Public Health Scotland

Scottish Renal Registry 2020

Annual report

Publication date: 13 October 2020

A Management Information release for Scotland

This is a Management Information publication

Published management information are non-official statistics which may be in the process of being transitioned into official statistics. They may not comply with the UK Statistics Authority's Code of Practice with regard to high data quality or high public value but there is a public interest or a specific interest by a specialist user group in accessing these statistics as there are no associated official statistics available.

Users should therefore be aware of the aspects of data quality and caveats surrounding these data, all of which are listed in this document.

Find out more about Management Information publications at:
https://www.statisticsauthority.gov.uk/wp-content/uploads/2016/06/National-Statisticians-Guidance-Management-Information-and-Official-Statistics.pdf

Contents

Introduction

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 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 2019.

It also presents audit data relating to the quality of treatment delivered up until 30 June 2020 measured against national standards/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 2019.

Funding

The Information and Services Division (ISD) of NHS Scotland assumed overall responsibility and funding for the SRR in April 1999. This is now part of Public Health Scotland which was formed in April 2020. 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.

Renal unit anonymity has been progressively removed since 1998. Patient anonymity is rigorously protected.

Conflict of interest

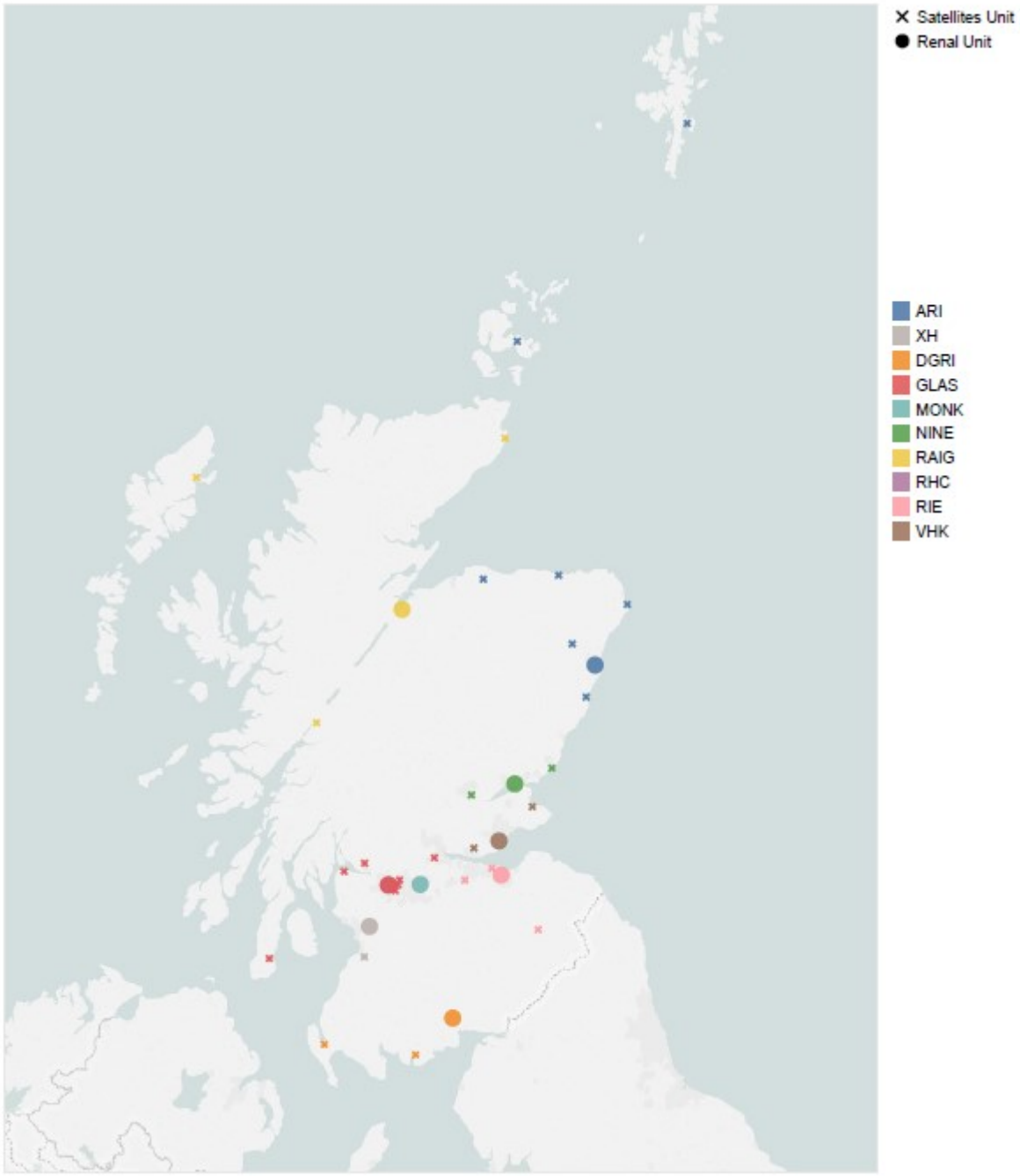
The SRR Chair, steering group and report editorial group do not have any conflicting interests.

Scottish National Audit Programme (SNAP)

The Scottish Renal Registry form part of the SNAP run by PHS and as such must participate in the SNAP Governance Process ensuring that outliers, issues etc. are appropriately followed up with each NHS Board via their Medical Director. The process involves clinically reviewing outliers at 2-3 standard deviations with a full investigatory process for outliers as 3 plus standard deviations, unfortunately the SRR have been unable to institute this process in 2020 but will participate fully in 2021.

The SRR is also working with PHS to ensure they fully comply with the requirements of the General Data Protection Regulations.

Dialysis locations



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 PHS is integral to the smooth running and functioning of the registry. We are grateful for her skill, enthusiasm and dedication. She is ably assisted by Stephanie Tippen. We are also very grateful to Jacqueline Campbell who has provided the statistical advice and performed the data analysis and also to our Clinical Coordinator Chrissie Watters. The SRR website is managed by the web and publications team at PHS.

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 authors:

Section	Authors
Incidence	J Campbell[1], JP Traynor[2], W Metcalfe[3], S Bell[5]
Prevalence	J Campbell[1], JP Traynor[2], W Metcalfe[3], S Bell[5]
Survival	J Campbell[1], JP Traynor[2], W Metcalfe[3], S Bell[5]
Cause of Death	J Campbell[1], JP Traynor[2], W Metcalfe[3], S Bell[5]
SMARRT	J Campbell[1], JP Traynor[2], W Metcalfe[3], S Bell[5]
Kidney Transplantation	J Campbell[1], JP Traynor[2], W Metcalfe[3], S Bell[5]
Peritoneal Dialysis	M Petrie[3], J Campbell[1]
Vascular Access for Haemodialysis	J Campbell[1], JP Traynor[2], P Thomson[4]
Bacteraemia in RRT Recipients	J Campbell[1], JP Traynor[2], W Metcalfe[3], S Bell[5], J Bishop[6], F Murdoch[6]
Adequacy of haemodialysis	J Campbell[1], JP Traynor[2]
Anaemia	J Campbell[1], JP Traynor[2]
Bone Mineral Metabolism	J Campbell[1], JP Traynor[2]
Scottish Renal Biopsy Registry	E McQuarrie[2] on behalf of the Scottish Renal Biopsy Registry steering group**, J Campbell[1]

[1]Public Health Scotland

[2]Glasgow Renal and Transplant Unit.

[3]Royal Infirmary of Edinburgh.

[4]Aberdeen Royal Infirmary.

[5]Ninewells Hospital, Dundee.

[6]Health Protection Scotland, Public Health Scotland.

[7]Dumfries & Galloway Royal Infirmary.

* Members of the SMARRT group

** Members of the Scottish Renal Biopsy Registry steering group

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 Summerside Computing 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 Samira Bell, Jamie Traynor and Wendy Metcalfe. As editors we remain responsible for the content.

Samira Bell
Chair Scottish Renal Registry
Scottish Renal Registry
Meridian Court
Public Health Scotland
5 Cadogan Street
Glasgow G2 6QE
Tel +44 141 282 2253
Email: phs.srr@phs.scot
Website: 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 2019, 18,636 patients had started renal replacement therapy (RRT) for ERF in Scotland. On 31 December 2019 there were 9 adult and one paediatric renal units in Scotland with 28 satellite dialysis units between them. All units contribute fully to the SRR and all patients receiving RRT for ERF are registered.

Demographic and Survival Data

In 2019, 571 people (105 per million population) started RRT for ERF. The median age of individuals starting RRT was 62 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 2015-2019. The proportion of patients starting RRT after developing ERF due to diabetic nephropathy continues to increase. Between 2015 and 2019 such patients were the largest single group, making up 29% of all patients starting RRT.

In contrast to numbers of new patients starting RRT, the numbers of prevalent patients are still rising. There are significant differences (after adjustment for age, sex and social deprivation) between NHS Board areas in the number of patients receiving RRT. NHS Lothian has a prevalence more than 2 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 2010-2019 are increasingly likely to survive for 5 years. Of those patients who started RRT between 1995 to 2014 when aged 45 to 64 years there is a significant trend of improving survival for each primary renal diagnosis group. There are significant differences between NHS Board areas in mortality when standardised for age, sex, social deprivation and Primary Renal Disease (PRD) at 90 days after starting RRT. The most common cause of death among patients on RRT in 2019 was cardiovascular disease accounting for 26% of deaths, infections were the main cause of death in 17% of cases and malignancy 9%.

Transplantation

Since 2011 the commonest treatment among prevalent patients for ERF in Scotland has been renal transplantation. On 31 December 2019 there were 5,436 prevalent patients receiving RRT, 61% of whom had a functioning kidney transplant, 35% were being treated with haemodialysis (HD) and 4% with peritoneal dialysis (PD). 297 patients resident in Scotland received a kidney transplant in Scotland in 2019, 60 (20%) of those transplants were pre-emptive meaning they were performed before the patient had required any other form of RRT. 30.8% of kidney transplants performed 2015-2019 were from living donors.

There is a significant trend of improving survival of function of transplanted kidneys from 1960 to 2019 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 standards and 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 standards 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.

The incidence of PD related peritonitis across Scotland has increased at 22.2 months between episodes in 2019 compared with 22.7 months between episodes in 2018.

The optimum form of access for haemodialysis is an arteriovenous (AV) fistula which minimises the risk of bacteraemia. The UKRA standard suggests that at least 60% of incident and 80% of prevalent patients should be using AV access. In the first six months of 2020 37% of patients started HD via AV access. In May 2020 65% of prevalent HD patients had a form of AV access and 35% were using central venous catheters. Significant differences persist between renal units with two (ARI and 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.

80% of patients treated by HD in May 2020 achieved the recommended standard urea reduction ratio (URR) of >65%. 58% of patients (excluding those not treated with an erythropoiesis stimulating agent (ESA)) treated by HD met the recommended blood haemoglobin concentration in the range 100-120 g/L in May 2020.

Incidence

Patients starting RTT

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. For the period covered in this report, the SRR did not routinely record the incidence of RRT for acute kidney injury.

