transplants 2015-2016	Patients undergoing biopsy in first 12 months	
		n	%
DBD	199	67	**33.7**
DCD	143	80	**55.9**
Live Donor	144	54	**37.5**

DBD - Deceased after brain death; DCD - Deceased after circulatory death.

F5.5 Biopsy Diagnosis of Rejection in first 12 months following transplant performed 2015-2016

Rejection Category	Number of Patients	% of Transplants 2015-2016
Borderline Rejection	13	**2.67**
T Cell Mediated Rejection*	29	**5.96**
Antibody Mediated Rejection	5	**1.03**
Mixed T-cell and Antibody Mediated Rejection	4	**0.82**
Total	**51**	**10.49**

* Includes chronic allograft arteriopathy.

For kidney transplants performed in Scotland in the two years 2015-2016, 10.5% of cases had biopsy proven acute rejection in the first year after transplantation.

The first biopsy diagnosis and severity of rejection for each case is shown in the table.

In all but one case the initial biopsy (when repeat biopsy was performed) demonstrated the most severe grade of rejection.

In one case the initial biopsy made a diagnosis of borderline rejection but a subsequent biopsy made a diagnosis of T-cell mediated rejection.

F6 Listing for kidney transplantation

F6.1 Percentage and prevalence per 100000 population of RRT patients with functioning kidney transplant or on transplant waiting list 31 December 2017 by NHS Health Board of residence

	All RRT patients 31/12/2017	Patients with kidney transplant		Transplant or transplant listed		NHS Health Board population	Prevalence per 100000 population
		n	%	n	%		
A&A	409	238	**58**	267	**65**	370410	72.1
BORD	111	70	**63**	80	**72**	115020	69.6
D&G	142	95	**67**	105	**74**	149200	70.4
FIFE	342	202	**59**	216	**63**	371410	58.2
FV	269	185	**69**	209	**78**	305580	68.4
GG&C	1227	820	**67**	940	**77**	1169110	80.4
GRAM	551	337	**61**	375	**68**	586380	64.0
HIGH	309	217	**70**	235	**76**	321990	73.0
LAN	669	454	**68**	520	**78**	658130	79.0
LOTH	689	439	**64**	471	**68**	889450	53.0
ORKN	15	9	**60**	9	**60**	22000	40.9
SHET	16	7	**44**	9	**56**	23080	39.0
TAY	413	238	**58**	266	**64**	416090	63.9
WI	29	14	**48**	16	**55**	26950	59.4
Scotland	**5191**	**3325**	**64**	**3718**	**72**	**5424800**	**68.5**

The prevalence per 100,000 column in Table F6.1 has been revised in this publication due to a technical error. The formula in the background excel document was not copied down to all NHS Boards and was showing prevalence per 100,000 for all RRT patients rather than prevalence per 100,000 of those who were transplant or transplant listed as at 31/12/17 which is now showing.

The percentage of patients in each NHS Health Board area treated by all forms of RRT (PD, HD, Transplant) who are either on the transplant waiting list or have a functioning transplant are shown.

Patients who were on the transplant waiting list but had suspended rather than active status are included.

F6.2 Frequency of first kidney transplants by NHS Health Board of residence at transplantation 2013-2017

	First Tx 2013-2017 (n)	Pre-emptive transplants (DD)	LD Tx in first year of RRT*
		Total Number (Number from DD)	
A&A	86	21 (11)	17
BORD	28	3 (0)	6
D&G	33	7 (2)	10
FIFE	62	9 (2)	13
FV	70	16 (9)	13
GG&C	305	68 (29)	59
GRAM	109	16 (5)	16
HIGH	65	13 (8)	12
LAN	163	26 (14)	26
LOTH	129	19 (9)	25
ORKN	3	0 (0)	1
SHET	2	0 (0)	0
TAY	76	16 (5)	21
WI	7	3 (3)	2
Scotland	**1138**	**217 (95)**	**221**

* Includes pre-emptive LD transplants

217 patients received a pre-emptive transplant in 2013-2017, 122 from a live donor (LD), 95 from a deceased donor (DD).

A further 99 patients received a LD transplant within one year of starting RRT.

SECTION G PERITONEAL DIALYSIS

Prospective audit of the incidence of peritoneal dialysis (PD) associated peritonitis, adequacy of dialysis and causes of technique failure have been reported the Scottish Renal Registry (SRR) by all adult renal units in Scotland since 1999. The data collection was previously every 6 months, but from 2017 has been reported as the full year.

The PD population has fallen further in Scotland with 182 prevalent adult patients on PD at the end of 2017 with 75% using APD.

G1 Number of patients treated with PD during 2017 and PD population with % APD at end 2017

Renal unit	Total treated by PD 2017	PD population end 2017	APD population end 2017	APD % end 2017
ARI	38	21	8	38
XH	47	27	26	96
DGRI	16	5	5	100
GLAS	81	45	40	89
MONK	36	18	12	67
NINE	30	16	14	88
RAIG	25	9	1	11
RIE	57	30	20	67
VHK	25	11	10	91
Scotland	**355**	**182**	**136**	**75**

G1 shows that a total of 355 patients were on PD at some point during 2017, reflecting the relatively high turnover of patients.

G2 Number of patients treated with PD during 2017 and PD population with % APD at end 2017											
Renal unit	**New**	**From HD**	**Transfer in**	**From Tx**	**Total in**	**Death**	**To Tx**	**To HD**	**Transfer out**	**Re-covered**	**Total out**
ARI	44	24	4	8	**80**	7	28	50	0	1	**86**
XH	56	11	2	1	**70**	35	18	30	0	0	**83**
DGRI	27	3	3	4	**37**	11	11	24	2	1	**49**
GLAS	106	53	2	17	**178**	39	50	90	3	1	**183**
MONK	47	14	1	4	**66**	12	15	34	1	1	**63**
NINE	41	23	2	1	**67**	12	12	37	1	0	**62**
RAIG	34	23	2	3	**62**	2	16	49	1	1	**69**
RIE	67	23	5	5	**100**	21	24	46	2	5	**98**
VHK	40	11	0	1	**52**	12	15	39	0	0	**66**
Scotland	**462**	**185**	**21**	**44**	**712**	**151**	**189**	**399**	**10**	**10**	**759**

G2 shows the source of patients starting PD and reasons for stopping PD 2013-2017; the proportions have stayed remarkably similar for the last 10 years, with 53% stopping because of technique failure (transfer to HD), 25% transplanted and 20% dying whilst on PD.

G3 PD associated peritonitis rates in adult renal units 2000-2017										
	2000-2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Months between episodes	19.9	18.5	18.7	18.8	23.4	27.0	22.1	24.2	19.9	15.8	17.0

Peritonitis rates remain high in Scotland, with an overall rate of 1 episode every 17.0 months in 2017 (Figure G3) with almost all units experiencing an increase in peritonitis rates in 2016-2017. The definition of PD associated peritonitis used by the SRR can be found on the SRR website:

http://www.srr.scot.nhs.uk/Projects/Projects3.html#periton

G4 PD associated peritonitis in adult renal units 2013-2017				
Unit	**No. of peritonitis episodes**	**Total patient months on PD**	**Peritonitis rate (months between episodes)**	**Peritonitis rate (episodes per PD treatment year)**
ARI	71	1613	22.7	0.53
XH	95	2303	24.2	0.50
DGRI	34	734	21.6	0.56
GLAS	125	2847	22.8	0.53
MONK	54	810	15.0	0.80
NINE	42	1145	27.3	0.44
RAIG	70	806	11.5	1.04
RIE	118	1765	15.0	0.80
VHK	65	1137	17.5	0.69
Scotland	**674**	**13160**	**19.5**	**0.61**

MONK, RAIG, VHK and RIE have peritonitis rates across the 5 years that are worse than the minimum standard specified by the Renal Association 2010 Guideline (<1 episode per 18 months). The Renal Association updated guideline (published June 2017) recommends that peritonitis rates should be less than 0.5 episodes per patient year. All units except NINE have peritonitis rates ≥ 0.5 episodes per patient year and so fail to meet this revised standard (Figure G4). Peritonitis may occur as a single episode, or may be followed by further episodes which are described as relapse, recurrent or repeat according to the definition agree by the International Society for Peritoneal dialysis (ISPD) and available on the SRR website:

http://www.srr.scot.nhs.uk/Projects/Projects3.html#periton

The SRR reports peritonitis rate using all episodes of peritonitis (which will result in a higher overall rate). The ISPD recommend omitting relapsed episodes from rate calculations; using these criteria the rate by unit for the 2017 audit period is shown in G5. The outcome of peritonitis by unit is also shown. In 2017, 74% of peritonitis episodes were cured, 24% resulted in PD catheter removal, and 2% resulted in patient death. When comparing peritonitis outcome data it is important to note that different organisms are associated with different cure rates, and different units may vary in their threshold for removing a PD catheter in the context of peritonitis. The UK Renal Associated suggests 80% as the primary cure minimum target.

G5	Proportion of patients experiencing peritonitis, type and outcome of peritonitis by unit (2017 data only)									
Unit	Proportion of patients experiencing peritonitis per unit		Type of peritonitis					Outcome of Peritonitis		
	Number patients treated with PD during audit period	% Patients developing peritonitis	Single episode	Recurrent	Relapse	Repeat	Peritonitis rate excluding repeat/ recurrent/ relapsed	% Cure	% Catheter Removed	% Death
ARI	38	11	12	0	0	1	28.8	69	31	0
XH	47	32	15	1	0	2	21.7	88	6	6
DGRI	16	25	4	0	0	1	18.4	100	0	0
GLAS	81	26	24	0	1	5	20.4	83	17	0
MONK	36	36	14	1	0	0	14.8	53	47	0
NINE	30	20	6	0	2	0	34.0	50	38	12
RAIG	25	48	17	2	1	2	7.1	54	46	0
RIE	57	33	19	2	2	1	19.2	63	33	4
VHK	25	44	14	0	3	4	11.5	76	24	0
Total	**355**	**33**	**125**	**6**	**9**	**16**	**18.1**	**74**	**24**	**2**

The organisms cultured vary between units. The culture negative rate 2013-2017 remains high at 25%, above the Renal Association suggested standard of less than 20%. The culture negative rate varies from 4.8-52% between unit. This has prompted a review of PD fluid culture technique in Scottish PD Units at a meeting in October 2017 to ensure all are following recommended sampling and culture methods.

G6 Rate (PD treatment months between episodes) of causative organisms of PD peritonitis in adult renal units 2013-2017							
Renal unit	**Staph aureus**	**Coagulase negative staph**	**Gram-negative bacilli**	**Fungi**	**Other**	**Culture negative**	**Total Rate**
ARI	538	90	101	1613	90	108	22.7
XH	192	256	192	0	192	47	24.2
DGRI	367	122	92	0	61	122	21.6
GLAS	219	95	150	569	98	98	22.8
MONK	58	0	135	405	116	32	15.0
NINE	143	104	164	0	82	573	27.3
RAIG	73	50	81	0	47	50	11.5
RIE	104	93	126	1765	38	84	15.0
VHK	190	37	76	0	162	227	17.5
Scotland	**153**	**94**	**123**	**1196**	**81**	**78**	**19.5**

2017 is the first year the SRR have reported the rate and causative organisms of PD catheter exit site infections. Exit site infection was defined as clinical evidence of infection with positive growth on an exit site swab.

G7 Rate and causative organism of PD catheter exit site infections in 2017							
Renal unit	**Staph aureus**	**Pseudo-monas**	**Coliforms**	**Other**	**Total**	**Treatment Months**	**Rate (months between episodes)**
ARI	-*	-	-	-	-	375	-
XH	6	4	2	3	15	390	26.0
DGRI	1	0	0	0	1	92	92.0
GLAS	27	0	0	4	31	595	19.2
MONK	0	1	0	0	1	222.4	222.4
NINE	4	0	0	0	4	204	51.0
RAIG	12	1	0	5	18	150	8.3
RIE	2	0	0	0	2	422	211.0
VHK	2	0	1	1	4	207	51.8
Scotland	**54**	**6**	**3**	**13**	**76**	**2657.4**	**35.0**

* Means there were no cases.

G8	Number of patients with total (peritoneal and renal) creatinine clearances (litres/week/1.73m2) in each 6 months audit period 2013-2016 and full year of 2017 with percentage of patients with inadequate (<50) and borderline (50-60) creatinine clearances							
Year	Adequacy						% < 50	% 50-60
	< 50	50-60	61-70	>70	Unassessed	Total		
2013a	16	30	33	92	112	283	**5.7**	**10.6**
2013b	23	31	34	84	52	224	**10.3**	**13.8**
2014a	25	29	27	79	44	204	**12.3**	**14.2**
2014b	25	29	30	88	34	206	**12.1**	**14.1**
2015a	28	28	19	73	59	207	**13.5**	**13.5**
2015b	25	27	26	74	61	213	**11.7**	**12.7**
2016a	23	28	21	76	49	197	**11.7**	**14.2**
2016b	24	25	18	74	70	211	**11.4**	**11.8**
2017	33	34	27	124	141	359	**9.2**	**9.5**
Total	**222**	**261**	**235**	**764**	**622**	**2104**	**10.6**	**12.4**

* a refers to first 6 months and b refers to second 6 months of each year

Most units wait at least 2 months after starting PD before performing an initial PD adequacy test. Not all units routinely test adequacy every 6 months. If more than one adequacy was performed in a given audit period, the most recent is reported. The proportion of patients with inadequate dialysis (i.e. below 50 litres/week/1.73m2) has remained fairly stable for the last 5 years.

The residual urine volume at the time of adequacy testing is presented for the first time in this report in G9. Of the 66% of patients with a residual urine volume reported, 12.8% are functionally anuric (urine output <100mls in 24 hours).