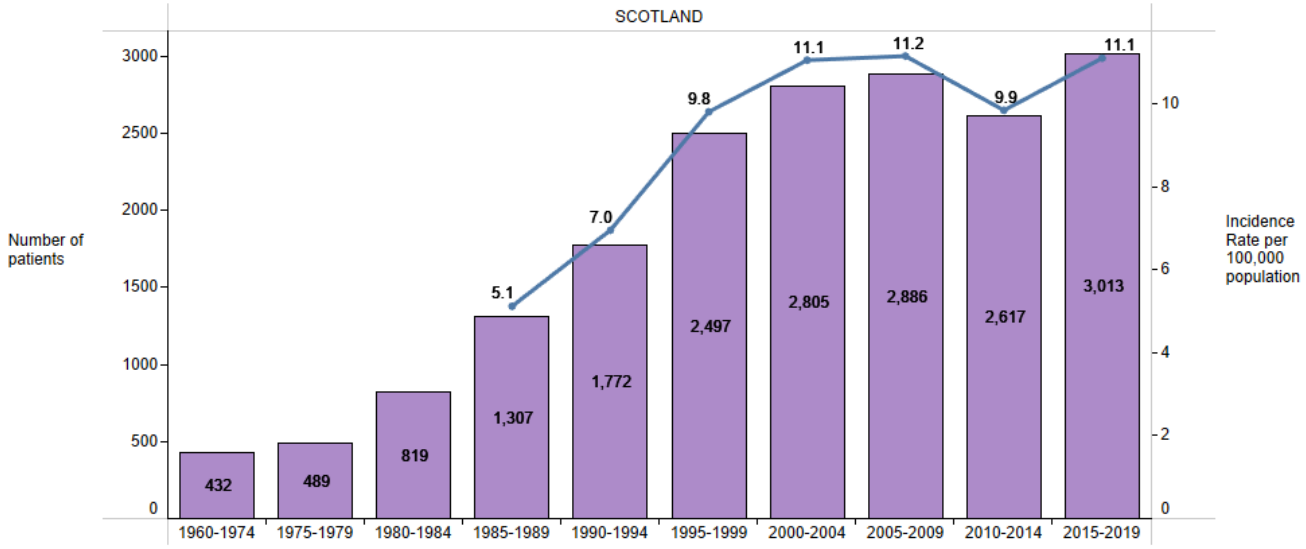
Patients who recover native renal function

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.

Annual Incidence of new patients starting RRT between 1960-2019 in Scotland



Annual incidence per 100,000 population of new patients starting RRT between 1985-2019

Year Start	Incident count	Scotland Mid-year population*	Incident rate per 100,000 Scottish population
1985-1989	1307	5,098,860	5.1
1990-1994	1772	5,088,978	7.0
1995-1999	2497	5,085,648	9.8
2000-2004	2805	5,069,188	11.1
2005-2009	2886	5,169,600	11.2
2010	520	5,262,200	9.9
2011	505	5,272,210	9.6
2012	527	5,262,830	10.0
2013	510	5,327,700	9.6
2014	555	5,326,020	10.4
2015	620	5,373,000	11.5
2016	569	5,382,850	10.6
2017	635	5,424,800	11.7
2018	617	5,438,100	11.3
2019	571	5,413,660	10.5

*The population estimates shown for the five year bands between 1984 and 2009 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.

RTT Incidence

The incidence of new patients starting RRT in each NHS 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. 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.

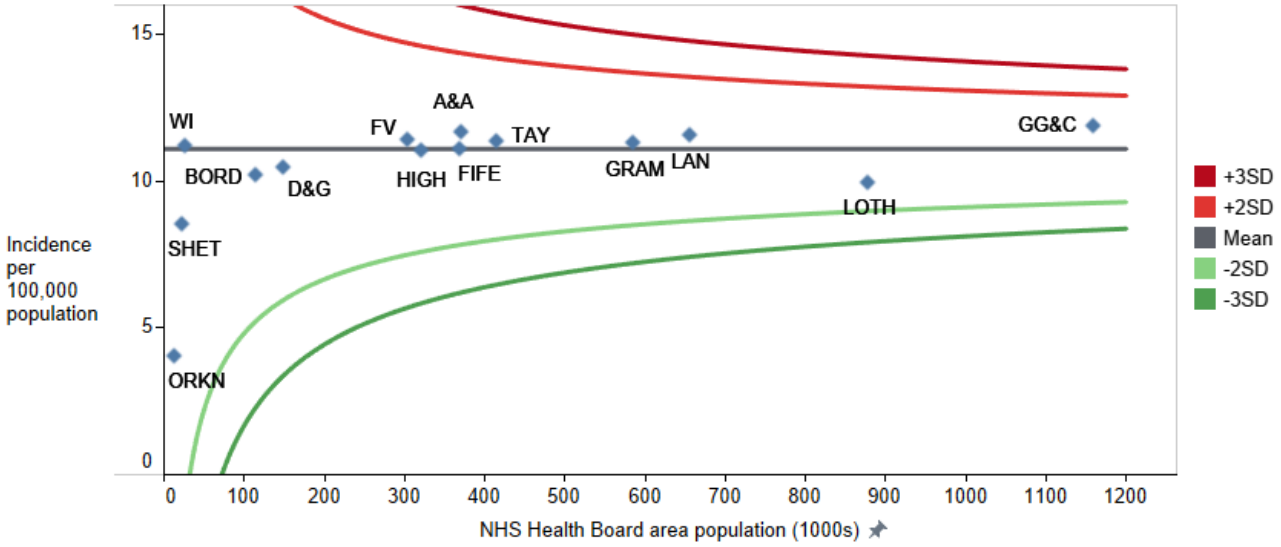
The age, sex, SIMD standardised incidence is the total number of residents who would be expected to start RRT in an NHS Board area population, if the age, sex, SIMD structure of the Board area was the same as that of Scotland as a whole. A five year incident period from 2015 to 2019 has been used to minimise the impact of year to year fluctuations in numbers of patients.

Annual Incidence of patients starting RRT 2015-2019 by NHS Board area of residence standardised for age, sex and social deprivation

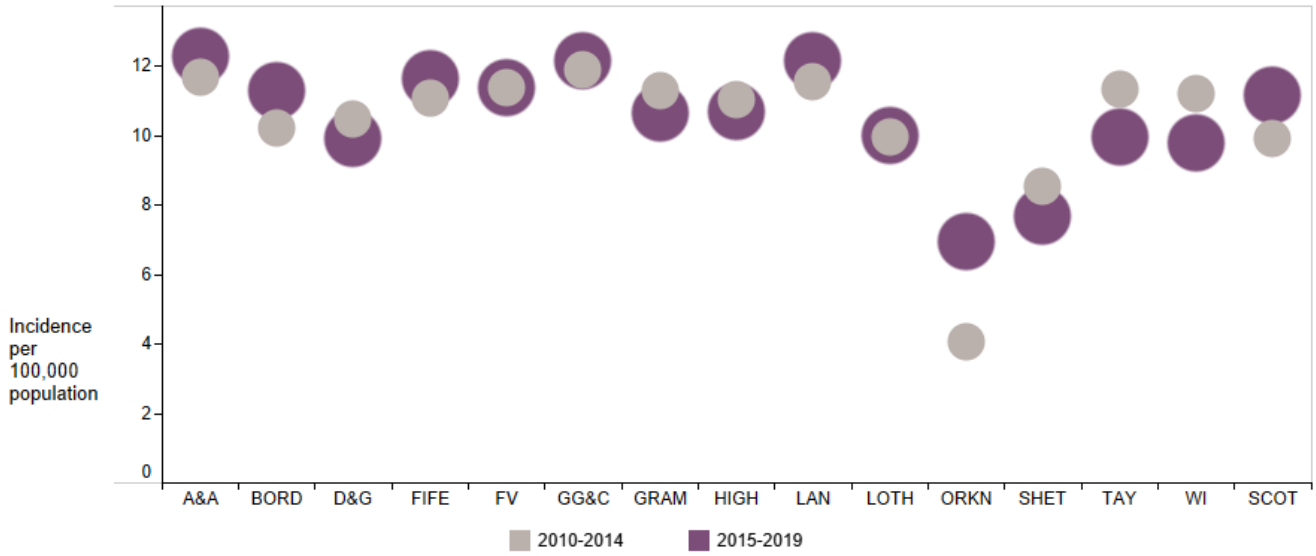
	Number starting RRT	Incidence* per 100,000 population	Standardised Incidence* per 100,000 population
NHS Ayrshire and Arran	254	13.7	12.3
NHS Borders	61	10.6	11.3
NHS Dumfries and Galloway	86	11.5	9.9
NHS Fife	221	11.9	11.6
NHS Forth Valley	169	11.1	11.4
NHS Grampian	284	9.7	10.6
NHS Greater Glasgow and Clyde	714	12.2	12.2
NHS Highland	177	11.0	10.7
NHS Lanarkshire	416	12.6	12.1
NHS Lothian	381	8.6	10.0
NHS Orkney	10	11.3	6.9
NHS Shetland	9	9.7	7.6
NHS Tayside	215	10.3	9.9
NHS Western Isles	16	14.8	9.8
Scotland	**3013**	**11.1**	**11.2**

*The population estimates shown for the five year bands between 2015-2019 are the arithmetical mean of the mid-year population estimates, the annual incidence of new patients is averaged over the five year periods.

Annual Incidence of new patients starting RRT 2015-2019 by NHS Board area of residence standardised for age, sex and social deprivation

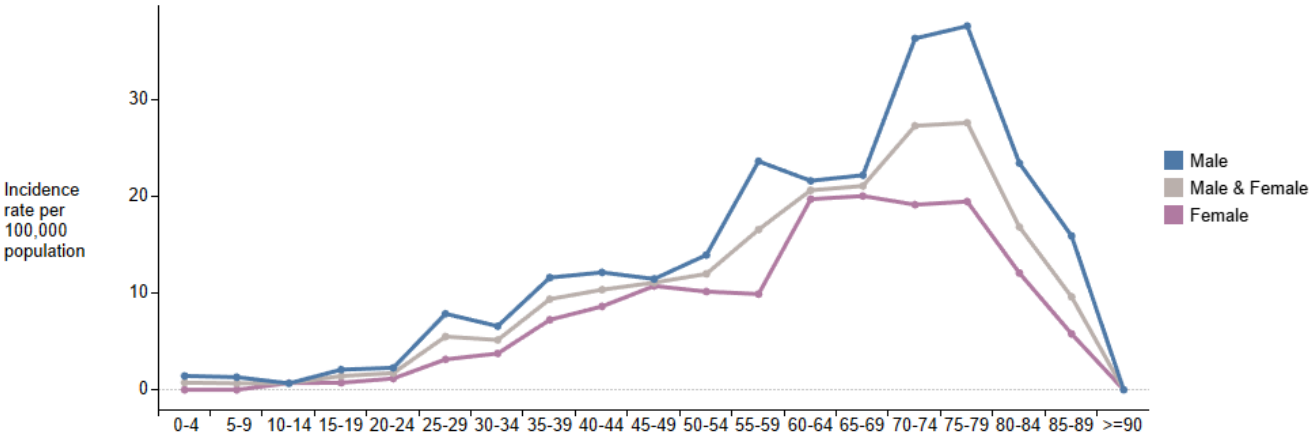


Standardised Annual Incidence of patients starting RRT 2010-2014 & 2015-2019

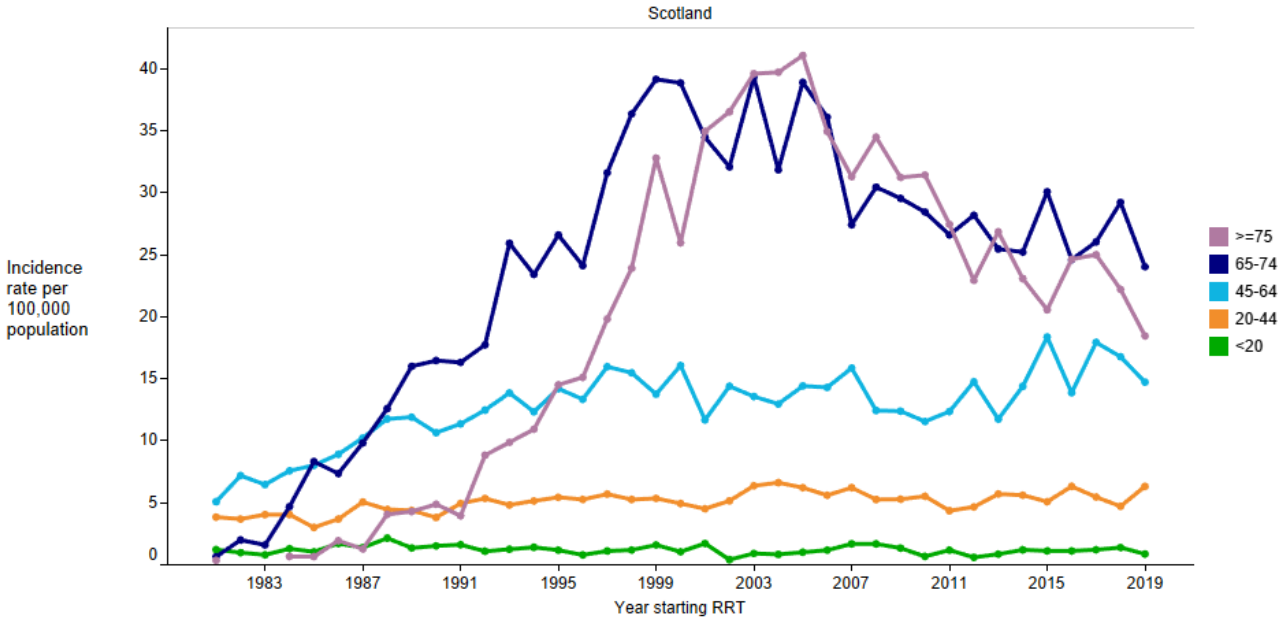


General Population and Incident RRT per 100,000 population

Age specific annual incidence of new patients starting RRT in 2019 per 100,000 population