G9 Residual urine volume at the time of 24 hour urine collection for most recent adequacy check (2017 data)

Unit	Number of patients with reported urine volume	% of patients with urine volume reported	% of patients with given residual urine volume in mls per 24 hours			
			<100	101-500	501-1000	>1000
ARI	32	78.0	15.6	25.0	18.8	31.3
XH	30	57.7	20.0	13.3	16.7	33.3
DGRI	8	50.0	12.5	25.0	25.0	37.5
GLAS	58	66.7	13.8	36.2	20.7	19.0
MONK	20	55.6	0.0	0.0	30.0	70.0
NINE	24	77.4	12.5	4.2	54.2	25.0
RAIG	23	85.2	13.0	26.1	21.7	30.4
RIE	33	57.9	15.2	30.3	21.2	33.3
VHK	17	68.0	5.9	17.6	35.3	41.2
Scotland	**250**	**66.3**	**12.8**	**22.0**	**24.8**	**31.6**

G10 Cause (number and percentage) of technique failures in each adult renal unit 2013-2017

Unit	Peritonitis		Access*		Under-dialysis		Poor UF**		High IP***		Wish HD		Stop Dial		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
ARI	19	42	2	4	12	27	1	2	4	9	6	13	1	2	45
XH	4	13	3	10	7	23	4	13	4	13	8	27	0	0	30
DGRI	4	18	1	5	12	55	0	0	1	5	4	18	0	0	22
GLAS	30	33	4	4	22	24	5	5	9	10	19	21	2	2	91
MONK	20	59	4	12	4	12	1	3	1	3	4	12	0	0	34
NINE	14	36	5	13	9	23	4	10	3	8	3	8	1	3	39
RAIG	23	52	3	7	7	16	0	0	4	9	7	16	0	0	44
RIE	25	44	5	9	6	11	2	4	3	5	11	19	5	9	57
VHK	18	45	5	13	7	18	1	3	2	5	5	13	2	5	40
Scotland	**157**	**39**	**32**	**8**	**86**	**21**	**18**	**4**	**31**	**8**	**67**	**17**	**11**	**3**	**402**

* Includes exit site/tunnel infection and failure of PD access.
** Poor ultrafiltration.
*** Complications of high intraperitoneal pressure (eg leaks).

The causes of technique failure have remained consistent overall in Scotland, with 39% caused by peritonitis, but there is variation between units.

Since 2016 an annual PD Meeting, with representation from all units, has examined PD Audit Data in more detail. Each meeting has focussed on one area of variation between units, hoping to identify reasons for variance and share best practice. Future reports hope to assess whether there is any noticeable overall improvement in outcomes, and reduction in variance between units.

SECTION H VASCULAR ACCESS FOR HAEMODIALYSIS

This section's data are available on-line in Tableau format which enables interaction with the data: http://www.srr.scot.nhs.uk/publications/Dashboards/Vascular-Access.html.

H1 Patients starting first RRT as Haemodialysis in Scotland

Details of vascular access used for haemodialysis for all hospital and home haemodialysis patients were collected during the SRR census week in May 2018. The SRR has collected data about the access used for first haemodialysis for incident patients since the start of 2012.

The Renal Association guideline (2015) suggests that 60% of all incident patients with established end stage kidney disease commencing planned haemodialysis should receive dialysis via a functioning arteriovenous fistula (AVF) or arteriovenous graft (AVG) and that 80% of all prevalent long term dialysis patients should receive dialysis treatment via definitive access: AVF or AVG.

Between 01 January 2017 and 31 December 2017 there were 504 incident adult haemodialysis patients in Scotland.

234 (46.4.%) of these commenced dialysis with AV access and 270 (53.6%) with a central venous catheter (CVC).

Between the 01 January 2018 and 30 June 2018 there were 219 incident adult haemodialysis patients. 99 (45.2%) patients commenced with AV access and 120 (54.8%) with a CVC.

During the same 6-month period, 1 paediatric patient started HD at RHC and commenced HD with a CVC.

There are no missing data.

H1.1 Types of vascular access used for first haemodialysis 2012 to June 2018

Year	No. starting HD	No. with data	Arteriovenous				Central Venous Catheter			
					Total				Total	
			Fistula	Graft	n	%	Tunnelled	Non-tunnelled	n	%
2012	418	418	173	2	**175**	**41.9**	164	79	**243**	**58.1**
2013	397	397	168	7	**175**	**44.1**	146	76	**222**	**55.9**
2014	433	433	183	9	**192**	**44.3**	155	86	**241**	**55.7**
2015	474	474	187	14	**201**	**42.4**	165	108	**273**	**57.6**
2016	440	440	186	21	**207**	**47.0**	139	94	**233**	**53.0**
2017	504	504	199	35	**234**	**46.4**	167	103	**270**	**53.6**
2018*	219	219	89	10	**99**	**45.2**	70	50	**120**	**54.8**

* 01 January - 30 June 2018.

In the five years 2012-2016 a total of 1212 patients started RRT via a central venous catheter. 60.5% were male, the distribution of primary renal diagnoses also reflected the incident RRT population as a whole, 29% had a primary renal diagnosis of diabetic nephropathy.

31 (2.6%) of the individuals starting RRT via a CVC had a live donor transplant within the first year of starting RRT.

37 (3.1%) of the individuals starting RRT via a CVC died within the first year of starting RRT and had malignancy recorded as primary cause of death.

It is not possible from Registry data to tell if a planned live donated kidney transplant, or knowledge of a life limiting malignancy influenced the decision not to form AV access for haemodialysis for these individuals.

H1.2 Relationship between time of first referral to nephrology and access used for first HD 01 January 2012 - 30 June 2018

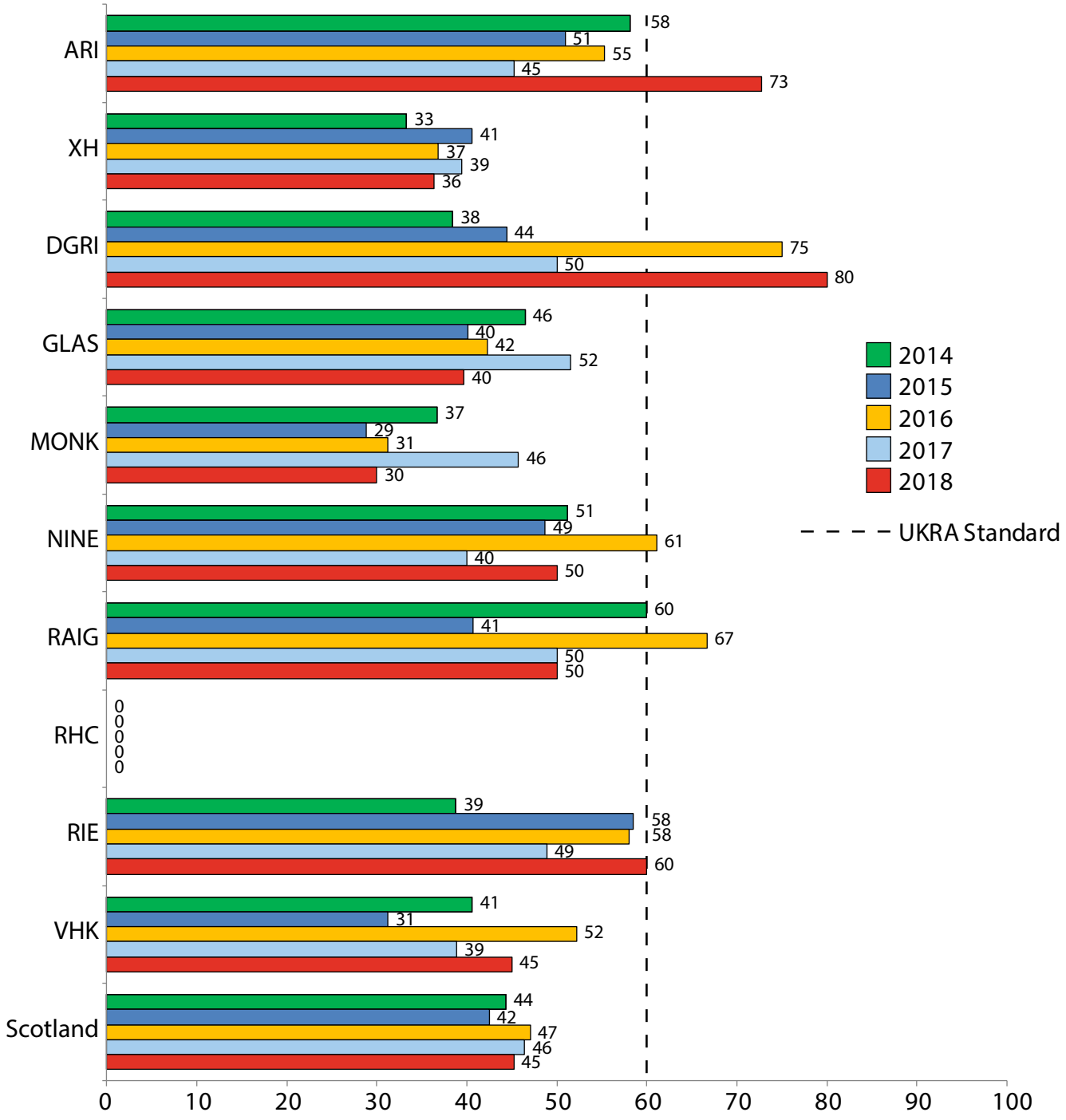
Type of Access	Total on HD	No. with data	Early referral		Late referral		Median time between referral and RRT	
			n	%	n	%	Months	IQR
AV	1283	1251	1226	51.8	25	5.5	61.3	31, 116.5
Line	1602	1569	1142	48.2	427	94.5	22.4	2.2, 68.5
Total	**2885**	**2820**	**2368**	**-**	**452**	**-**	**41.2**	**10.1, 92.8**

Date of referral to renal services was available for 2820 (97.7%) of the incident haemodialysis patients. Late referral was defined as less then 3 months between referral and first haemodialysis session.

Only 25 patients (5.5%) referred less than 3 months before starting dialysis had AV access for the first haemodialysis session.

Of patients referred within six months of starting haemodialysis 1232 (53.1%) started haemodialysis using AV access and 1165 (55.0%) of those referred within 12 months.

H1.3 Percentage of patients with AV access for first haemodialysis by renal unit 01 January 2014 - 30 June 2018



H2 Vascular access use in Scotland during census May 2018

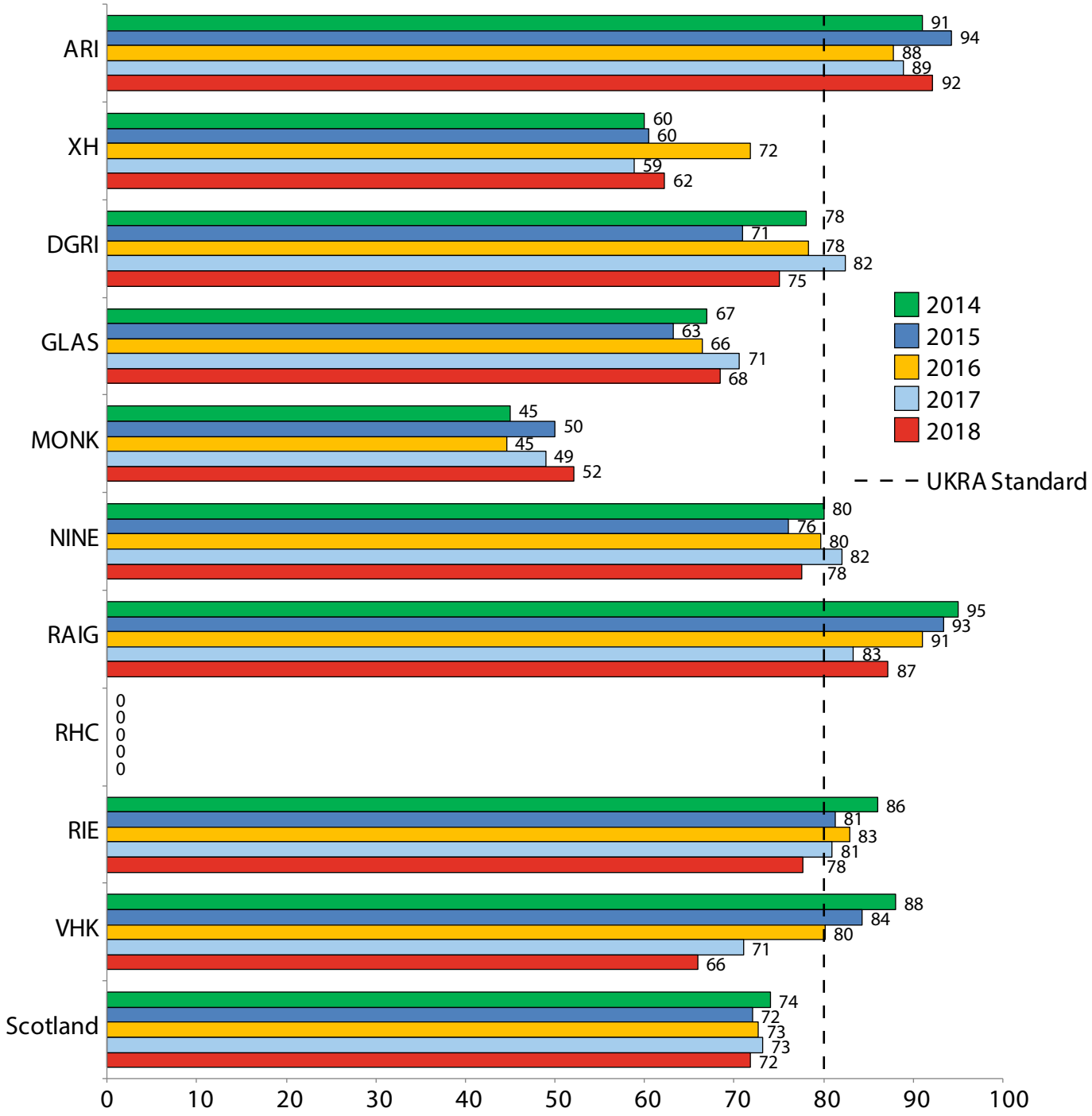
H2.1 Types of vascular access for haemodialysis patients each May 2009-2018

Year	No. on HD	No. with data		Arteriovenous					Central Venous Catheter			
							Total				Total	
		n	%	Fistula	Graft	Un-known	n	%	Tun-nelled	Non-tun-nelled	n	%
2009	1848	1699	91.9	1206	58	16	**1280**	**75.3**	385	34	**419**	**24.7**
2010	1868	1748	93.6	1262	51	2	**1315**	**75.2**	400	33	**433**	**24.8**
2011	1877	1810	96.4	1275	54	40	**1369**	**75.6**	405	36	**441**	**24.4**
2012	1873	1769	94.4	1284	72	10	**1366**	**77.2**	379	24	**403**	**22.8**
2013	1885	1680	89.1	1217	69	0	**1286**	**76.5**	343	51	**394**	**23.5**
2014	1853	1803	97.3	1256	76	4	**1336**	**74.1**	437	30	**467**	**25.9**
2015	1906	1831	96.1	1236	79	0	**1315**	**71.8**	482	34	**516**	**28.2**
2016	1878	1817	96.8	1207	114	1	**1322**	**72.8**	470	25	**495**	**27.2**
2017	1954	1874	95.9	1221	145	0	**1366**	**72.9**	491	17	**508**	**27.1**
2018	1950	1885	96.7	1189	164	0	**1353**	**71.8**	508	24	**532**	**28.2**