Age specific annual incident RRT population per 100,000 population



Number of patients in each age group and median age when starting RRT 1960-2019

	<20		20-44		45-64		65-74		>=75		Median Age
	n	%	n	%	n	%	n	%	n	%	
1960-1974	69	16	276	64	85	20	2	0	0	0	33.78
1975-1979	59	12	240	49	183	37	7	1	0	0	40.58
1980-1984	87	11	317	39	367	45	45	5	3	0	45.39
1985-1989	98	7	365	28	562	43	240	18	42	3	52.72
1990-1994	79	4	429	24	685	39	450	25	129	7	58.12
1995-1999	71	3	478	19	860	34	717	29	371	15	62.95
2000-2004	57	2	453	16	853	30	795	28	647	23	65.43
2005-2009	75	3	475	16	921	32	748	26	667	23	64.49
2010-2014	48	2	424	16	925	35	671	26	549	21	63.54
2015-2019	63	2	480	16	1219	40	753	25	498	17	61.63
All	**706**	**4**	**3937**	**21**	**6660**	**36**	**4428**	**24**	**2906**	**16**	**60.11**

Number and median age of patients starting RRT 2015-2019 by renal unit

Renal Unit	2015-2019		2019	
	Number starting RRT	Median Age	Number starting RRT	Median Age
ARI	260	63	29	61
XH	222	67	45	72
DGRI	77	67	18	64
GLAS	1023	61	203	59
MONK	324	62	71	63
NINE	208	64	27	59
RAIG	133	65	18	53
RHC	49	9	7	10
RIE	521	60	108	59
VHK	196	64	45	61
Scotland	**3013**	**62**	**571**	**61**

Number of patients in each age group and median age when starting RRT 2015-2019 by NHS Board area of residence

	<20	20-44	45-64	65-74	>=75	Number starting RRT 2015-2019	Median Age
NHS Ayrshire and Arran	5	31	97	57	64	254	64
NHS Borders	1	8	23	22	7	61	62
NHS Dumfries and Galloway	1	11	30	24	20	86	66
NHS Fife	6	35	86	59	35	221	63
NHS Forth Valley	3	31	69	36	30	169	60
NHS Grampian	7	49	121	71	36	284	61
NHS Greater Glasgow and Clyde	16	120	288	173	117	714	62
NHS Highland	1	32	62	51	31	177	63
NHS Lanarkshire	11	64	179	94	68	416	61
NHS Lothian	5	67	162	98	49	381	61
NHS Orkney			5	3	2	10	63
NHS Shetland		1	4	4		9	63
NHS Tayside	6	29	87	55	38	215	63
NHS Western Isles	1	2	6	6	1	16	61
Scotland	**63**	**480**	**1219**	**753**	**498**	**3013**	**62**

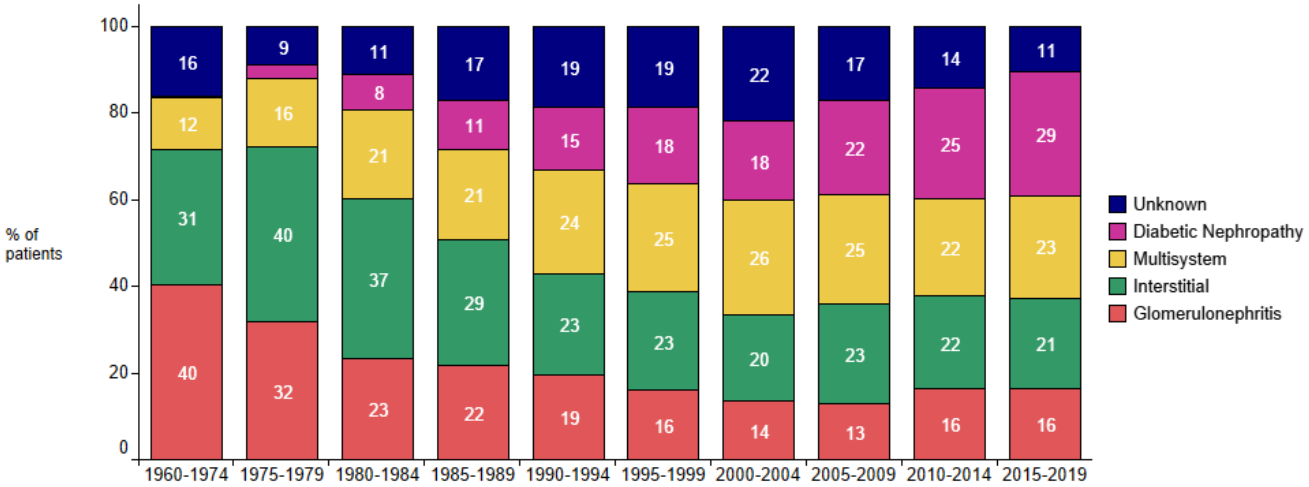
Primary Renal Diagnosis of patients starting RRT

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:

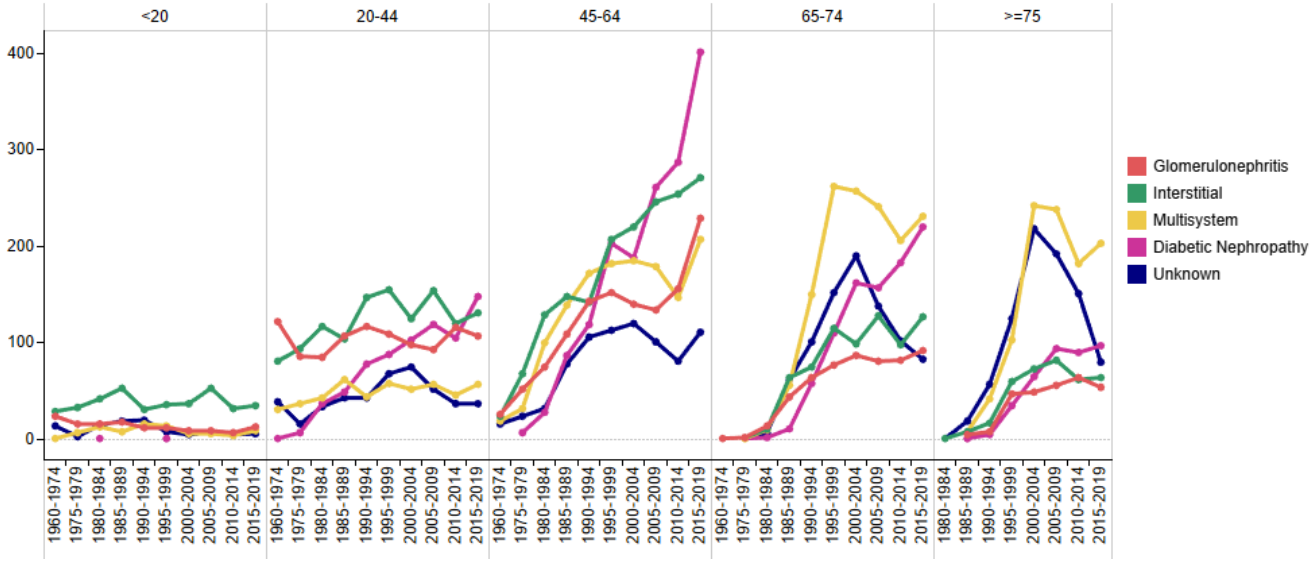
http://www.srr.scot.nhs.uk/Projects/Methods.html

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).

Percentage of patients in each diagnosis group starting RRT 1960-2019



Number of patients in each diagnosis group starting RRT 1960-2019, split by age group



Number of patients in each diagnosis group starting RRT 1960-2019

Year	Glomerulo nephritis		Interstitial		Multisystem		Diabetic Nephropathy		Unknown		Missing		
	n	%	n	%	n	%	n	%	n	%	n	%	Total
1960-1974	173	5	135	3	51	1	2	0	69	2	2	7	432
1975-1979	156	5	197	4	77	2	15	0	44	1	0	0	489
1980-1984	190	6	300	7	167	4	68	2	89	3	5	17	819
1985-1989	283	9	377	9	273	6	148	4	221	7	5	17	1307
1990-1994	344	11	412	9	424	10	260	7	327	11	5	17	1772
1995-1999	397	12	573	13	619	14	437	12	466	15	5	17	2497
2000-2004	383	12	554	13	742	17	518	14	608	20	0	0	2805
2005-2009	373	12	663	15	721	17	631	17	490	16	8	27	2886
2010-2014	425	13	566	13	585	13	665	18	376	13	0	0	2617
2015-2019	495	15	628	14	707	16	866	24	317	11	0	0	3013

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 2015 and 2019 (n=866), 67% are attributed to type II diabetes.

The median age when starting RRT attributed to type 1 diabetes is 46 years (IQR 38,55) and 64 years (IQR 58,71) for type 2 diabetes.

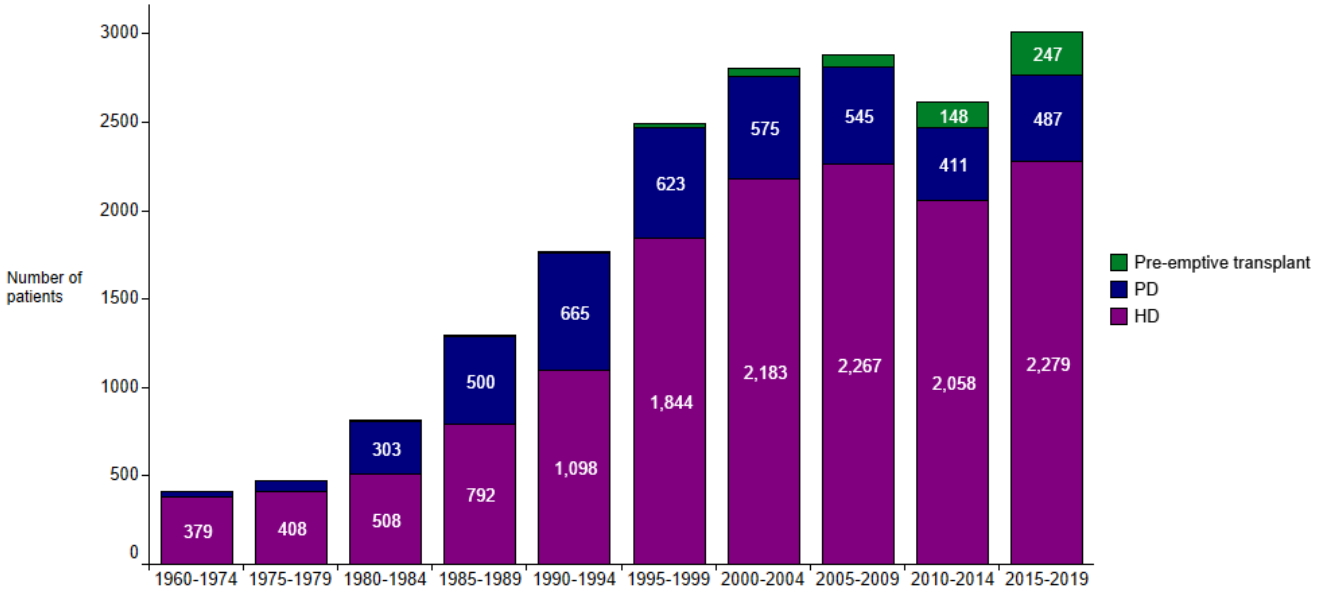
The increase in number of patients starting RRT with a PRD of diabetic nephropathy is mainly due to the increase in those in the 45-64 age group.