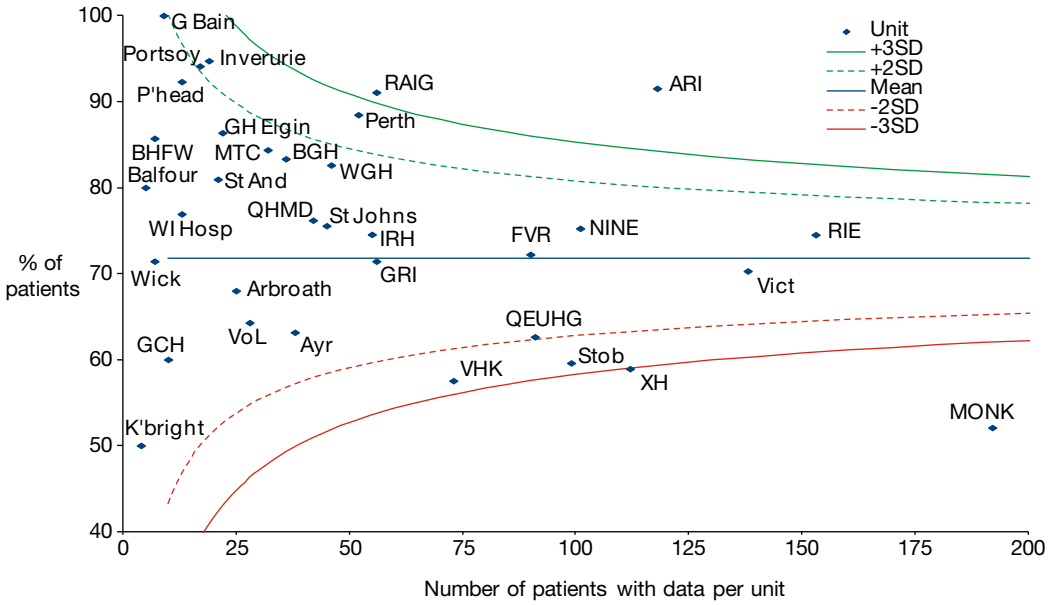
1950 patients with established renal failure were being treated by haemodialysis in May 2018, details of vascular access were available for 1885 (96.7%).

There were large, significant differences between renal units. Figure H2.2 shows the percentage of AV access in each unit for 2014-2018.

H2.2 Percentage of haemodialysis patients with AV access by renal unit: Census results 2014 - 2018



H2.3 Percentage of patients on hospital haemodialysis with AV access by satellite unit May 2018



RHC had no patients with AV access and is not shown on the funnel plot.

Of the 46 patients receiving home haemodialysis during the census, information on vascular access was available for 44 (95.7%).

Of those with data, 38 patients were receiving dialysis via AV fistula or graft (86.4%) and 6 via a central venous catheter (13.6%).

H2.4 Number of patients confirmed as using buttonhole cannulation technique for AV fistulae by renal unit May 2018

	ARI	XH	DGRI	GLAS	MONK	NINE	RAIG	RHC	RIE	VHK	Scotland
Total on HD	222	166	53	594	195	181	90	10	298	141	1950
Total with AV access	167	93	33	322	95	112	64	0	216	87	1189
Sufficient data	165	90	11	278	90	111	64	0	209	76	1094
Buttonhole yes	135	78	1	8	75	82	43	0	70	3	495
Buttonhole no	30	12	10	270	15	29	21	0	139	73	599

1094 (92.0%) of the 1189 prevalent haemodialysis patients with AV Fistulae had their AV access cannulation technique recorded in the May 2018 census.

H3 Native Arterio-venous fistula creation across Scotland 2015 - 2016

A special project was undertaken identifying every native AV fistula created across Scotland in the years 2015 and 2016 with at least one-year follow up.

Several outcome measures were assessed including primary patency, primary-assisted patency and secondary patency.

Patency rates were estimated using recommended reporting standards of the Society for Vascular Surgery and the American Association for Vascular Surgery[1].

Primary patency was defined as the interval from the time of access placement until any type of intervention to maintain or restore patency.

Primary-assisted patency was defined as the interval from the time of access placement until access thrombosis.

Secondary patency was defined as the interval from the time of access placement until either final failure or until the vessel was abandoned with or without preceding successful interventional or surgical procedures to maintain or restore patency.

The definitions of patency are based on pubished guidelines[1] but some examples below help illustrate what each category means.

Example 1: A fistula was created at time x, required angioplasty to assist maturation at time y, thrombosed and successfully declotted at time z and then became aneurysmal and abandoned at time w. Primary, primary-assisted and secondary patencies are x-y, x-z, and x-w time, respectively.

Example 2: A fistula was created at time x, required ligation of tributaries at time y, thrombosed and had an unsuccessful attempt for surgical thrombectomy at time z. Primary, primary-assisted and secondary patencies are x-y, x-z and x-z time, respectively.

Example 3: A fistula was created at time x, is patent (based on surveillance scans, clinical examination etc.) but has not been used until the end of follow-up at time z. Primary, primary-assisted and secondary patencies are x-z time.

1. J Vasc Surg. 2002 Mar;35(3):603-10. Recommended standards for reports dealing with arteriovenous hemodialysis accesses. Sidawy AN, Gray R, Besarab A, Henry M, Ascher E, Silva M Jr, Miller A, Scher L, Trerotola S, Gregory RT, Rutherford RB, Kent KC.

H3.1 Patency rates of AVF created in 2015 stratified by access location (upper vs forearm and use of cephalic vs basilic vein)

2015	Total AVF (N=582)	Forearm AVF (N=196)	Upper arm AVF (N=386)	P-value[a]	Brachio-cephalic AVF (N=273)	Brachio-basilic AVF (N=107)	P-value[b]
Patency (%, 95% CI)							
Primary patency							
6 months	62% (58-66)	55% (47-62)	66% (61-71)	0.005	72% (66-77)	51% (41-60)	<0.001
12 months	48% (44-52)	43% (35-50)	51% (46-56)		57% (51-63)	35% (26-45)	
Primary-assisted patency							
6 months	74% (70-77)	62% (55-69)	80% (76-84)	<0.001	84% (79-88)	69% (59-76)	0.002
12 months	67% (63-71)	55% (48-62)	73% (68-77)		77% (72-82)	62% (52-71)	
Secondary patency							
6 months	76% (72-79)	65% (58-71)	82% (77-85)	<0.001	87% (82-90)	72% (63-80)	0.001
12 months	69% (65-73)	58% (51-65)	74% (70-79)		80% (75-85)	65% (55-73)	

a Upper vs. Forearm (log-rank test).
b Brachio-cephalic vs. brachio-basilic (log-rank test).

H3.2 Patency rates of AVF created in 2015 and 2016

Arm AVF	2015 (N=582)	2016 (N=751)
Patency (%, 95% CI)		
Primary patency		
6 months	62% (58-66)	72% (69-75)
12 months	48% (44-52)	62% (58-65)
Primary-assisted patency		
6 months	74% (70-77)	79% (76-82)
12 months	67% (63-71)	72% (69-75)
Secondary patency		
6 months	76% (72-79)	81% (77-83)
12 months	69% (65-73)	75% (71-78)

SECTION I BACTERAEMIA IN RRT RECIPIENTS: A JOINT REPORT WITH HEALTH PROTECTION SCOTLAND

This section's data are available on-line in Tableau format which enables interaction with the data: http://www.srr.scot.nhs.uk/publications/Dashboards/Bacteraemia.html.

Patients treated by renal replacement therapy (RRT) for established renal failure are at high risk of infection with associated increased morbidity and mortality. Infection was the second most frequent cause of death of RRT recipients in 2017.

All bacteraemia episodes in Scotland, that is bacteria being detected within a patient's blood stream by means of a positive blood culture, are reported directly from microbiology laboratories to Health Protection Scotland (HPS) using the Electronic Communication of Surveillance in Scotland (ECOSS) system. Methicillin resistant *Staphylococcus aureus* (MRSA) bacteraemia incidence surveillance has been mandatory in Scotland since 2001 and surveillance was extended in 2006 to include methicillin sensitive *S. aureus* (MSSA). In addition, mandatory *Escherichia coli* bacteraemia surveillance was introduced in Scotland in April 2016. Whilst surveillance of bacteraemia with other organisms is not mandatory, all positive blood cultures are reported to ECOSS enabling these data to be used robustly in epidemiological analyses.

Database linkage was performed between the Scottish Renal Registry including all patients who have received RRT in Scotland and ECOSS bacteraemia data namely *S. aureus*, *Staphylococcus epidermidis*, *Streptococcus* sp., *E. coli*, *Klebsiella* sp. and Pseudomonas sp.. These organisms were chosen due to their clinical significance in RRT patients. For the purpose of the analyses, *E. coli*, *Klebsiella* sp. and *Pseudomonas* sp. were grouped as Gram-negative organisms. Linkage was performed for the period 01 January 2013 to 31 December 2017. An episode of bacteraemia was defined as a bacteraemia in a patient without a previous episode of bacteraemia with the same organism in the preceding two weeks.

I1 Bacteraemia reported in patients treated by RRT 2013-2017

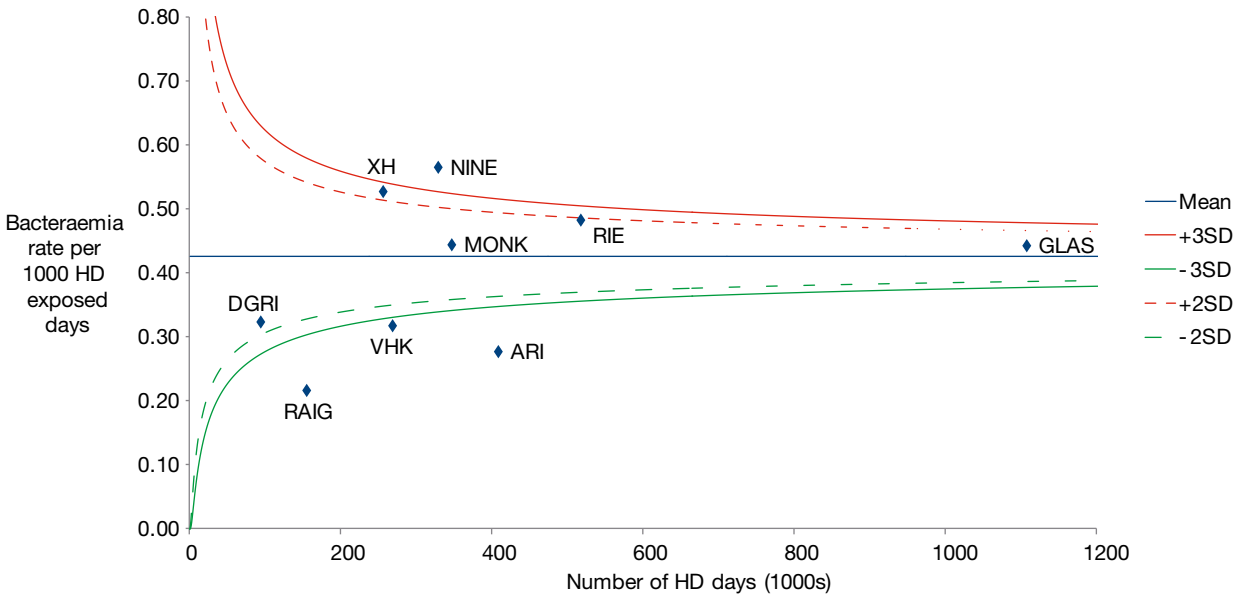
I1.1 Incidence of Bacteraemia in RRT population 2013-2017 by modality of RRT

Organism	HD		PD		Tx		All	
	n	%	n	%	n	%	n	%
Gram negative*	350	**23**	18	**32**	341	**65**	709	**34**
Staphylococcus aureus	495	**33**	11	**20**	36	**7**	542	**26**
Staphylococcus epidermidis	474	**31**	21	**38**	103	**20**	598	**29**
Streptococcus sp.	191	**13**	6	**11**	44	**8**	241	**12**
Total	1510	-	56	-	524	-	2090	-

* Gram-negative organism group comprises *Escherichia coli*, *Klebsiella* sp. and *Pseudomonas* sp.

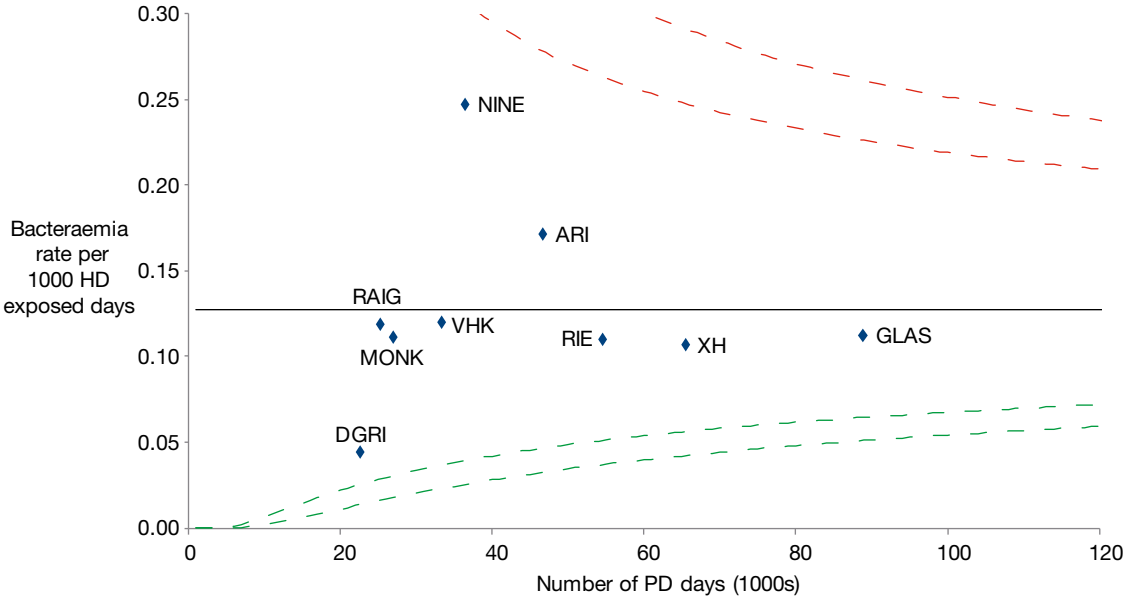
S. epidermidis, a member of the coagulase negative Staphylococcus group, are commonly found on the skin and may be identified in blood cultures incidentally due to a breakdown in technique during collection of blood cultures. Bacteraemia rates should be interpreted with caution as the laboratory and linkage data used has not been validated and clinical investigation was not undertaken to assess whether the positive blood cultures were a true bacteraemia or a contaminated blood culture.