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.

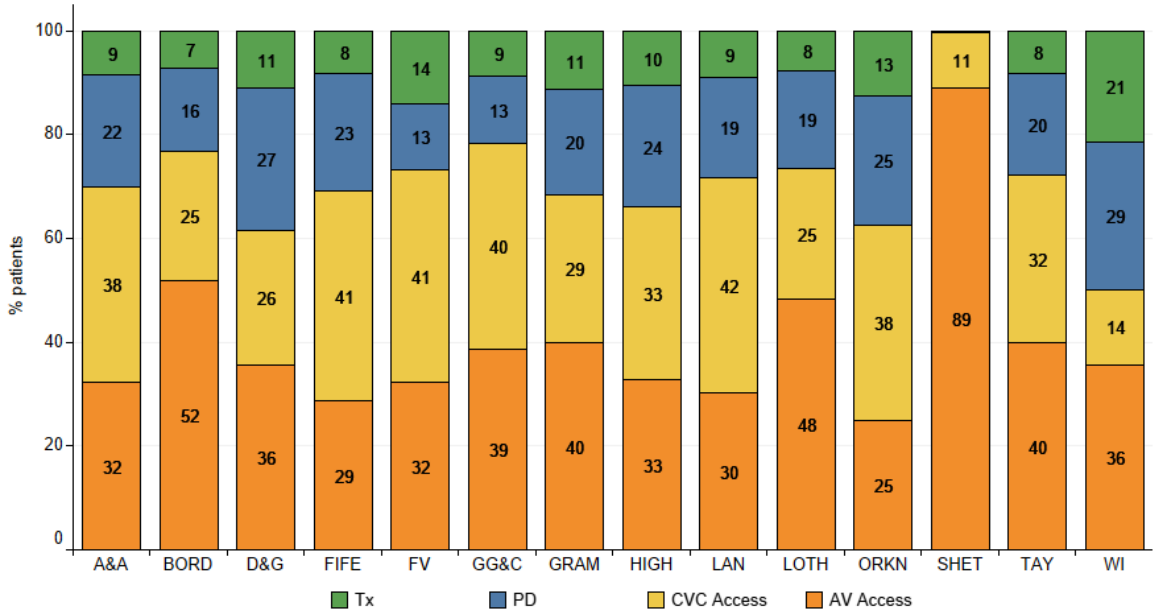
Mode of first RRT between 1960-2019



Mode of first RRT between 1960-2019

	HD		PD		Pre-emptive transplant	
	n	%	n	%	n	%
1960-1974	379	93	30	7	0	-
1975-1979	408	86	66	14	0	-
1980-1984	508	63	303	37	1	0
1985-1989	792	61	500	39	5	0
1990-1994	1098	62	665	38	6	0
1995-1999	1844	74	623	25	25	1
2000-2004	2183	78	575	21	46	2
2005-2009	2267	79	545	19	71	2
2010-2014	2058	79	411	16	148	6
2015	477	77	92	15	51	8
2016	433	76	102	18	34	6
2017	498	78	84	13	54	8
2018	455	74	114	18	48	8
2019	416	73	95	17	60	11

Incident patients first mode of RRT and vascular access for first HD by NHS Board of residence between 2015-2019



Incident patients first mode of RRT and vascular access for first HD by NHS Board of residence between 2015-2019

	AV Access		CVC Access		PD		Tx	
	n	%	n	%	n	%	n	%
NHS Ayrshire and Arran	72	32.3	84	37.7	48	21.5	19	8.5
NHS Borders	29	51.8	14	25.0	9	16.1	4	7.1
NHS Dumfries and Galloway	26	35.6	19	26.0	20	27.4	8	11.0
NHS Fife	56	28.7	79	40.5	44	22.6	16	8.2
NHS Forth Valley	48	32.2	61	40.9	19	12.8	21	14.1
NHS Grampian	102	39.8	73	28.5	52	20.3	29	11.3
NHS Greater Glasgow and Clyde	249	38.5	257	39.8	84	13.0	56	8.7
NHS Highland	50	32.7	51	33.3	36	23.5	16	10.5
NHS Lanarkshire	113	30.1	156	41.6	72	19.2	34	9.1
NHS Lothian	157	48.3	82	25.2	61	18.8	25	7.7
NHS Orkney	2	25.0	3	37.5	2	25.0	1	12.5
NHS Shetland	8	88.9	1	11.1	0	0.0	0	0.0
NHS Tayside	73	39.9	59	32.2	36	19.7	15	8.2
NHS Western Isles	5	35.7	2	14.3	4	28.6	3	21.4
Scotland	**990**	**37.1**	**941**	**35.3**	**487**	**18.3**	**247**	**9.3**

347 patients started HD within 90 days of presenting to a nephrologist and have been excluded from this graph. This allows comparison with the UK Renal Association guideline.

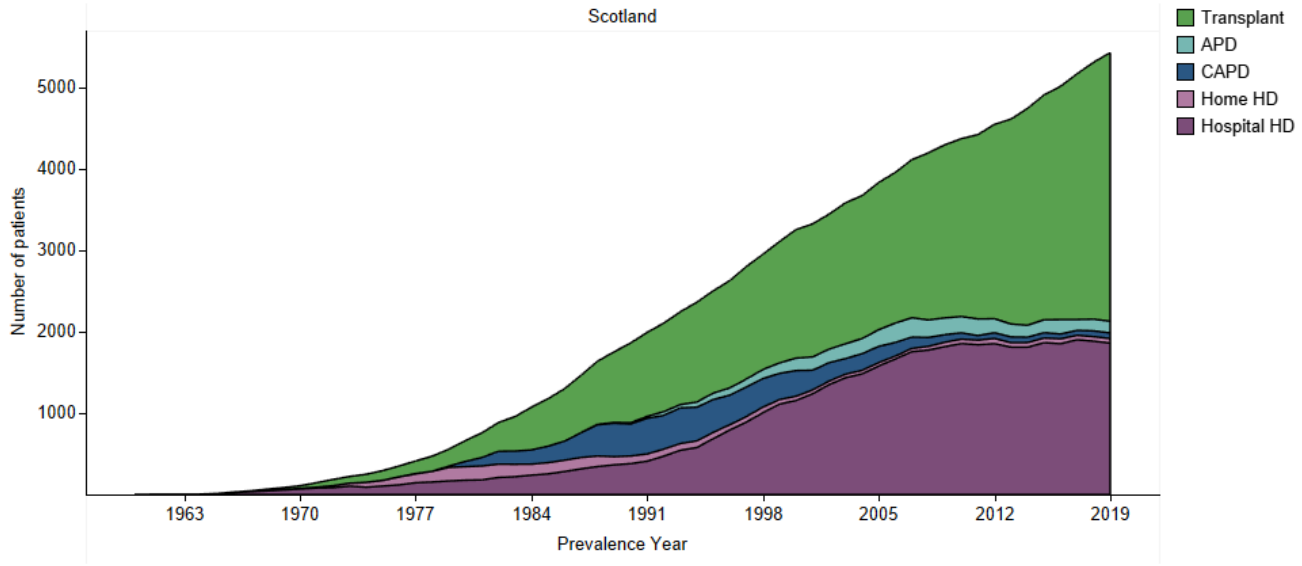
The UK Renal Association guideline on initiation of RRT suggests that patients known to nephrology services for 3 months or more and who are planned to have renal support should start RRT using an established access (arteriovenous fistula [AVF], arteriovenous graft [AVG], PD catheter) or by pre-emptive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

Prevalence

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

Patients whose treatment started on or before 31 December 2019 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.

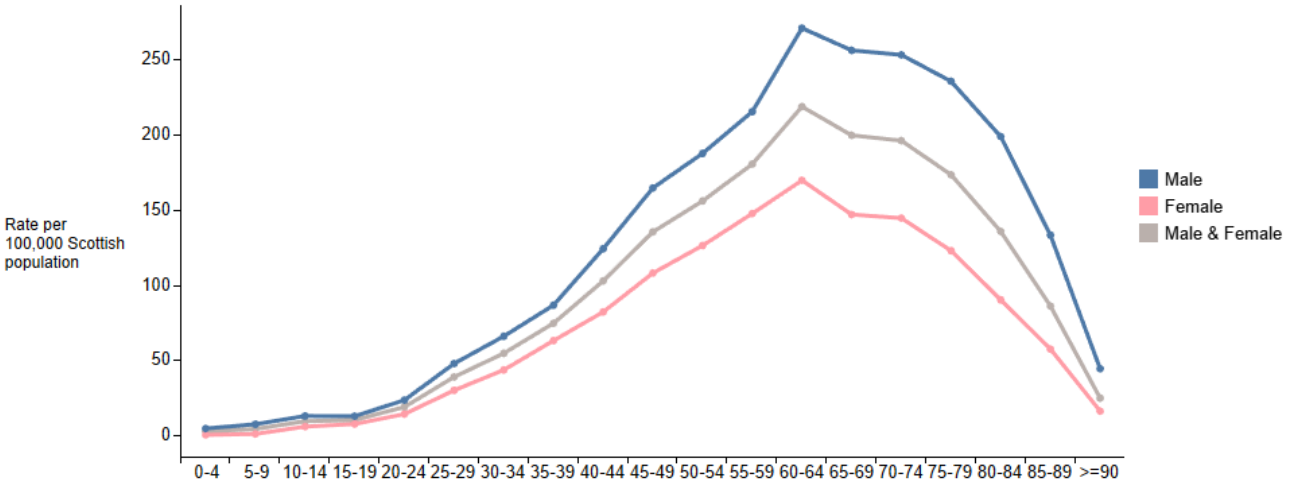
Prevalent patients on 31 December between 1960 – 2019



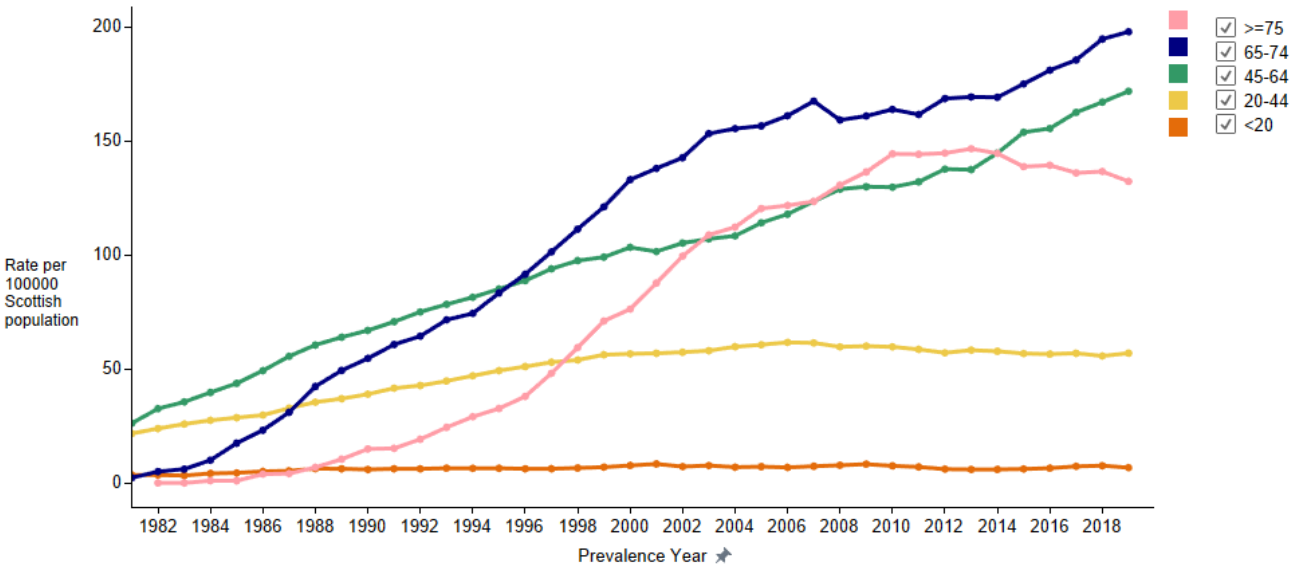
Prevalent patients on 31 December between 1960 – 2019

	Hospital HD		Home HD		CAPD		APD		Transplant		Total
	N	%	N	%	N	%	N	%	N	%	N
1975	104	35	69	23	2	1	0	-	119	40	294
1980	176	27	167	25	64	10	0	-	256	39	663
1985	254	22	138	12	202	17	0	-	584	50	1178
1990	380	20	94	5	393	21	17	1	981	53	1865
1995	688	27	78	3	403	16	79	3	1258	50	2506
2000	1157	35	52	2	316	10	153	5	1582	49	3260
2005	1581	41	42	1	200	5	205	5	1811	47	3839
2010	1857	42	54	1	78	2	201	5	2188	50	4378
2015	1868	38	57	1	66	1	159	3	2766	56	4916
2016	1855	37	61	1	59	1	177	4	2871	57	5023
2017	1904	37	55	1	61	1	133	3	3024	58	5177
2018	1886	35	56	1	71	1	144	3	3161	59	5318
2019	1863	34	56	1	69	1	144	3	3304	61	5436

Age specific prevalence of RRT patients on 31 December 2019 per 100,000 Scottish population



Age specific prevalent RRT population 1981-2019 per 100,000 Scottish population



	Hospital HD		Home HD		CAPD		APD		Transplant		
	n	%	n	%	n	%	n	%	n	%	Total
75+	453	24	5	9	8	12	23	16	128	4	617
65-74	494	27	6	11	25	36	38	26	582	18	1145
45-64	715	38	37	66	25	36	49	34	1754	53	2580
20-44	192	10	7	13	11	16	26	18	777	24	1013
<20	9	0	1	2	0	0	8	6	63	2	81
Total	**1863**	**-**	**56**	**-**	**69**	**-**	**144**	**-**	**3304**	**-**	**5436**
Median Age	65		56		63		61		55		

Number and percentage of patients in each age group receiving RRT at each renal unit on 31 December 2019

Unit	<20		20-44		45-64		65-74		>=75		Total
	n	%	n	%	n	%	n	%	n	%	
ARI	2	0	132	23	252	45	124	22	54	10	564
XH	1	0	52	14	180	50	83	23	43	12	359
DGRI	1	1	24	16	69	46	33	22	22	15	149
GLAS	4	0	372	20	906	49	374	20	200	11	1856
MONK	2	0	105	20	250	48	102	19	67	13	526
NINE	1	0	66	15	213	47	102	23	67	15	449
RAIG	0	0	48	17	140	49	61	22	34	12	283
RHC	68	100	0	0	0	0	0	0	0	0	68
RIE	2	0	162	18	446	50	190	21	85	10	885
VHK	0	0	52	18	124	42	76	26	45	15	297
Scotland	**81**	**1**	**1013**	**19**	**2580**	**47**	**1145**	**21**	**617**	**11**	**5436**

Number and percentage of patients on each mode of RRT and renal unit providing treatment on 31 December 2019

Unit	Hospital HD		Home HD		CAPD		APD		Transplant		Total
	n	%	n	%	n	%	n	%	n	%	n
ARI	191	34	3	1	22	4	0	-	348	62	564
XH	139	39	14	4	0	-	24	7	182	51	359
DGRI	51	34	2	1	1	1	7	5	88	59	149
GLAS	576	31	18	1	10	1	35	2	1217	66	1856
MONK	208	40	0		9	2	12	2	297	56	526
NINE	162	36	7	2	0	-	21	5	259	58	449
RAIG	93	33	7	2	12	4	0	-	171	60	283
RHC	8	12	1	1	0	-	7	10	52	76	68
RIE	295	33	2	0	14	2	27	3	547	62	885
VHK	140	47	2	1	1	0	11	4	143	48	297
Scotland	**1863**	**34**	**56**	**1**	**69**	**1**	**144**	**3**	**3304**	**61**	**5436**

Number of patients in each age group and median age by NHS Board of residence on 31 December 2019

	<20		20-44		45-64		65-74		>=75		Median Age
	n	%	n	%	n	%	n	%	n	%	
NHS Ayrshire and Arran	6	1	59	14	205	50	92	22	49	12	60
NHS Borders	1	1	17	15	60	51	29	25	10	9	58
NHS Dumfries and Galloway	2	1	23	15	72	46	37	24	22	14	60
NHS Fife	5	1	63	17	154	43	87	24	52	14	60
NHS Forth Valley	4	1	55	19	134	46	64	22	37	13	58
NHS Grampian	9	2	121	22	243	45	117	22	54	10	57
NHS Greater Glasgow and Clyde	21	2	251	20	629	49	242	19	131	10	57
NHS Highland	3	1	58	17	161	48	72	21	43	13	58
NHS Lanarkshire	15	2	159	22	339	47	135	19	79	11	57
NHS Lothian	6	1	132	18	358	49	157	22	73	10	59
NHS Orkney	1	6	2	13	11	69	2	13			54
NHS Shetland			4	24	4	24	7	41	2	12	65
NHS Tayside	7	2	62	15	197	47	96	23	61	14	59
NHS Western Isles	1	3	6	19	12	39	8	26	4	13	60
Scotland	**81**	**1**	**1012**	**19**	**2579**	**47**	**1145**	**21**	**617**	**11**	**58**

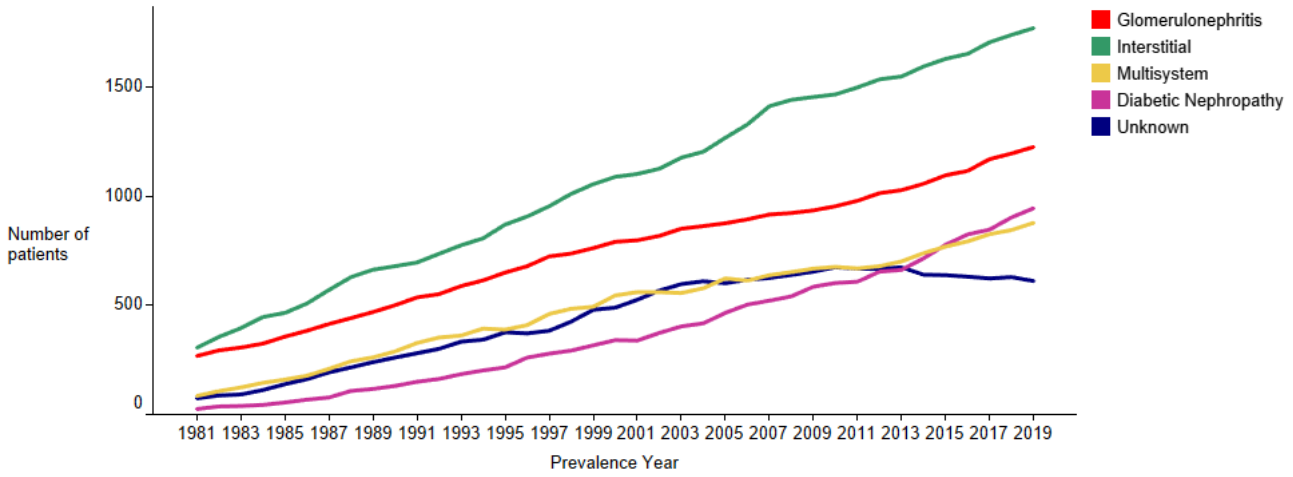
Two patients lived outside of Scotland and were receiving treatment within Scottish renal units on 31 December 2019

Number of patients on each mode of RRT in each NHS Board of residence on 31 December 2019

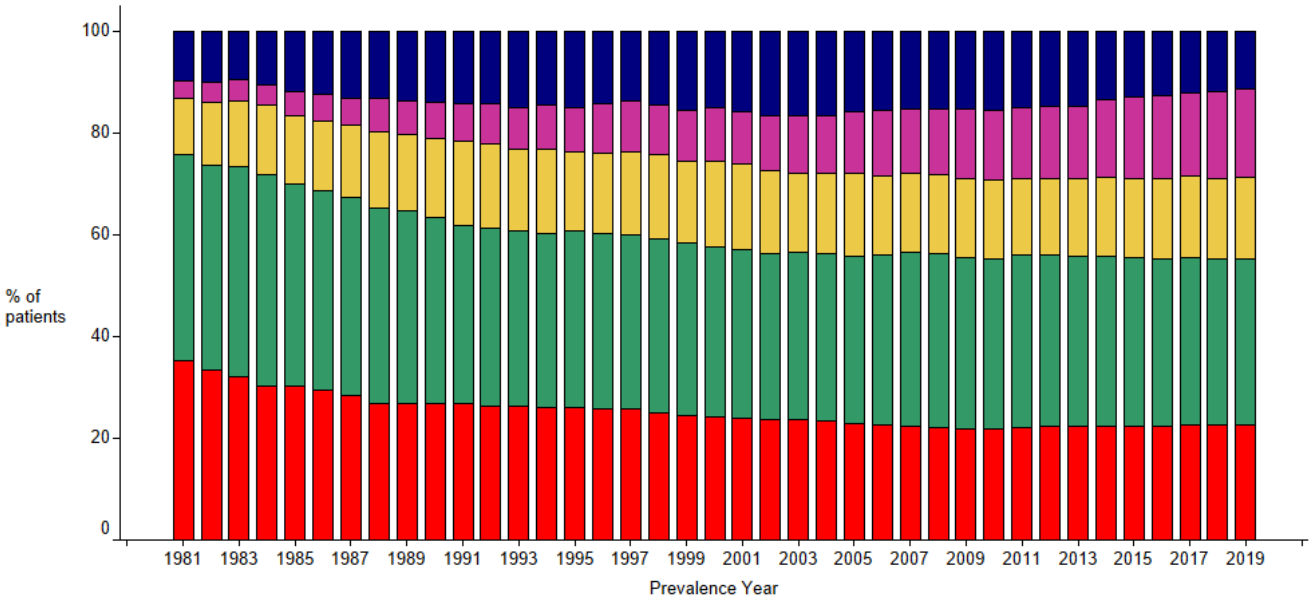
	Hospital HD		Home HD		CAPD		APD		Transplant		Total
	n	%	n	%	n	%	n	%	n	%	
NHS Ayrshire and Arran	146	36	15	4			25	6	225	55	411
NHS Borders	38	32			1	1	4	3	74	63	117
NHS Dumfries and Galloway	50	32	2	1	1	1	6	4	97	62	156
NHS Fife	149	41	3	1	1	0	12	3	196	54	361
NHS Forth Valley	101	34	3	1	1	0	7	2	182	62	294
NHS Grampian	183	34	3	1	21	4	1	0	336	62	544
NHS Greater Glasgow and Clyde	419	33	9	1	7	1	24	2	815	64	1274
NHS Highland	101	30	9	3	12	4	3	1	212	63	337
NHS Lanarkshire	240	33	4	1	10	1	16	2	457	63	727
NHS Lothian	257	35	2	0	13	2	24	3	430	59	726
NHS Orkney	3	19							13	81	16
NHS Shetland	8	47							9	53	17
NHS Tayside	156	37	6	1			22	5	239	57	423
NHS Western Isles	12	39			2	6			17	55	31
Scotland	**1863**	**34**	**56**	**1**	**69**	**1**	**144**	**3**	**3302**	**61**	**5434**