I1.2 Haemodialysis patient bacteraemia* rate per 1000 HD treatment days by adult renal unit 2013-2017



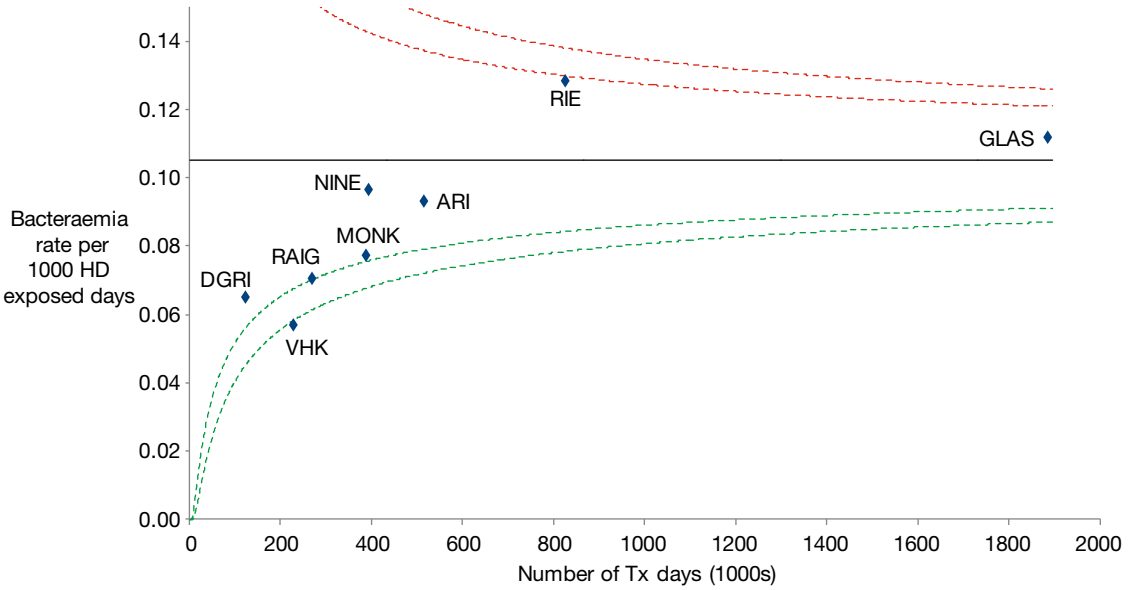
* Includes *S. aureus*, *S. epidermidis*, *Streptococcus* sp. and Gram-negative group as previously defined.

I1.3 Peritoneal dialysis patient bacteraemia* rate per 1000 PD treatment days by adult renal unit 2013-2017



*Includes *S. aureus*, *S. epidermidis*, *Streptococcus* sp. and Gram-negative group as previously defined.

I1.4 Transplanted patient bacteraemia* rate per 1000 Tx treatment days by adult renal unit 2013-2017



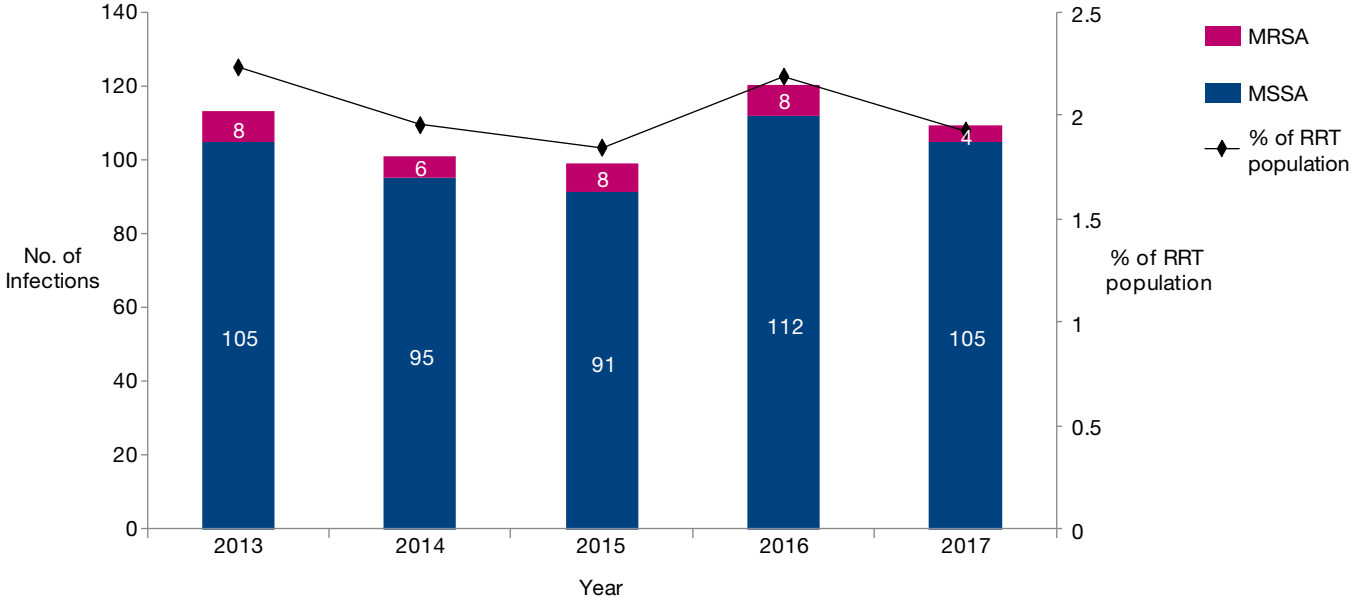
*Includes *S. aureus*, *S. epidermidis*, *Streptococcus* sp. and Gram-negative group as previously defined.

Graphs I1.2, I1.3 and I1.4 show the bacteraemia rate occurring in patients treated by each mode of RRT. The number of treatment days for each modality is the total number of days provided at each adult unit for all patients in the time period 2013-2017.

The data would suggest across Scotland as a whole during 2013-2017 one bacteraemia episode occurred in every 2352 days of delivered haemodialysis; every 7844 days of delivered peritoneal dialysis and 9504 days in patients with a kidney transplant.

I2 Staphylococcus aureus bacteraemia reported in patients treated by RRT 2013-2017

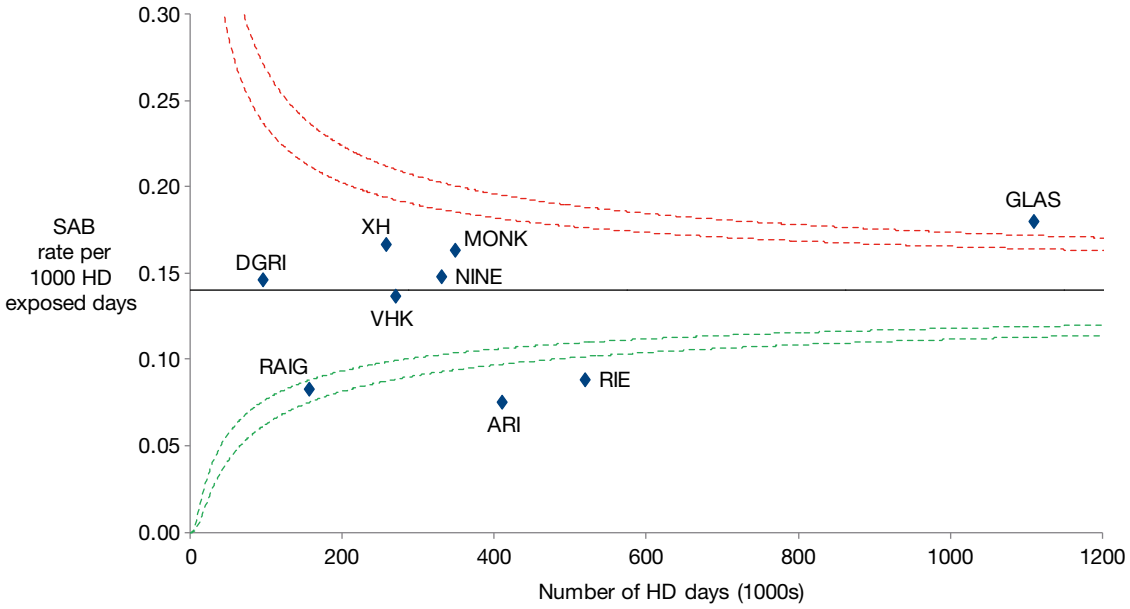
I2.1 Incidence of MRSA and MSSA bacteraemia reported in RRT patients in Scotland 2013-2017



I2.2 *Staphylococcus aureus* bacteraemia rate for haemodialysis patients by adult renal unit 2013-2017

Unit	Rate per 1000 HD Days 2013-2017	95% CI
ARI	0.08	(0.05, 0.11)
XH	0.17	(0.12, 0.23)
DGRI	0.15	(0.08, 0.25)
GLAS	0.18	(0.16, 0.21)
MONK	0.16	(0.12, 0.21)
NINE	0.15	(0.11, 0.2)
RAIG	0.08	(0.04, 0.14)
RIE	0.09	(0.06, 0.12)
VHK	0.14	(0.1, 0.19)
Scotland	**0.14**	**(0.13, 0.15)**

I2.3 *Staphylococcus aureus* bacteraemia (SAB) rate for haemodialysis patients by adult renal unit 2013-2017



I2.4 Number of episodes of *Staphylococcus aureus* bacteraemia (SAB) per patient on RRT between 2013-2017

Number of infections	Number of patients	Number of SAB episodes
1	348	348
2	53	106
3	18	54
≥4	5	27

I2.5 Number of deaths following an episode(s) of *Staphylococcus aureus* bacteraemia (SAB) per patient on RRT between 2013-2016

Number of SABs	Number of Deaths within 1 year	% deaths within 1 year of SAB
360	124	34.4

* For patients who had multiple SAB episodes between 2013-2016 - only the final SAB episode is counted within this table.

I2.6 Cause of deaths within 1 year of a *Staphylococcus aureus* bacteraemia (SAB) in patients on RRT between 2013-2016

Cause of Death	Died within 1 year of SAB*	
	n	%
Cardiovascular	33	26.6
Infection	40	32.3
Malignancy	3	2.4
Other	11	8.9
RRT Complication	3	2.4
Treatment Withdrawn	33	26.6
Missing	1	0.8
All	**124**	**100.0**

* For patients who had multiple SAB episodes between 2013-2016 - only the final SAB episode is counted within this table.

I2.7 Number of deaths within 1 year of starting RRT between 2013-2016 in those who had a SAB and those who did not

	Number of patients	Number of Deaths within 1 year of starting RRT	% deaths within 1 year of starting RRT
Number of patients with SAB* within 1 year of starting RRT	162	29	17.9
No SAB recorded within 1 year of starting RRT	2093	269	12.9
Number starting RRT 2013-2016	2255	298	13.2

* Those patients who had multiple SAB episodes - only the first SAB is counted within this table.

SECTION J ADEQUACY OF HAEMODIALYSIS

This section's data are available on-line in Tableau format which enables interaction with the data: http://www.srr.scot.nhs.uk/publications/Dashboards/Census-May-2017.html.

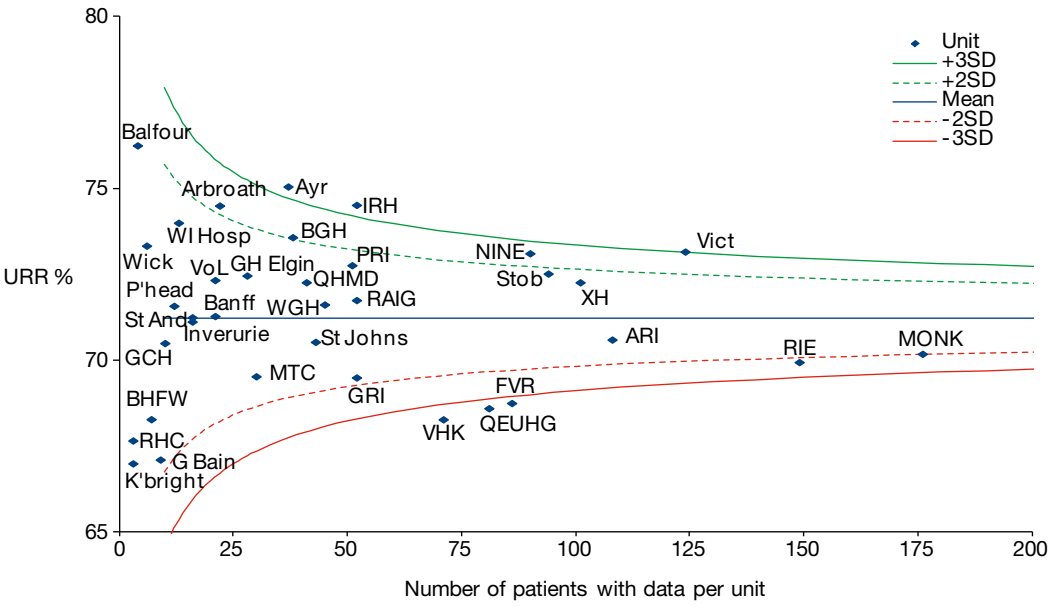
The quality of haemodialysis treatment for ERF can be assessed by measuring the urea reduction ratio (URR). The UKRA guideline for adult patients on three times per week HD is to achieve a URR consistently >65%.

The URR audit was performed in May 2018; all patients in Scotland receiving hospital or home haemodialysis on 01 May 2018 were included in the audit. There were 1848 results from 1950 patients (94.8%).

Although most patients continue to receive haemodialysis three times per week, it is clear that a large proportion of home and a small proportion of hospital haemodialysis patients are receiving more frequent sessions.

Of the 1853 patients with information on dialysis frequency, 1782 continue to have three times per week and 52 patients received a greater frequency (36 hospital HD (1.9% of total on hospital HD) and 16 home HD (34.8% of total on home HD)). 18 patients were receiving twice weekly dialysis and 1 patient was recorded as receiving once per week dialysis. For those patients not dialysing three times per week, URR may not reflect adequately the quality of dialysis and for these patients standardised Kt/V is preferable. We therefore have limited URR comparison to those receiving three times weekly HD in Figures J1 and J2 and used data from the census to calculate standardised Kt/V for all those with sufficient data.