Prevalence over time by Primary Renal Diagnosis (PRD)

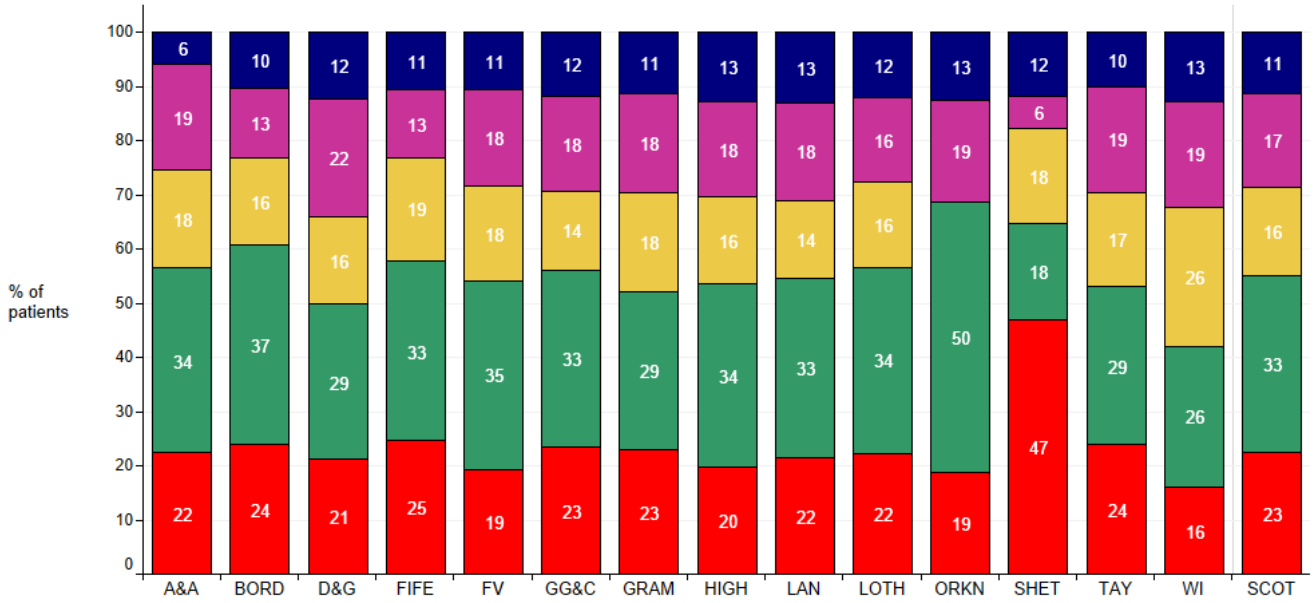
Number of people receiving RRT on 31 December 1981 - 2019 by PRD



Percentage of people receiving RRT on 31 December 1981 - 2019 by PRD



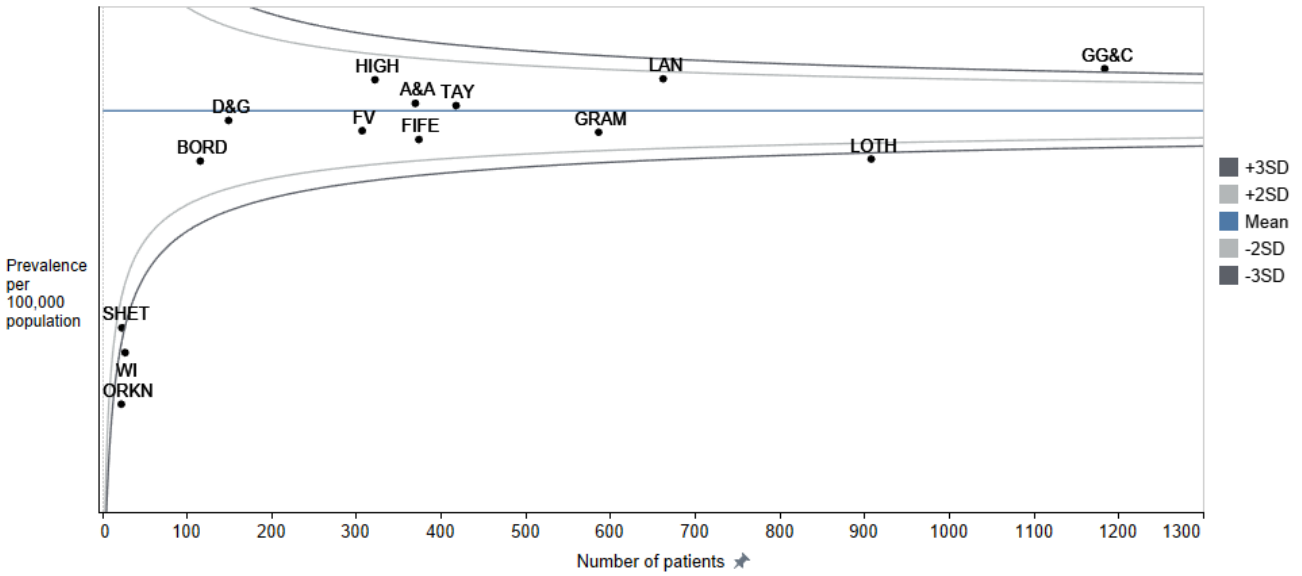
Percentage of patients in each PRD group and their NHS Board area of residence 31 December 2019



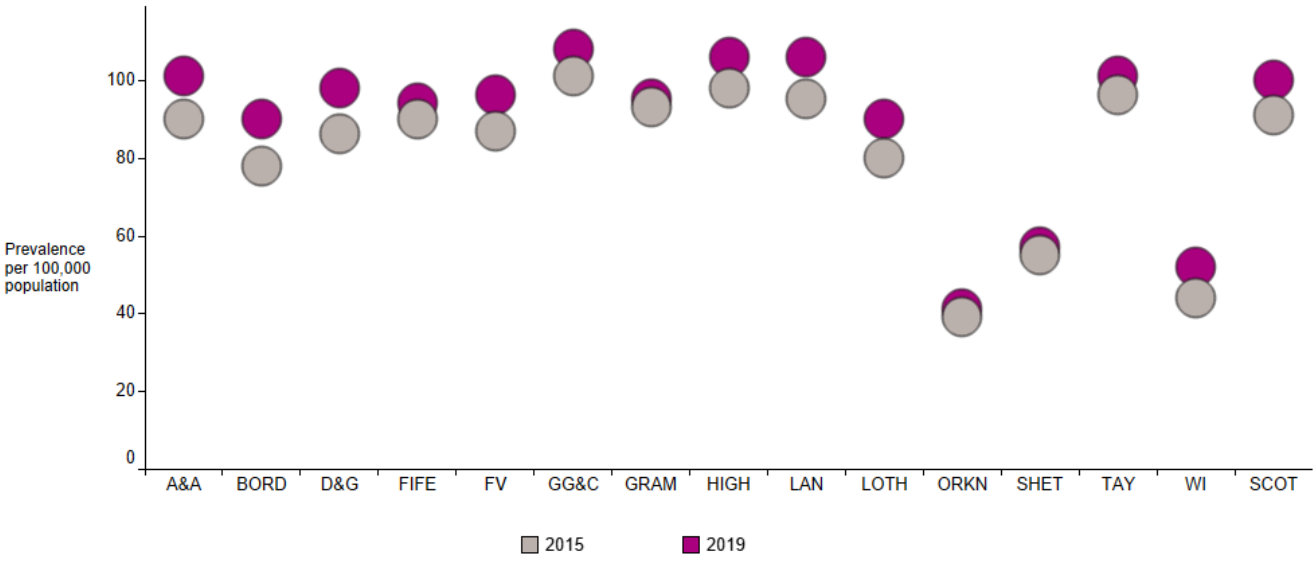
Prevalence of patients receiving RRT

	Population on 30 June 2019	RRT population 31 December 2019	Prevalence per 100,000 population	Standardised prevalence per 100,000 population
NHS Ayrshire and Arran	369,360	411	111	101
NHS Borders	115,510	117	101	90
NHS Dumfries and Galloway	148,860	156	105	98
NHS Fife	373,550	361	97	94
NHS Forth Valley	306,640	294	96	96
NHS Grampian	585,700	544	93	95
NHS Greater Glasgow and Clyde	1,183,120	1,274	108	108
NHS Highland	321,700	337	105	106
NHS Lanarkshire	661,900	727	110	106
NHS Lothian	907,580	726	80	90
NHS Orkney	22,270	16	72	41
NHS Shetland	22,920	17	74	57
NHS Tayside	417,470	423	101	101
NHS Western Isles	26,720	31	116	52

Prevalence of patients receiving RRT on 31 December 2019 by NHS Board: standardised for age, sex and social deprivation



Prevalence of patients receiving RRT on 31 December 2015 and 31 December 2019 by NHS Board: standardised for age, sex and social deprivation



Survival

Survival Analysis

The start date for the survival analyses is the first date of RRT for established renal failure. The end date is the date of death or the censor date of 31 December 2019.

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.

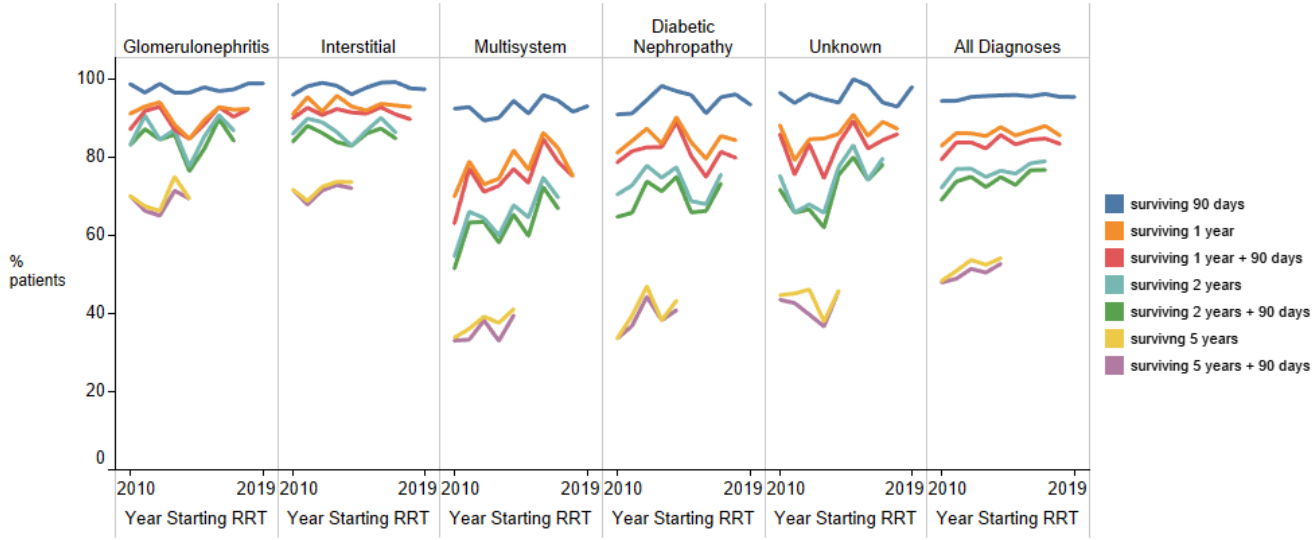
Patients who were lost to follow up or moved, but later came back to have RRT in Scotland had their entire period of RRT included for survival analyses.