J1 Mean achieved URR in Hospital HD patients on thrice weekly treatment in May 2018 by dialysis unit



Most units lie within 3 standard deviations of the population mean (71.2%) with the exception of Ayr and IRH which achieved higher than 3SD above the mean and VHK, QEUHG and FVR which fall more than 3SD below the mean.

1774 patients (90.1%) had adequate data to calculate standardised Kt/V (URR, dialysis frequency, dialysis treatment time and access used). More information about this method of calculating Kt/V is available on the SRR website.

1480 patients had sufficient data on dialysis modality from the May census to quantify use of haemodiafiltration (HDF) versus standard haemodialysis (HD). Across Scotland 845 (57.1%) were confirmed as receiving HDF whereas 635 (42.9%) were confirmed as receiving HD.

Since 2007 the median URR achieved during each annual census by all units in Scotland has been very steady fluctuating between 72% and 74%.

http://www.srr.scot.nhs.uk/Projects/Projects1.html#adequ

J2 Number of haemodialysis patients, median URR, median stdKt/V and achievement of audit standard by parent renal unit May 2018

	ARI	XH	DGRI	GLAS	MONK	NINE	RAIG	RHC*	RIE	VHK	Scotland
Number of patients on HD	222	166	53	594	195	181	90	10	298	141	**1950**
Number of patients with missing data	6	18	5	34	9	14	5	1	6	4	**102**
% patients with URR >65%**	**83**	**82**	**79**	**83**	**81**	**88**	**87**	**75**	**82**	**78**	**83**
Upper quartile**	75	79	74	76	74	79	77	68	75	75	**76**
Median URR**	72	73	70	72	71	73	73	67	72	72	**72**
Lower quartile**	68	68	67	68	67	69	68	65	68	66	**68**
% patients with data for stdKt/V***	**96**	**76**	**87**	**91**	**91**	**92**	**91**	**90**	**94**	**93**	**91**
Median stdKt/V***	2.12	2.14	2.06	2.10	2.06	2.14	2.11	1.89	2.08	2.08	**2.10**
Number of patients with sufficient HDF data	**36**	**155**	**46**	**548**	**190**	**175**	**75**	**6**	**128**	**121**	**1480**
HDF - YES	35	153	46	57	89	175	74	0	95	121	**845**
HDF - NO	1	2	0	491	101	0	1	6	33	0	**635**

* Data for RHC. The standards set for adult patients are not applicable to children; data are given for reference purposes only.
** Analysis limited to those with sufficient data and confirmed as receiving thrice-weekly haemodialysis (n = 1741).
*** Standardised Kt/V calculation only possible for patients with URR, dialysis frequency, dialysis treatment time and access used (n = 1774).

SECTION K ANAEMIA

This section's data are available on-line in Tableau format which enables interaction with the data: http://www.srr.scot.nhs.uk/publications/Dashboards/Census-May-2017.html.

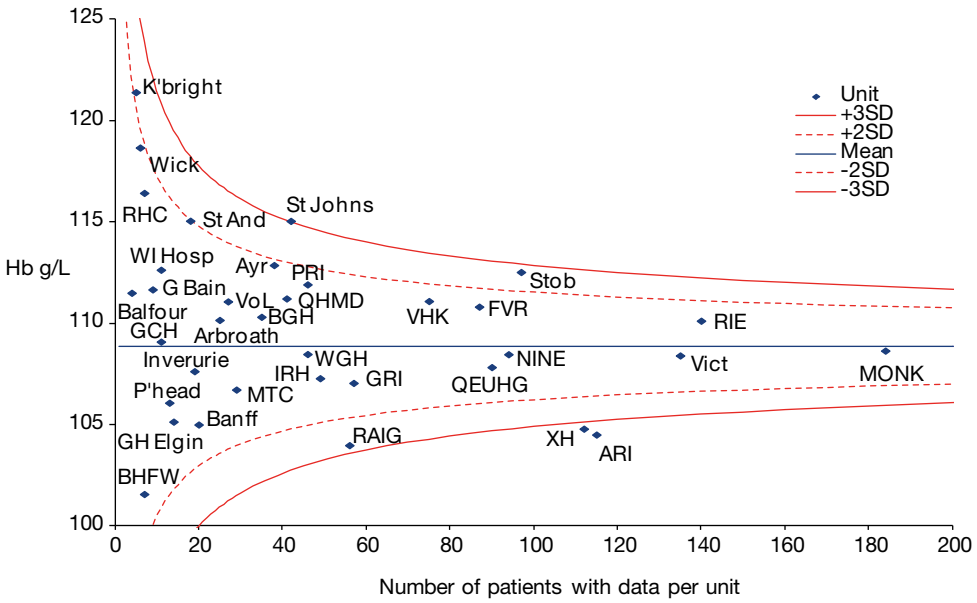
The anaemia audit was performed in May 2018; all patients in Scotland receiving hospital or home haemodialysis on 01 May 2018 were included in the audit. Results were excluded for patients who had received a recent blood transfusion (17 patients). There were 1901 results from 1950 patients (97.5%).

Haemoglobin concentration (Hb) was measured in a pre-dialysis blood sample after the first short interdialytic gap of the audit week, or as soon as possible thereafter. Auditing after the short (2 day) gap is done in order to minimise the potential effect of dilution due to fluid overload.

The UK Renal Association (UKRA) guideline from November 2010 and updated in 2017 recommends a target Hb of 100-120g/L for patients with chronic kidney disease, but only for those patients receiving Erythropoiesis Stimulating Agents (ESA) therapy.

We have reported the mean achieved Hb value by satellite dialysis unit where data are available and also the percentage of patients, by parent unit, achieving the UKRA standard.

K1 Mean Hb of Hospital HD patients in each dialysis unit May 2018



Patients with Hb >120g/L and confirmed as not receiving ESA therapy (90 patients) are excluded from the funnel plot. All units lie within 3 standard deviations of the population mean (108.9 g/L) with the exception of XH and ARI which fall more than 3SD below the mean.

K2 Number of HD patients, median Hb and achievement of audit standards by renal unit May 2018											
	ARI	XH	DGRI	GLAS	MONK	NINE	RAIG	RHC*	RIE	VHK	Scot-land
Number of patients	222	166	53	594	195	181	90	10	298	141	**1950**
Missing data or transfused	4	3	3	13	6	7	2	0	8	3	**49**
% patients with Hb data	98	98	94	98	97	96	98	100	97	98	**97**
Missing ESA Data	7	4	2	16	5	6	4	1	7	12	**64**
% on ESA Therapy	89	90	79	87	92	80	77	80	81	84	**85**
Missing Iron data	7	4	2	16	5	6	4	1	9	12	**66**
% on iv iron	85	85	60	72	68	60	76	50	71	62	**72**
Median Hb all patients**	107	108	111	110	110	113	109	123	113	114	**110**
% patients with Hb 100-120 g/L***	57.2	60.1	58.5	55.8	68.8	61.6	69.1	12.5	59.4	63.2	**59.7**
% patients with Hb >120 g/L***	10.3	16.2	14.6	19.2	13.6	18.8	5.9	50.0	20.8	24.8	**17.3**
Upper quartile***	114	116	117	118	115	119	114	125	120	119	**118**
Median Hb g/L***	106	108	110	109	110	111	108	112	112	114	**110**
Lower quartile***	97	100	99	100	104	102	100	96	103	107	**101**
Range g/L***	73 - 138	54 - 136	78 - 139	74 - 157	61 - 138	81 - 147	60 - 135	89 - 161	53 - 151	72 - 137	**53 - 161**

* The UKRA standards apply to patients 2 years and older.
** All patients with results except those with recent blood transfusion (n=1901).
*** UKRA standard. Hb 100-120 g/L on ESA therapy. Patients were excluded if there were no data, they had recently received a blood transfusion or were not receiving ESA therapy on the census date (n=1586).

Of the 1901 patients with Hb values, 1479 (77.8%) had Hb ≥100g/L.

209 patients were confirmed as not receiving ESA therapy and had not recently received a blood transfusion. Of the 204 with data, 24 (11.8%) had Hb <100g/L, 90 (44.1%) had Hb 100 - 120g/L and 90 (44.1%) had Hb >120g/L.

Data on ESA treatment (including patients confirmed as not receiving ESA) were available for 1831 (96.3%) patients. Using this information we were able to calculate the proportion of patients achieving the UKRA standard (Hb 100-120g/L) receiving ESA therapy on the census

date. Of the 1586 patients confirmed as receiving ESA treatment and who had data and had not recently been transfused, 947 (59.7%) achieved the UKRA standard. Hb was <100g/L in 365 (23.0%) of patients, Hb was >120g/L in 274 (17.3%) and 133 (8.4%) had Hb >125g/L.

Both the ESA and iron data are based on what the patients were receiving on the census date. If someone has either of these medicines stopped just before the census (or started just after) we will not have captured this.

There is variation in practice across Scotland for ESA prescription when patients are diagnosed with malignancy; some units stop therapy whereas other take a more individualised approach. We have not taken this into account in our analyses.

SECTION L BONE MINERAL METABOLISM

This section's data are available on-line in Tableau format which enables interaction with the data: http://www.srr.scot.nhs.uk/publications/Dashboards/Census-May-2017.html.

The laboratory data relating to bone mineral metabolism were audited in May 2018 for all prevalent patients receiving hospital or home haemodialysis. Pre-dialysis blood samples were collected after a short interdialytic gap. Any samples marked 'post-haemodialysis' were excluded.

As recommended by the Working Group of Senior Scottish Clinical Biochemists on bone biochemistry targets in the management of renal failure, the PTH data in this report are presented according to the recommended assay specific targets appropriate to each renal unit.

The working group's recommendations which have been adopted across Scotland are available on the SRR website:

http://www.srr.scot.nhs.uk/Projects/Projects1.html#calc

L1 Achievement of guideline targets for phosphate (PO4), corrected calcium (cCa) and PTH in haemodialysis patients by renal unit May 2018

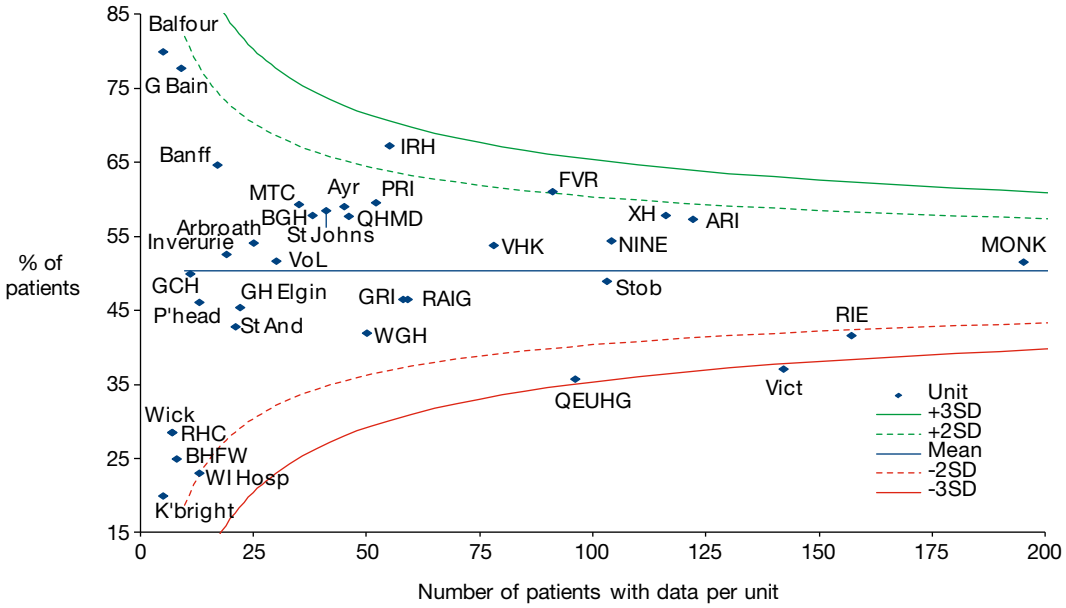
Renal Unit	Number of patients	% with PO4 result	% on PO4 Binders	Mean PO4 mmol/L	% with result 1.1-1.7 mmol/L	% with cCa result	% with cCa in normal range	% with PTH result	% PTH result 2-9x UL* normal
ARI	222	100.0	58.6	1.46	56.8	100.0	82.0	92.8	50.5
XH	166	98.8	30.7	1.40	59.1	99.4	83.0	94.0	36.5
DGRI	53	92.5	37.7	1.56	53.1	94.3	78.0	94.3	62.0
GLAS	594	96.8	77.3	1.71	47.1	97.6	82.6	91.4	57.1
MONK	195	96.4	57.4	1.42	51.6	97.4	88.9	97.9	57.1
NINE	181	97.8	57.5	1.63	54.2	98.3	79.8	87.8	57.9
RAIG	90	98.9	62.2	1.82	39.3	98.9	76.4	94.4	41.2
RHC	10	100.0	50.0	1.24	30.0	100.0	90.0	80.0	62.5
RIE	298	99.3	59.1	1.68	45.9	99.7	80.2	93.6	60.2
VHK	141	99.3	58.9	1.63	53.6	99.3	72.1	96.5	60.3
Scotland	**1950**	**97.9**	**61.3**	**1.61**	**50.4**	**98.5**	**81.4**	**93.0**	**54.8**

* UL - upper limit of normal

Analytical methods for phosphate are standard across Scotland and results are comparable both between units, and against the UKRA recommended guideline (Pre-dialysis PO4 between 1.1 and 1.7 mmol/L).

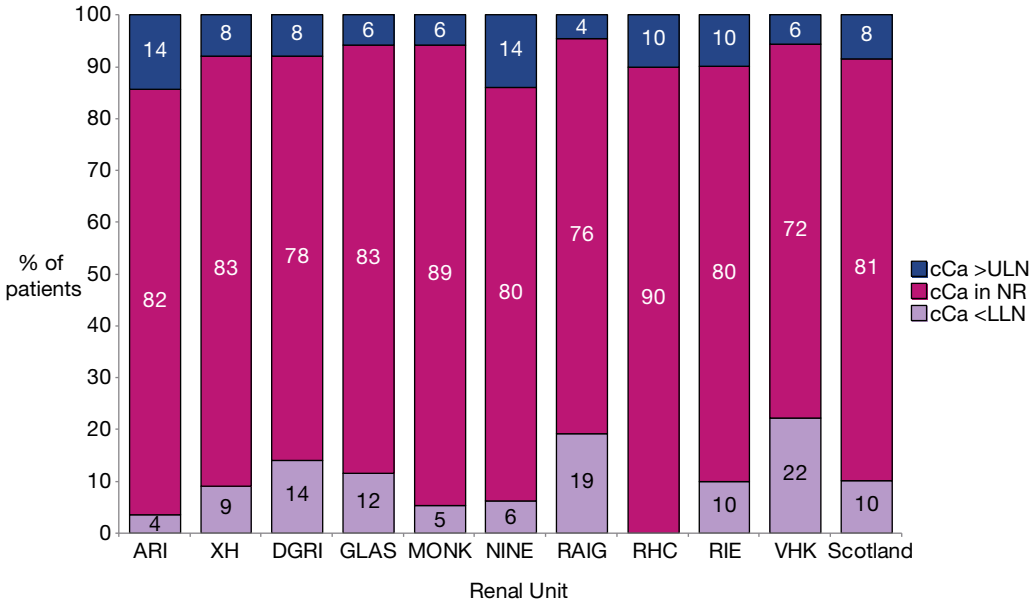
Information on use of phosphate binders is based on what the patients were receiving on the census date. If someone had these medicines stopped just before the census (or started just after) we will not have captured this.

L2 Percentage of hospital HD patients achieving pre-dialysis PO4 target of 1.1-1.7 mmol/L by dialysis unit May 2018



1910 (97.9%) patients had phosphate results. 242 (12.7%) had a phosphate <1.1 mmol/L, 962 (50.4%) achieved the UKRA standard and 706 (37.0%) had phosphate >1.7 mmol/L. All units lie within 3 standard deviations of the national average achieving target (50.4%) with the exception of Vict which falls more than 3SD below this.

L3 Distribution of pre-dialysis corrected serum calcium in haemodialysis patients by renal unit May 2018



The graph shows the percentage of patients within each unit, who were hypocalcaemic (cCa< lower limit of normal range (LLN)), normocalcaemic (cCa in normal range (NR)) and

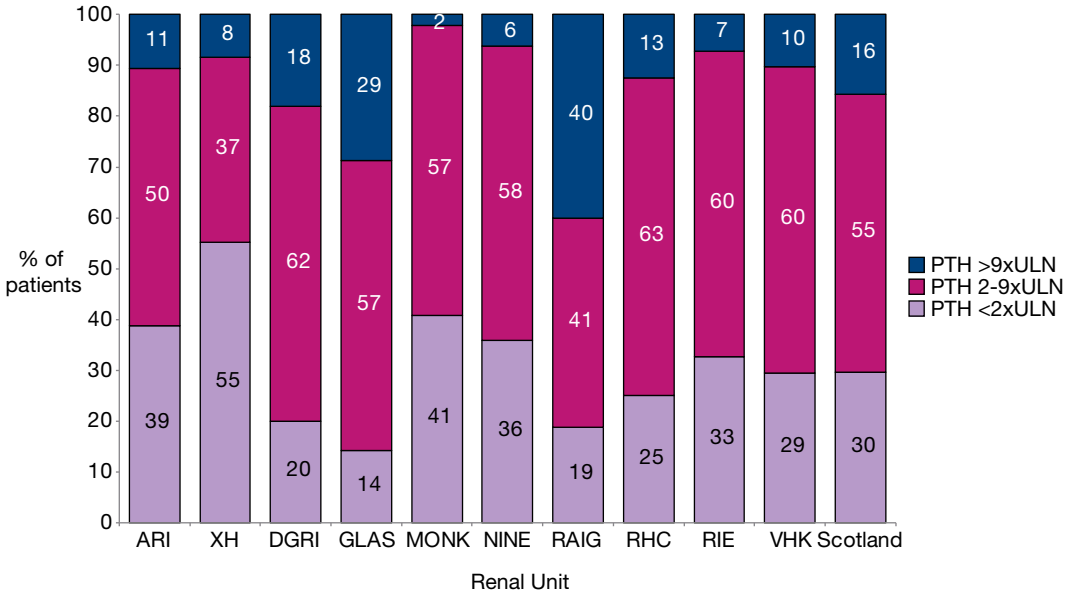
hypercalcaemic (cCa>upper limit of normal range (ULN)) according to the local assay ranges for the biochemistry laboratory serving each dialysis unit.

The UKRA guideline suggests that corrected calcium should be maintained within the local normal range, the normal range differs between renal units, therefore actual calcium values are not shown.

The local ranges for corrected calcium for the biochemistry laboratories that serve each dialysis unit are available on the SRR website:

http://www.srr.scot.nhs.uk/Projects/Projects1.html#calc

L4 Distribution of pre-dialysis serum PTH in haemodialysis patients by renal unit May 2018



The UKRA guideline suggests that PTH levels should be maintained between 2 and 9 times the upper limit of normal (ULN) for the assay used.

Assay specific PTH ranges are available on the SRR website:

http://www.srr.scot.nhs.uk/Projects/Projects1.html#calc

SECTION M SCOTTISH RENAL BIOPSY REGISTRY: SURVEY OF TRANSPLANT KIDNEY BIOPSY IN SCOTLAND 2017

All centres in Scotland were able to provide date of procedure, date of birth, sex, and main diagnosis for all transplant renal biopsies performed in the calendar year 2017. Biopsy diagnosis was selected from a bespoke codeset agreed by the SRR Biopsy Steering Group (see M4 below). Centres also provided indication for biopsy, selected from pre-defined terms. Biopsies at the time of transplant ('implantation biopsies', 'time zero biopsies') were not included.

The total number of reported transplant biopsies was 278 in 222 patients giving an incidence of 51.2 transplant biopsies per million population (pmp) down from 59.0 pmp in 2016 and 70.6 pmp in 2015. 278 transplant biopsies amounts to 0.10 biopsies per prevalent transplant recipient using the Scottish Renal Registry reported prevalent transplant patient data from 31/12/2016 and this is down from 0.12 in 2016.

Total number of biopsies and total number of patients having transplant renal biopsy in each centre were expressed pmp and per prevalent transplant patient and for each centre based on the populations shown in table 1.

Some centres perform no transplant biopsies or only a proportion of the transplant biopsies for patients from their NHS Health Board area with the others being performed at the relevant transplant centre. For this reason all analyses include a comparison of the NHS Health Board areas served by the Glasgow (West) transplant unit (A&A, D&G, GG&C, FV, LAN) and Edinburgh (East) transplant unit (GRAM, SHET, ORKN, TAY, HIGH, WI, LOTH, BORD, FIFE).

M1 Number of transplant kidney biopsies by renal unit and NHS Health Board

Renal unit	NHS Health Board	Population 2017	Prevalent transplant patients 31/12/2016	Total transplant biopsies (n)	Total number patients having biopsy	Transplant biopsies pmp/year	Patients having transplant biopsies pmp/year	Transplant biopsies per prevalent transplant patient/yr
ARI	GRAM + SHET + ORKN	631460	311	31	21	49.1	33.3	0.10
XH	A&A	370410	214	6	6	16.2	16.2	0.03
DGRI	D&G	149200	75	0	0	0.0	0.0	0.00
Glas	GG&C + FV	1474690	876	99	84	67.1	57.0	0.11
Monk	LAN	658130	385	0	0	0.0	0.0	0.00
Nine	TAY	416090	202	14	11	33.6	26.4	0.07
Raig	HIGH + WI	348940	203	6	6	17.2	17.2	0.03
RIE	LOTH + BORD	1004470	437	108	88	107.5	87.6	0.25
VHK	FIFE	371410	169	14	10	37.7	26.9	0.08
East		2772370	1322	167	134	60.2	48.3	0.13
West		2652430	1550	105	88	39.6	33.2	0.07
Scotland		**5424800**	**2872**	**278**	**222**[a]	**51.2**	**40.9**	**0.10**

a. 4 patients had a transplant biopsy in 2 different centres during 2017 which is why the numbers from individual centres do not add up exactly to the numbers in the East/West and Overall columns.

Some centres perform no transplant biopsies or only a proportion of the transplant biopsies for patients from their NHS Health Board area with the others being performed at the relevant transplant centre. For this reason, all analyses include a comparison of the NHS Health Board areas served by the Glasgow (West) transplant unit (A&A, D&G, GG&C, FV, LAN) and Edinburgh (East) transplant unit (GRAM, SHET, ORKN, TAY, HIGH, WI, LOTH, BORD, FIFE).

Time since transplant.

Time since the most recent transplant was categorised according to pre-defined clinically meaningful periods as shown in Table M2.

M2 Time from transplant to biopsy in 2017

	ARI	XH	DGRI	GLAS	MONK	NINE	RAIG	RIE	VHK	East	West	Scotland
1-28 days	1	0	0	16	0	1	0	59	1	62	16	78
1-3 months	7	0	0	15	0	3	5	16	0	31	15	46
3-12 months	8	0	0	18	0	4	1	10	2	25	18	43
1-5 years	8	2	0	31	0	3	0	14	6	31	33	64
5-10 years	5	2	0	14	0	2	0	7	5	19	16	35
>10 years	2	2	0	5	0	1	0	2	0	5	7	12

Indication for transplant biopsy

Indication for transplant renal biopsy is shown in M3. There were 2 biopsies without a recorded indication.

M3 Indication for transplant biopsy 2017

	ARI	XH	DGRI	GLAS	MONK	NINE	RAIG	RIE	VHK	East	West	Scotland
Surveillance during delayed graft function	0	0	0	5	0	0	0	20	0	20	5	25
Achieved transplant function lower than expected	3	0	0	0	0	3	0	19	0	25	0	25
AKI	17	0	0	39	0	4	4	29	12	66	39	105
Assessment of response to treatment of rejection	6	0	0	0	0	2	0	6	0	14	0	14
Assessment of response to BK virus treatment	0	0	0	0	0	1	0	1	0	2	0	2
Protocol (surveillance) biopsy	0	0	0	0	0	0	2	10	1	13	0	13
Chronically deteriorating transplant function and proteinuria	3	4	0	13	0	0	0	6	0	9	17	26
Chronically deteriorating transplant function only	1	2	0	35	0	3	0	12	0	16	37	53
Preserved transplant function and proteinuria	0	0	0	1	0	0	0	0	0	0	1	1
Nephrotic Syndrome	0	0	0	0	0	0	0	2	0	2	0	2
Other (specify)	1	0	0	5	0	1	0	3	0	5	5	10

Histopathological diagnosis.

Nephrologists were asked to select the diagnosis that was the main explanation for the clinico-pathological features. The reported diagnoses are shown in Table M4.

M4 Transplant biopsy histopathological diagnosis 2017

	ARI	XH	DGRI	GLAS	MONK	NINE	RAIG	RIE	VHK	East	West	Scotland
Acute tubulodegenerative change (ATN)	0	0	0	16	0	1	0	27	1	29	16	45
Rejection: ACR (1A)	5	0	0	10	0	0	0	8	1	14	10	24
Rejection: ACR (1B)	0	0	0	6	0	0	0	0	0	0	6	6
Rejection: ACR (2A, 2B, 3)	1	1	0	12	0	2	0	5	0	8	13	21
Rejection: ACR (NOS)	0	0	0	0	0	0	0	0	0	0	0	0
Rejection: borderline	0	0	0	3	0	0	1	9	2	12	3	15
Rejection: acute / active ABMR	1	0	0	3	0	0	0	2	0	3	3	6
Rejection: chronic ABMR	0	0	0	6	0	1	0	1	0	2	6	8
Rejection: chronic allograft arteriopathy	0	0	0	0	0	0	0	0	0	0	0	0
Rejection: chronic, active ABMR	1	1	0	6	0	0	0	2	0	3	7	10
Rejection: mixed ABMR & ACR	5	1	0	4	0	0	0	0	0	5	5	10
Rejection - other	0	0	0	0	0	0	0	0	0	0	0	0
BKVAN	2	1	0	9	0	0	0	6	0	8	10	18
CNI toxicity	6	0	0	0	0	0	0	1	0	7	0	7
Donor disease	0	0	0	4	0	2	0	13	0	15	4	19
IFTA	7	0	0	5	0	2	1	8	3	21	5	26
IIFTA	1	0	0	0	0	0	0	1	1	3	0	3
Infection (other than BKVAN)	0	0	0	0	0	0	0	2	0	2	0	2
Recurrent native disease	1	0	0	1	0	2	0	6	0	9	1	10
Insufficient tissue for diagnosis	0	0	0	2	0	0	2	4	0	6	2	8
No significant histopathological abnormality	0	0	0	2	0	3	0	8	2	13	2	15
Not stated	0	0	0	0	0	0	0	0	1	1	0	1
Other	1	2	0	10	0	1	2	5	3	12	12	24

ACR = acute cellular rejection, 1A, 1B, 2A, 2B, 3 refer to Banff classification
ABMR = antibody mediated rejection
BKVAN = BK virus associated nephropathy
CNI = calcineurin inhibitor
IFTA = interstitial fibrosis and tubular atrophy
iIFTA = inflammatory interstitial fibrosis and tubular atrophy

Major Complications

Complications were categorised as shown in table M5. There was only 1 major complication (0.36%) with no loss of transplant kidney or death.

M5 Major complications

Complication	n
Arteriography and embolisation	0
Arteriography no embolisation	1
Blood transfusion only	0
Clot obstruction managed conservatively	0
Clot obstruction requiring intervention	0
Death	0
Nephrectomy	0
Other please specify	0
Surgery no nephrectomy	0
Total	**1**

This is the third consecutive analysis of all transplant renal biopsies in Scotland in a calendar year. Analysing the data by region (East v West) again demonstrates a higher incidence of transplant biopsies in the East region (60.2 v 39.6 pmp) despite a higher incidence of kidney transplantation in the West region. The difference in incidence between East and West is accounted for mainly by biopsies in the first 3 months after transplant and is also partly accounted for by repeat biopsies in the same patients since the difference in incidence of patients having at least one transplant biopsy in the two regions is closer (48.3 v 33.2 pmp). The analysis of indication and histopathological diagnosis suggests a lower clinical threshold for performing transplant biopsy in the East region; the incidences of biopsy for 'surveillance during delayed graft function', 'achieved function lower than expected', 'AKI', 'assessment of response to treatment of acute rejection' were higher in the East. Similarly, the incidences of 'no significant histopathological abnormality', 'ATN', and borderline acute rejection were higher in the East but the incidences of definite acute rejection categories and BKVAN were very similar.