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
2010	94.4	82.9	79.4	72.2	69.1	48.3	48.0
2011	94.5	86.2	83.8	77.0	73.8	50.9	48.9
2012	95.4	86.1	83.8	77.1	75.0	53.7	51.4
2013	95.7	85.4	82.2	75.0	72.4	52.5	50.5
2014	95.9	87.7	85.7	76.6	75.0	54.2	52.7
2015	96.0	85.6	83.3	75.8	72.9	-	-
2016	95.6	86.8	84.5	78.4	76.7	-	-
2017	96.2	88.0	84.8	79.0	76.8	-	-
2018	95.5	85.6	83.4	-	-	-	-
2019	95.4	-	-	-	-		-

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.

Trends in survival of patients starting RRT 2010-2019



Proportion of patients starting RRT 2010-2018 surviving at 90 days and 1 year, by NHS Health Board area of residence

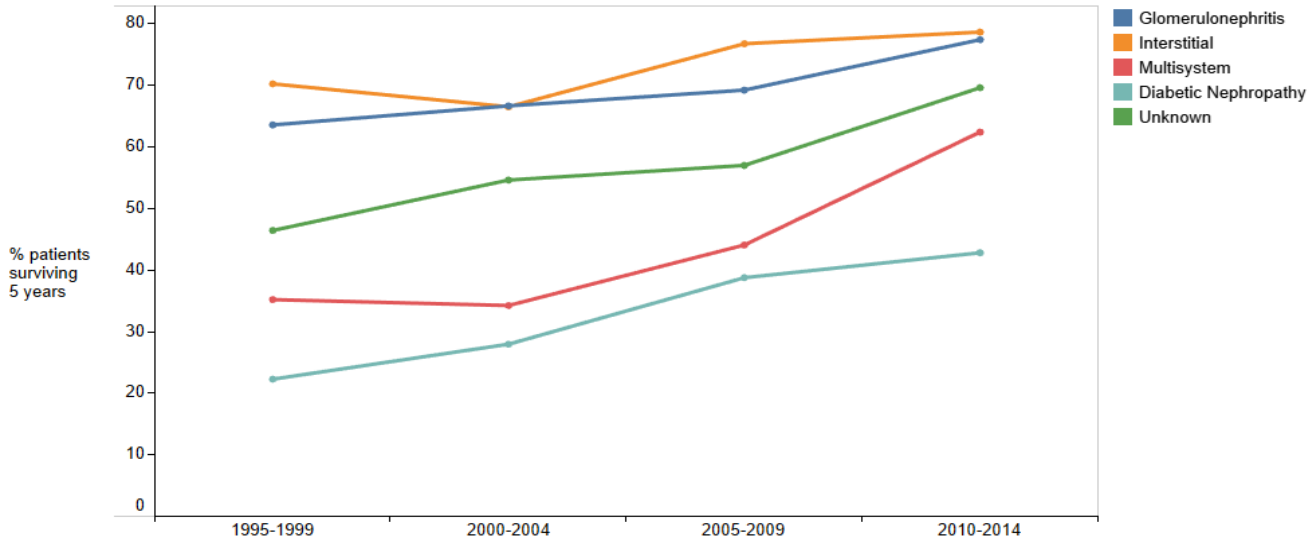
	90 Day Survival		1 Year Survival	
	n	%	n	%
NHS Ayrshire and Arran	388	93	344	82
NHS Borders	93	97	91	95
NHS Dumfries and Galloway	133	96	124	89
NHS Fife	373	95	339	87
NHS Forth Valley	288	96	248	83
NHS Grampian	501	96	465	89
NHS Greater Glasgow and Clyde	1077	95	961	85
NHS Highland	255	96	229	86
NHS Lanarkshire	657	97	583	87
NHS Lothian	590	95	515	85
NHS Orkney	16	94	14	82
NHS Shetland	15	88	13	76
NHS Tayside	386	97	346	87
NHS Western Isles	32	100	31	100
Scotland	**4804**	**95**	**4303**	**86**

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 1995-2014.

Data relating to patients starting RRT after 2014 are excluded to ensure a minimum available follow up period of 5 years.

Trend in 5 year survival from starting RRT 1995-2014 for patients aged 45-64 for each PRD group



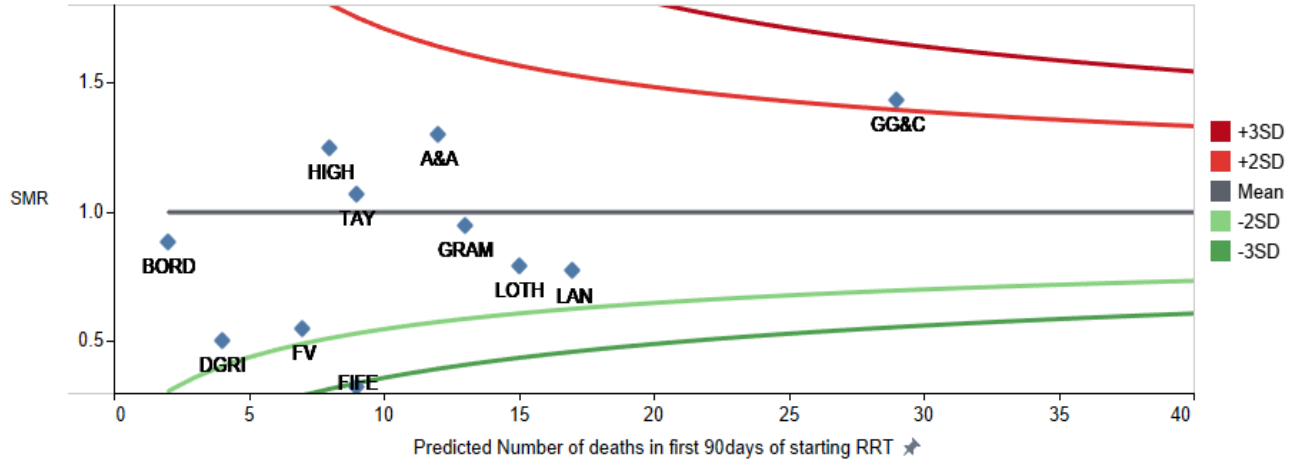
Survival by NHS Board of Residence

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

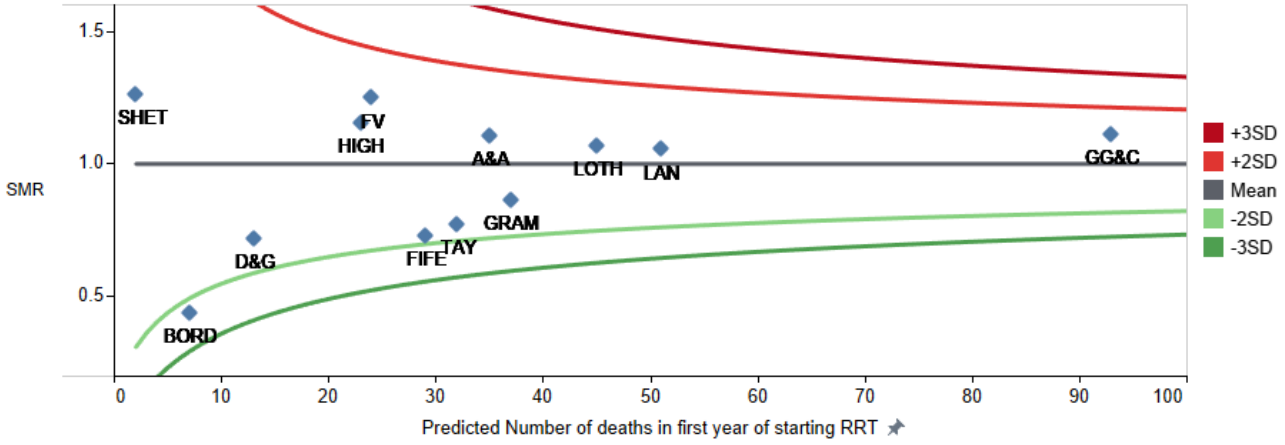
90 day standardised mortality ratio for patients starting RRT 2015-2019 by NHS Board area of residence



NHS GG&C is within 2SD and 3 SD above the Scottish mean. NHS Fife is 3SD below the Scottish Mean. All other areas fall within 3 SD.

The mortality in the first 90 days of RRT for patients starting RRT in the five years 2014-2018 was 4.2%.

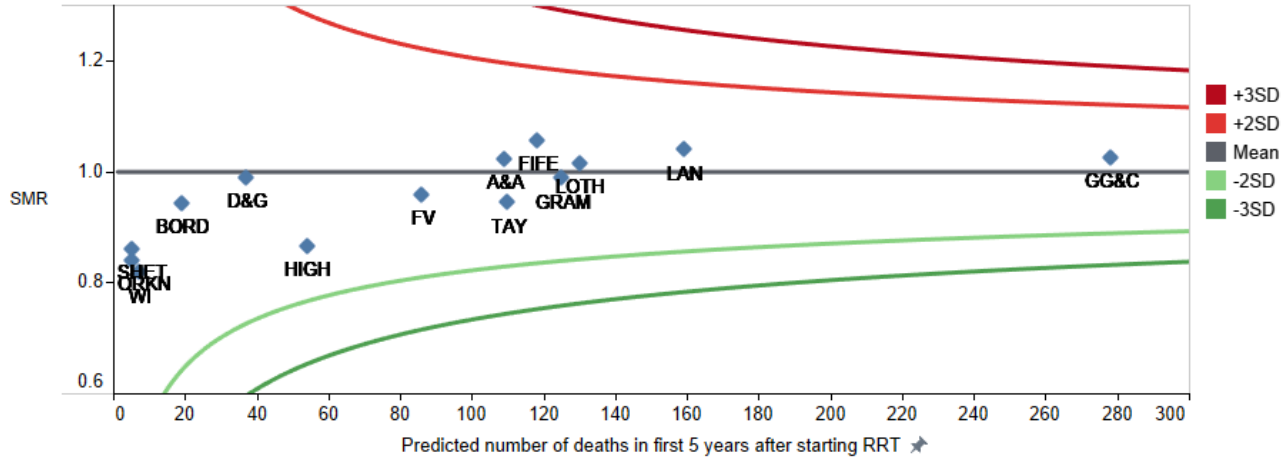
One year standardised mortality ratio for patients starting RRT 2014-2018 by NHS Board area of residence



NHS Borders is between 2 and 3 SD below SMR.

The mortality in the first year of RRT for patients starting RRT in the five years 2014-2018 was 13.3%.

Five year standardised mortality ratio for patients starting RRT 2010-2014 by NHS Board area of residence

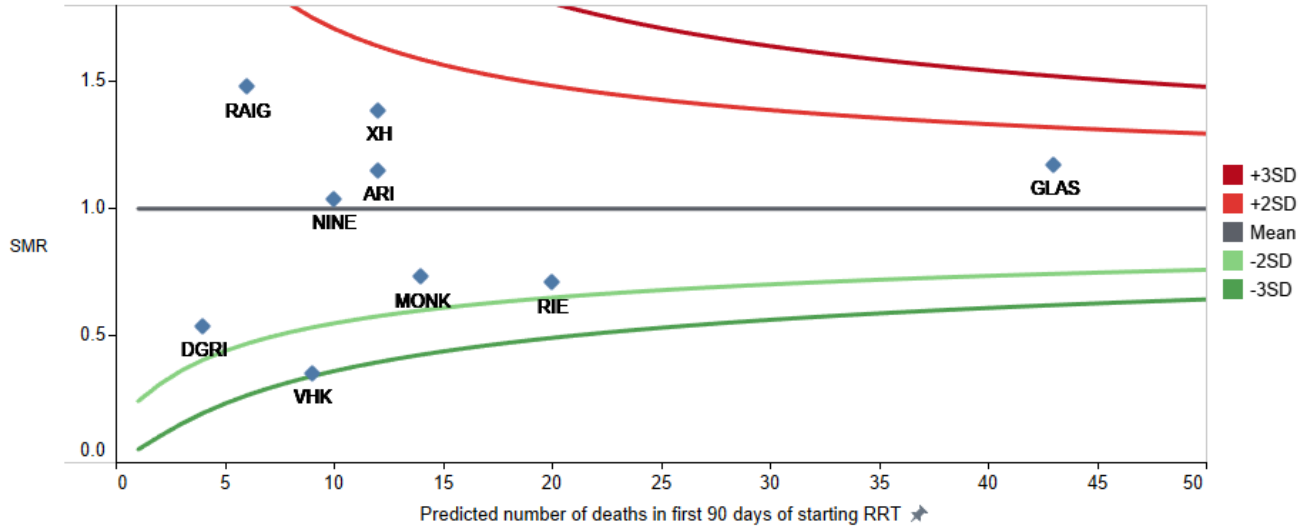


All NHS Health Board areas fall within 3 standard deviations of the mean.