SECTION N SCOTTISH RENAL BIOPSY REGISTRY: SURVEY OF NATIVE RENAL BIOPSY IN SCOTLAND 2017

All centres in Scotland were able to provide date of birth, sex, indication for biopsy, main diagnosis and major complications for all native renal biopsies performed in the calendar year 2017.

Diagnosis was selected from the 2012 ERA/EDTA primary renal diagnosis codes (http://www.era-edta-reg.org/prd.jsp) with the addition of 'Complement 3 glomerulopathy', 'Kidney biopsy result normal' and 'Insufficient histological evidence from kidney biopsy for diagnosis'. Indication for biopsy, operator and major complications were selected from pre-defined codesets. Units were also asked to indicate if this was the first biopsy for this diagnosis.

The total number of reported biopsies was 651 in 632 patients giving an incidence of 120.0 native kidney biopsies per million population (pmp) per year which is lower than the incidences of 139.2 pmp in 2016, 130.1 pmp in 2015 and 127.1 pmp in 2014. Centres were asked to indicate if this was the first biopsy ever with this diagnosis to take account of patients having repeat biopsies to monitor disease. 588 patients were having their first renal biopsy for this diagnosis meaning that 63 biopsies were repeat biopsies. This compares with 686 patients having first renal biopsy in 2016.

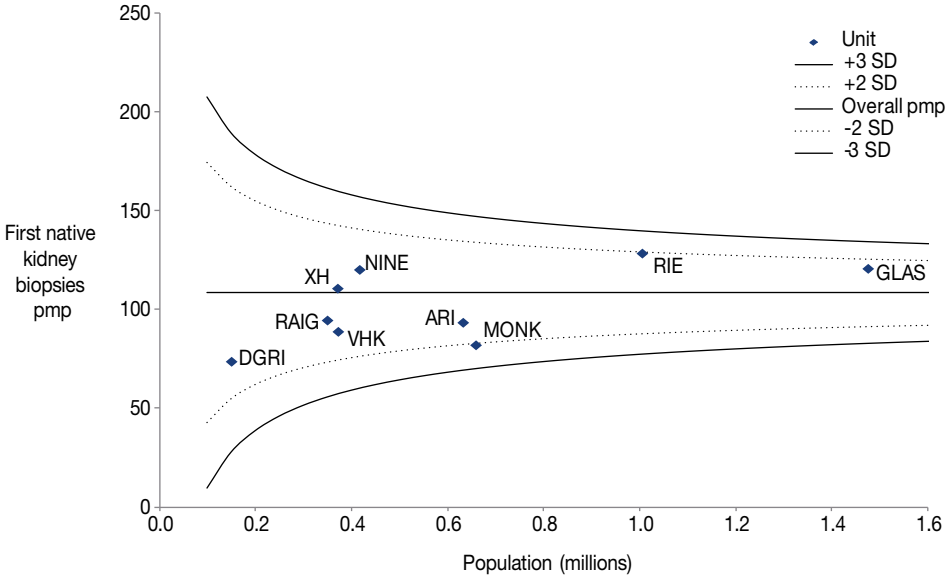
Total number of biopsies and total number of patients having native renal biopsy were expressed pmp for each centre based on the populations shown in N1. Repeat native biopsy was commonest in RIE.

N1 Number of native kidney biopsies 2017 by renal unit and NHS Health Board

Renal Unit	NHS Health Board	Population 2016	Total native biopsies	Second or subsequent biopsies	Number patients having biopsy	No. of pts having 1st renal biopsy	Native biopsies pmp/yr	Patients having first renal biopsy pmp/yr	Mean age at biopsy (yrs)	% Male
ARI	GRAM + SHET + ORKN	631460	65	0	65	59	102.9	93.4	57.8	50.8
XH	A&A	370410	41	0	41	41	110.7	110.7	58.8	63.4
DGRI	D&G	149200	13	1	12	11	87.1	73.7	59.4	69.2
GLAS	GG&C + FV	1474690	186	2	184	178	126.1	120.7	60.3	52.2
MONK	LAN	658130	58	1	57	54	88.1	82.1	57.0	51.7
NINE	TAY	416090	54	3	51	50	129.8	120.2	53.0	53.7
RAIG	HIGH + WI	348940	34	0	34	33	97.4	94.6	61.3	50.0
RIE	LOTH + BORD	1004470	166	11	155	129	165.3	128.4	54.0	56.6
VHK	FIFE	371410	34	1	33	33	91.5	88.9	58.8	44.1
Scotland		**5424800**	**651**	**19**	**632**	**588**	**120.0**	**108.4**	**57.4**	**53.8**

The number of patients experiencing a first renal biopsy in 2017 pmp for each centre was compared in a funnel plot (N2).

N2 Incidence per million population of first native kidney biopsies in 2017 by renal unit

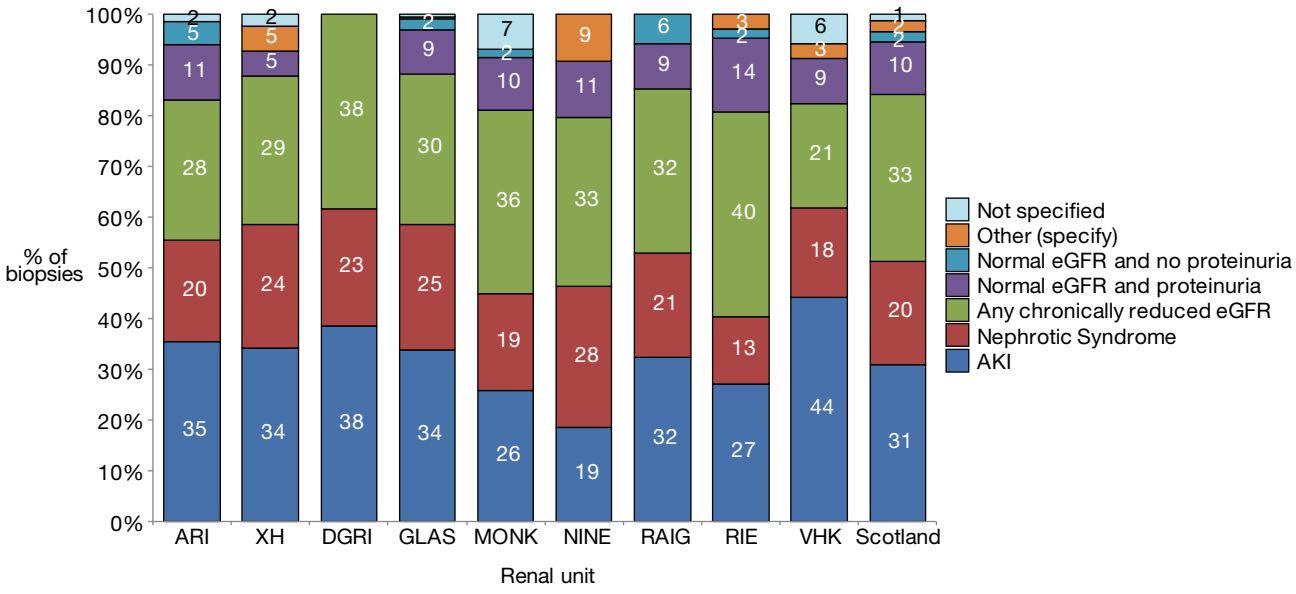


The incidence of native kidney biopsies per million population in 2017 was highest in the two units serving the largest populations similar to 2016.

Indication for biopsy

Indication for native renal biopsy using pre-defined indication terms was expressed per million population and shown in N3.

N3 Indication for native kidney biopsy in 2017 by renal unit



Diagnosis

Nephrologists were asked to select the diagnosis that was the main explanation for the clinic-pathological features of each biopsy. A diagnosis was recorded in all but 4 cases.

In 1 case the diagnosis was recorded as 'Insufficient tissue for diagnosis' and in 3 cases there was no kidney tissue obtained. In 7 cases the diagnosis was recorded as 'Insufficient histological evidence from kidney biopsy for diagnosis'. Most of these patients had a further biopsy. For 23 biopsies the diagnosis was recorded as 'Chronic kidney disease (CKD) / chronic renal failure (CRF) - aetiology uncertain / unknown - histologically proven'. 7 biopsies were reported as 'Kidney biopsy result normal'.

Of the remainder, a total of 48 different ERA/EDTA Primary Renal Diagnosis terms were recorded as the primary explanation for the clinical indication for native renal biopsy. In a further 12 cases the nephrologists felt that none of the ERA/EDTA terms were sufficient (recorded as 'other'). The diagnoses for first biopsies are presented in table N4. If the first biopsy produced insufficient tissue and was repeated the subsequent diagnosis is presented. The top 20 reported diagnoses are shown in table N4 in descending order of frequency along with the frequency for first biopsies in 2016 and all biopsies (ie not just first biopsies) in 2015.

All recorded diagnoses and frequencies in each centre for 2017 can be viewed on the Scottish Renal Registry website:

http://www.srr.scot.nhs.uk/Biopsy-Registry/Main.html

N4 Most frequent 20 recorded native kidney biopsy diagnoses recorded in 2017 by renal unit and compared with incidence 2015 and 2016. In 2017 and 2016 only first renal biopsies for this diagnosis are included

Centre	ARI	XH	DGRI	Glas	Monk	Nine	Raig	RIE	VHK	Scotland 2017	Scotland 2016	Scotland 2015
IgA nephropathy - histologically proven	4	5	1	18	7	2	6	17	6	66	104	101
Tubulointerstitial nephritis - histologically proven[a]	7	4	0	25	3	7	4	8	5	63	65	61
Microscopic polyangiitis - histologically proven	4	4	1	13	1	2	1	12	3	41	55	34
Membranous nephropathy - idiopathic	4	2	0	17	2	4	1	5	2	37	42	73
Minimal change nephropathy - histologically proven	2	1	1	10	4	4	2	7	1	32	31	28
Primary focal segmental glomerulosclerosis (FSGS)	5	2	0	7	0	7	2	7	1	31	41	31
Diabetic nephropathy in Type II diabetes - histologically provena[b]	2	4	1	11	5	3	1	3	0	30	23	42
Ischaemic nephropathy / microvascular disease - histologically proven	0	2	0	14	3	2	0	3	1	25	18	10
Acute kidney injury	1	4	1	3	3	0	0	11	0	23	26	14
Chronic kidney disease (CKD) / chronic renal failure (CRF) - aetiology uncertain / unknown - histologically proven	7	1	0	2	4	2	2	3	2	23	12	12
Systemic lupus erythematosus / nephritis - histologically proven	3	2	0	4	3	4	2	3	2	23	22	39
Chronic hypertensive nephropathy - histologically proven	1	0	1	4	3	0	0	10	0	19	14	11
Granulomatosis with polyangiitis - histologically proven	1	2	1	6	1	0	0	2	0	13	23	33
Renal amyloidosis[c]	2	1	0	4	0	0	1	4	1	13	18	10
Mesangial proliferative glomerulonephritis	1	1	1	3	0	0	0	4	1	11	15	6

N4 Most frequent 20 recorded native kidney biopsy diagnoses recorded in 2017 by renal unit and compared with incidence 2015 and 2016. In 2017 and 2016 only first renal biopsies for this diagnosis are included

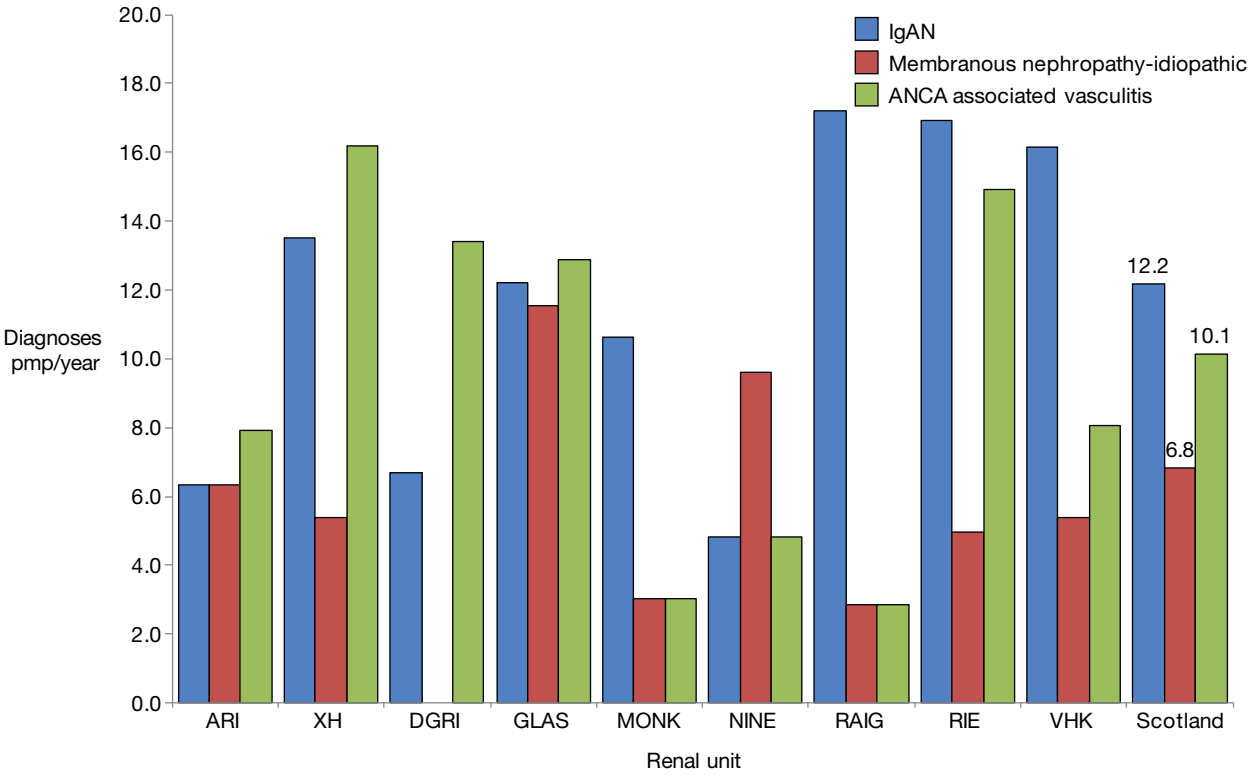
Centre	ARI	XH	DGRI	Glas	Monk	Nine	Raig	RIE	VHK	Scotland 2017	Scotland 2016	Scotland 2015
Henoch-Schönlein purpura / nephritis - histologically proven	1	0	0	0	1	1	2	2	2	9	15	8
Light chain deposition disease	3	0	0	0	0	0	1	5	0	9	1	6
Mesangiocapillary glomerulonephritis type 1	0	0	1	1	0	1	2	2	0	7	1	7
Focal and segmental proliferative glomerulonephritis	0	0	0	6	0	0	0	0	0	6	5	11
Myeloma cast nephropathy - histologically proven	0	0	0	4	0	0	1	1	0	6	4	7

a. Not including tubulo-interstitial nephritis where a specific cause stated.
b. In 2015 cases of type 1 and type 2 diabetic nephropathy were included together.
c. AA amyloid, AL amyloid and 'renal amyloidosis' combined.

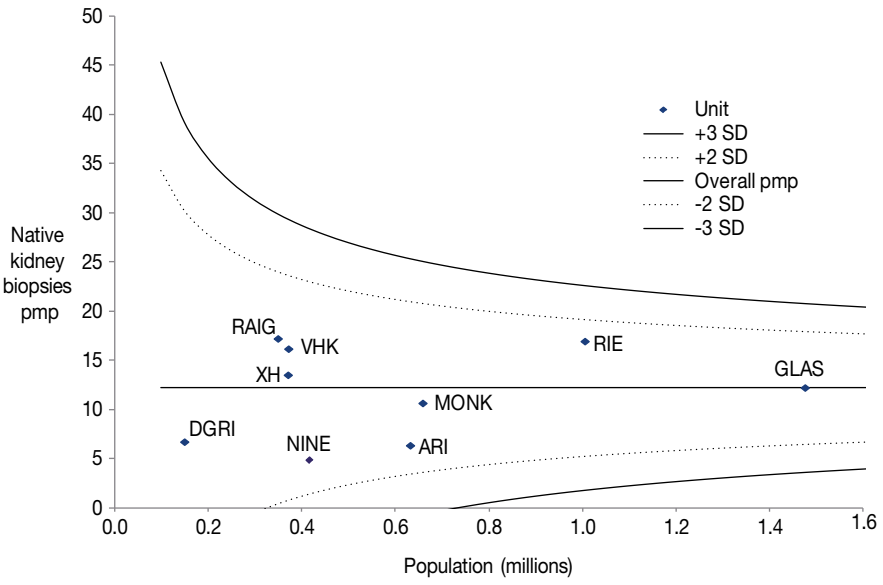
There have been marked reductions in the incidence of IgA nephropathy, granulomatosis with polyangiitis and idiopathic membranous nephropathy.

The incidences of IgA nephropathy, idiopathic membranous nephropathy and ANCA associated vasculitis (a combination of granulomatosis with polyangiitis, microscopic polyangiitis and Churg Strauss syndrome) were expressed pmp and compared between centres in N5. Funnel plots of the incidence of IgAN and ANCA associated vasculitis are shown in N6 and N7 respectively.

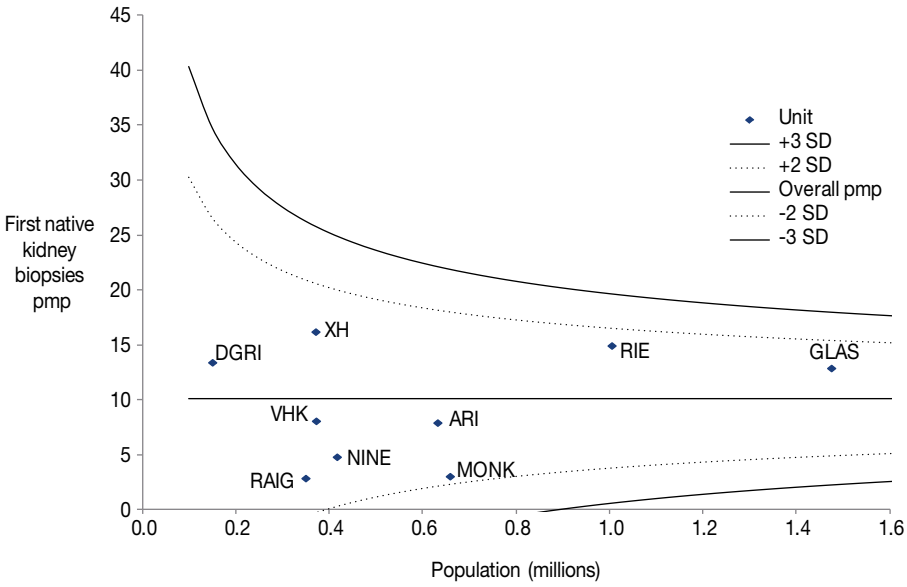
N5 Incidences per million population of selected first native biopsy diagnoses 2017



N6 Incidence per million population of biopsy diagnosis of IgA nephropathy by renal unit 2017



N7 Incidence per million population of biopsy diagnosis of ANCA associated vascilitides (AAV) by renal unit 2017



Complications

Major complications were defined as shown in N8. There were 19 major complications (2.9%) compared with 43/2160 biopsies (2.0%) between 2014 and 2016 inclusive.

N8 Major complications of kidney biopsies 2014 to 2017

Complication	2014		2015		2016		2017		2014-2017	
	n	%	n	%	n	%	n	%	n	%
Arteriography no embolisation	1	0.15	6	0.83	8	1.06	8	1.23	23	0.82
Arteriography and embolisation	2	0.29	2	0.28	0	-	7	1.08	11	0.39
Blood transfusion only	7	1.03	3	0.41	2	0.27	3	0.46	15	0.53
Clot obstruction managed conservatively	1	0.15	1	0.14	0	0.00	1	0.15	3	0.11
Clot obstruction requiring intervention	0	-	0	-	3	0.40	0	-	3	0.11
Death	1	0.15	1	0.14	0	-	0	-	2	0.07
Nephrectomy	0	-	0	-	0	-	0	-	0	-
Other please specify	1	0.15	3	0.41	1	0.13	0	-	5	0.18
Surgery no nephrectomy	0	-	0	-	0	-	0	-	0	-
Total number of complications	13	1.91	16	2.20	14	1.86	19	2.92	62	2.21
Total number of native biopsies	**682**		**726**		**752**		**651**		**2811**	

* Percentage is expressed as number of complications as a proportion of total biopsies in that time period.

APPENDIX 1 ABBREVIATIONS USED IN THE TEXT

Some definitions and further details of parent and satellite renal units are given in the SRR website at: http://www.srr.scot.nhs.uk/Renal_Units/Main.html

Abbreviation	Expanded text
AAPD	Assisted Automated Peritoneal Dialysis
AAV	ANCA Associated Vasculitis
ABMR	Anti-body Mediated Rejection
ACR	Acute Cellular Rejection
AKI	Acute Kidney Injury
ANCA	Anti-Neutrophil Cytoplasmic Antibody
APD	Automated Peritoneal Dialysis
AV	Arteriovenous
AVF	Arteriovenous Fistula
AVG	Arteriovenous Graft
BKVAN	BK Virus Associated Nephropathy
BP	Blood Pressure
CAPD	Continuous Ambulatory Peritoneal Dialysis
Cat	Category
cCa	Corrected calcium
CI	Confidence Interval
CKD	Chronic Kidney Disease
CNI	Calcineurin inhibitor
CVC	Central Venous Cannula
DBD	Donor after Brain-stem Death
DCD	Donor after Circulatory Death
DD	Deceased Donor
DM	Diabetes Mellitus
DN	Diabetic Nephropathy
ECOSS	Electronic Communication of Surveillance in Scotland
eKt/V	equilibrated Kt/V
EPR	Electronic Patient Record
ERA-EDTA	European Renal Association-European Dialysis and Transplant Association
ERF	Established (chronic) Renal Failure
ESA	Erythropoiesis Stimulating Agent
ESRD	End Stage Renal Disease
g/L	Grams per Litre
GN	Glomerulonephritis
Hb	Haemoglobin concentration
HD	Haemodialysis
HDF	Haemodiafiltration
HHD	Home Haemodialysis
HR	Hazard Ratio
IFTA	Interstitial Fibrosis and Tubular Atrophy
iIFTA	inflammatory Interstitial Fibrosis and Tubular Atrophy

IP	Intraperitoneal Pressure
IQR	Interquartile Range
ISD	Information Services Division NHS Scotland
IU/L	International Unit per Litre
IV	Intravenous
KDOQI	Kidney Disease Outcomes Quality Initiative
Kg	Kilogram
LD	Living Donor
LLN	Lower Limit of Normal range
m2	Metre squared
Max	Maximum
MDRD	Modification of Diet in Renal Disease
Min	Minimum
mmol/L	Millimole per Litre
MRSA	Meticillin Resistant Staphylococcus Aureus
MSSA	Meticillin Sensitive Staphylococcus Aureus
n	Number
NHS	National Health Service
NHSBT	NHS Blood and Transplant
NHS QIS	NHS Quality Improvement Scotland
NHSScotland	National Health Service in Scotland
NK	Not Known
NR	Normal Range
NTCVC	Non Tunnelled Central Venous Cannula
OR	Odds Ratio
PD	Peritoneal Dialysis
PHI	Public Health and Intelligence
pmol/L	picomoles per Litre
PMP	Patients per million population
PO4	Phosphate
PRD	Primary Renal Diagnosis
PTH	Parathyroid Hormone
RA	Renal Association
RCP	Royal College of Physicians
RRT	Renal Replacement Therapy
SAB	Staphylococcus aureus Bacteraemia
SD	Standard Deviation
SIMD	Scottish Index of Multiple Deprivation
SMARRT	Scottish Mortality Audit of Renal Replacement Therapy
SMR	Standardised Mortality Ratio
sp.	Species
SRA	Scottish Renal Association
SRR	Scottish Renal Registry
StdKt/V	Standardised Kt/V
TCVC	Tunnelled Central Venous Cannula
Tx	Transplant
UF	Ultrafiltration
UK	United Kingdom

UKRA	United Kingdom Renal Association
UKRR	UK Renal Registry
UL	Upper Limit
ULN	Upper Limit of Normal range
URR	Urea Reduction Ratio

Renal and Satellite units

Abbreviation	**Expanded text**
Arbroath	Arbroath Infirmary dialysis unit
ARI	Aberdeen Royal Infirmary
Ayr	Ayr Hospital
Balfour	Balfour Hospital
Banff	Chalmers Hospital, Banff
BGH	Borders General Hospital
BHFW	Belford Hospital, Fort William
DGRI	Dumfries and Galloway Royal Infirmary
FVR	Forth Valley Royal Hospital
G Bain	Gilbert Bain Hospital
GCH Stran	Galloway Community Hospital, Stranraer
GH Elgin	Dr Gray's Hospital, Elgin
GLAS	Glasgow Renal and Transplant Unit
GRI	Glasgow Royal Infirmary
Inverurie	Inverurie Dialysis unit
IRH	Inverclyde Royal Hospital
K'bright	Kirkcudbright Hospital
MONK	Monklands Hospital
MTC	Mountainhall Treatment Centre
NINE	Ninewells Hospital
P'head	Peterhead Community Hospital
PRI	Perth Royal Infirmary
QEUHG	Queen Elizabeth University Hospital Glasgow
QMHD	Queen Margaret's Hospital, Dunfermline
RAIG	Raigmore Hospital
RHC	Royal Hospital for Children Glasgow
RIE	Royal Infirmary of Edinburgh
St And	St Andrews Community Hospital
St John's	St John's Hospital
Stob	Stobhill Hospital
VHK	Victoria Hospital, Kirkcaldy
Vict	Victoria Hospital
VoL	Vale of Leven Hospital
XH	Crosshouse Hospital
WGH	Western General Hospital
Wick	Caithness General Hospital
WIG	Western Infirmary Glasgow
WI Hosp	Western Isles Hospital

NHS Health Boards

Abbreviation	Expanded text
A&A	Ayrshire& Arran
BORD	Borders
D&G	Dumfries & Galloway
FIFE	Fife
FV	Forth Valley
GRAM	Grampian
GG&C	Greater Glasgow and Clyde
HIGH	Highland
LAN	Lanarkshire
LOTH	Lothian
ORKN	Orkney
SHET	Shetland
TAY	Tayside
WI	Western Isles

APPENDIX 2 RENAL UNITS, SATELLITE DIALYSIS UNITS AND NHS HEALTH BOARD AREA OF UNITS' LOCATION

Parent Renal Unit	Satellites	NHS Health Board	Full name
ARI		GRAM	Aberdeen Royal Infirmary
	Balfour	ORKN	Balfour Hospital, Orkney
	Banff	GRAM	Chalmers Hospital, Banff
	G Bain	SHET	Gilbert Bain Hospital, Lerwick
	GH Elgin	GRAM	Dr Gray's Hospital, Elgin
	Inverurie	GRAM	Inverurie Dialysis Unit
	P'head	GRAM	Peterhead Community Hospital
XH		A&A	University Hospital Crosshouse, Kilmarnock
	Ayr	A&A	University Hospital Ayr
DGRI		D&G	Dumfries and Galloway Royal Infirmary
	GCH Stran	D&G	Galloway Community Hospital, Stranraer
	K'bright	D&G	Kirkcudbright Hospital
	MTC	D&G	Mountainhall Treatment Centre
GLAS		GG&C	Glasgow Renal and Transplant Unit, Queen Elizabeth University Hospital, Glasgow
	FVR	FV	Forth Valley Royal Hospital
	GRI	GG&C	Glasgow Royal Infirmary
	IRH	GG&C	Inverclyde Royal Hospital, Greenock
	Stob	GG&C	Stobhill Hospital, Glasgow
	Vict	GG&C	Victoria Hospital, Glasgow
	VoL	GG&C	Vale of Leven Hospital, Alexandria
MONK		LAN	Monklands Hospital, Airdrie
NINE		TAY	Ninewells Hospital, Dundee
	Arbroath	TAY	Arbroath Infirmary Dialysis unit
	PRI	TAY	Perth Royal Infirmary
VHK		FIFE	Victoria Hospital, Kirkcaldy
	St And	FIFE	St Andrews Community Hospital
	QMHD	FIFE	Queen Margaret Hospital, Dunfermline

Parent Renal Unit	Satellites	NHS Health Board	Full name
RAIG		HIGH	Raigmore Hospital, Inverness
	BHFW	HIGH	Belford Hospital, Fort William
	Wick	HIGH	Caithness General Hospital
	WI Hosp	WI	Western Isles Hospital, Stornoway
RHC		GG&C	Royal Hospital for Children, Glasgow
RIE		LOTH	Royal Infirmary of Edinburgh
	BGH	BORD	Borders General Hospital, Melrose
	St John's	LOTH	St John's Hospital, Livingston
	WGH	LOTH	Western General Hospital, Edinburgh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