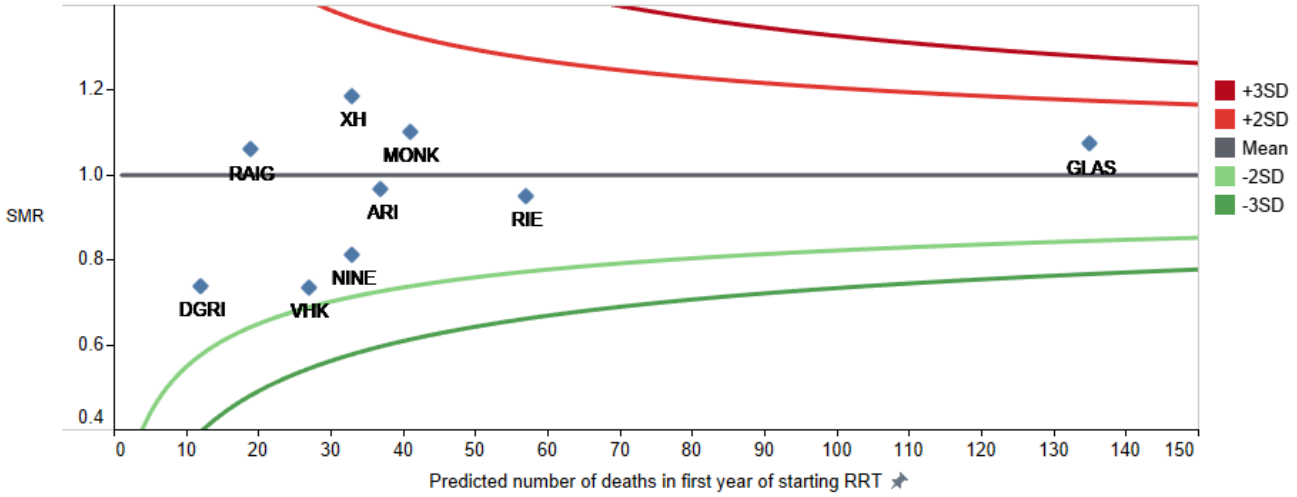
The mortality in the first 5 years of RRT for patients starting RRT in the five years 2010-2014 was 48.0%.

Survival by Renal Unit

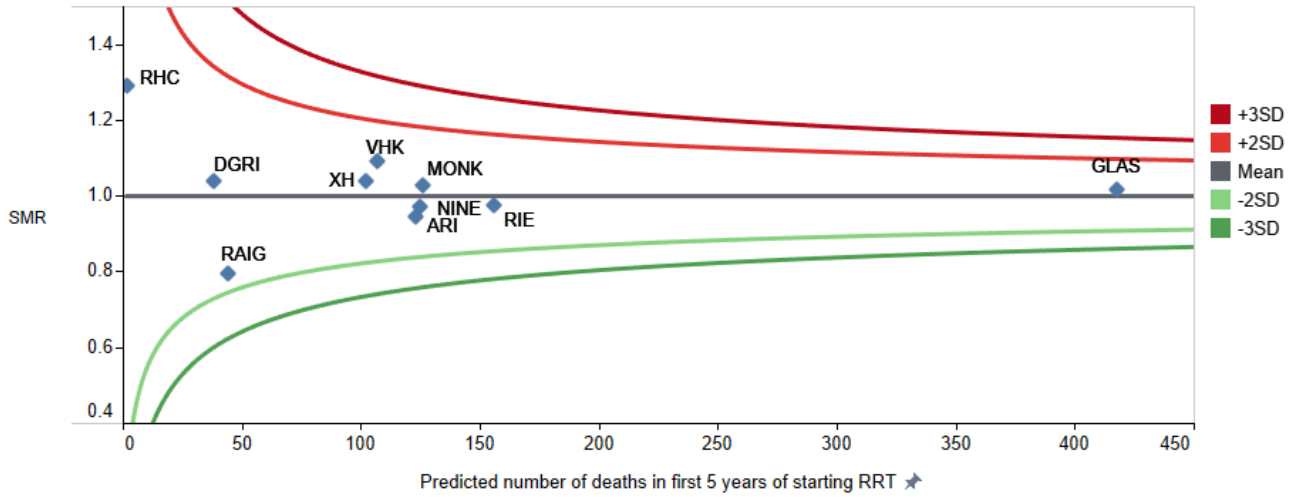
90 day standardised mortality ratio by renal unit providing first RRT for patients starting RRT 2015-2019



One year standardised mortality ratio by renal unit providing first RRT for patients starting RRT 2014-2018



Five year standardised mortality ratio by renal unit providing first RRT for patients starting RRT 2010-2014



Cause of Death

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:

72% of those dying between 1990-1999
51% between 2000-2007
99% since 2008 and the start of the SMARRT audit.

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

Year of death	Number of deaths	% of deaths in RRT populati on*	Age at death Median	Age at death IQR	Age when Starting RRT (Years) Median	Age when Starting RRT (Years) IQR	Time on RRT before death (Years) Median	Time on RRT before death (Years) IQR
2008-2014**	3038	8.3	71	(61,78)	66	(54,75)	3	(1,22)
2015	461	8.6	71	(61,78)	66	(53,74)	4	(1,24)
2016	471	8.6	70	(59,78)	62	(50,73)	4	(1,25)
2017	488	8.6	71	(62,78)	65	(53,74)	4	(1,26)
2018	471	8.1	69	(60,77)	64	(50,74)	4	(1,27)
2019	464	7.9	72	(61,79)	64	(53,74)	4	(1,26)

* 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

Cause of death group and modality of RRT at death 2008-2019

	HD		PD		Tx		RRT Stopped*		
Cause of Death	n	%	n	%	n	%	n	%	Total
Cardiovascular	1343	35	126	40	211	25	28	7	1708
Infection	865	22	47	15	234	28	37	10	1183
Malignancy	306	8	26	8	201	24	55	15	588
Other	469	12	54	17	143	17	26	7	692
RRT Complication	73	2	19	6	10	1	5	1	107
Treatment Withdrawn	756	20	39	12	24	3	224	59	1043
Missing	51	1	2	1	17	2	2	1	72
Total	**3863**	**100**	**313**	**100**	**840**	**100**	**377**	**100**	**5393**

* 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 2008-2019 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 2008-2019 22 patients stopped RRT and then survived for more than 90 days. They had received RRT for a median of 325 days, range 6-4174 days before stopping RRT.

Cause of death by age group 2008-2019

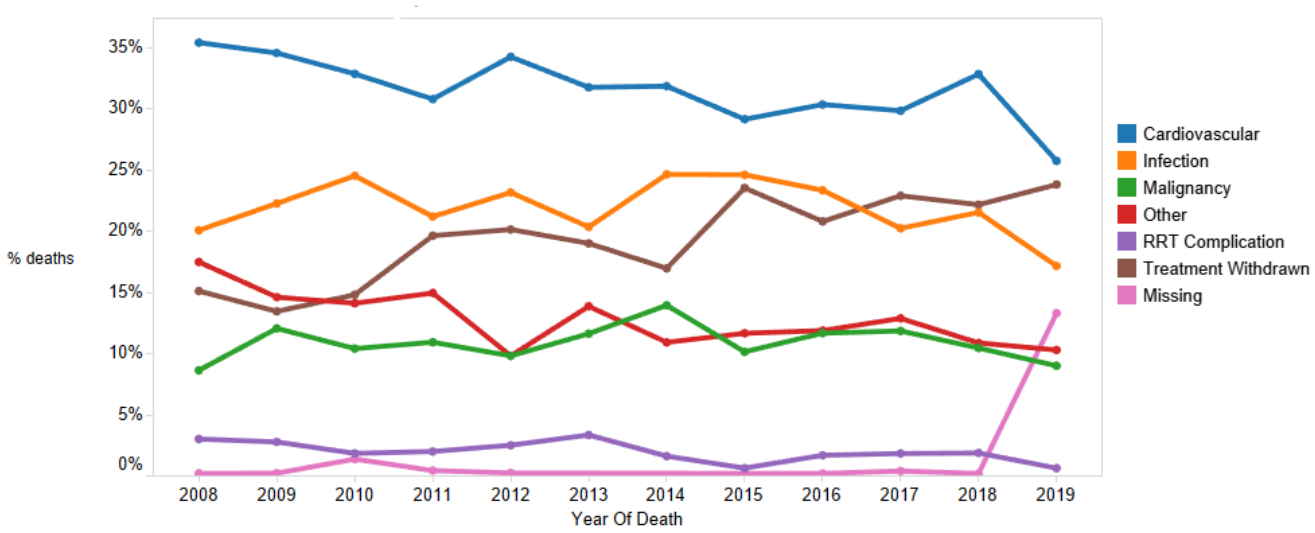
Cause of Death	<20		20-44		45-64		65-74		>=75		Total
	n	%	n	%	n	%	n	%	n	%	
Cardiovascular	2	22	88	33	555	38	496	31	567	27	1708
Infection	1	11	50	19	316	21	371	23	445	22	1183
Malignancy	1	11	23	9	180	12	205	13	179	9	588
Other	1	11	55	21	215	15	191	12	230	11	692
RRT Complication	2	22	21	8	24	2	33	2	27	1	107
Treatment Withdrawn	2	22	22	8	170	12	264	17	585	28	1043
Missing		0	5	2	14	1	23	1	30	1	72
Total	**9**	**100**	**264**	**100**	**1474**	**100**	**1583**	**100**	**2063**	**100**	**5393**

Cause of death by primary renal diagnosis 2008-2019

Cause of Death	Glomerlo nephritis		Interstitial		Multisystem		Diabetic Nephropathy		Unknown	
	n	%	n	%	n	%	n	%	n	%
Cardiovascular	220	30	303	28	385	29	566	41	235	26
Infection	173	23	258	24	281	21	267	20	205	23
Malignancy	98	13	161	15	190	14	54	4	86	10
Other	107	14	153	14	138	10	170	12	125	14
RRT Complication	18	2	26	2	24	2	18	1	21	2
Treatment Withdrawn	117	16	159	15	292	22	266	19	220	24
Missing	9	1	14	1	24	2	25	2	6	1
Total	**742**	**100**	**1074**	**100**	**1334**	**100**	**1366**	**100**	**898**	**100**

There is one missing PRD code.

Trends in cause of death groups by year 2008-2019



Trends in cause of death groups by year 2008-2019

	2008-2014		2015		2016		2017		2018		2019	
	n	%	n	%	n	%	n	%	n	%	n	%
Cardiovascular	1008	33	135	29	143	30	146	30	156	33	120	26
Infection	678	22	113	25	110	23	99	20	103	22	80	17
Malignancy	336	11	47	10	55	12	58	12	50	11	42	9
Other	420	14	53	11	56	12	63	13	52	11	48	10
RRT Complication	75	2	3	1	8	2	9	2	9	2	3	1
Treatment Withdrawn	513	17	109	24	98	21	112	23	102	22	109	23
Missing	8	0	1	0			1	0			62	13
All	**3038**		**461**		**470**		**488**		**472**		**464**	

Scottish Mortality Audit Renal Replacement Therapy (SMARRT)

Data regarding all deaths in 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 originally occured:

• 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.

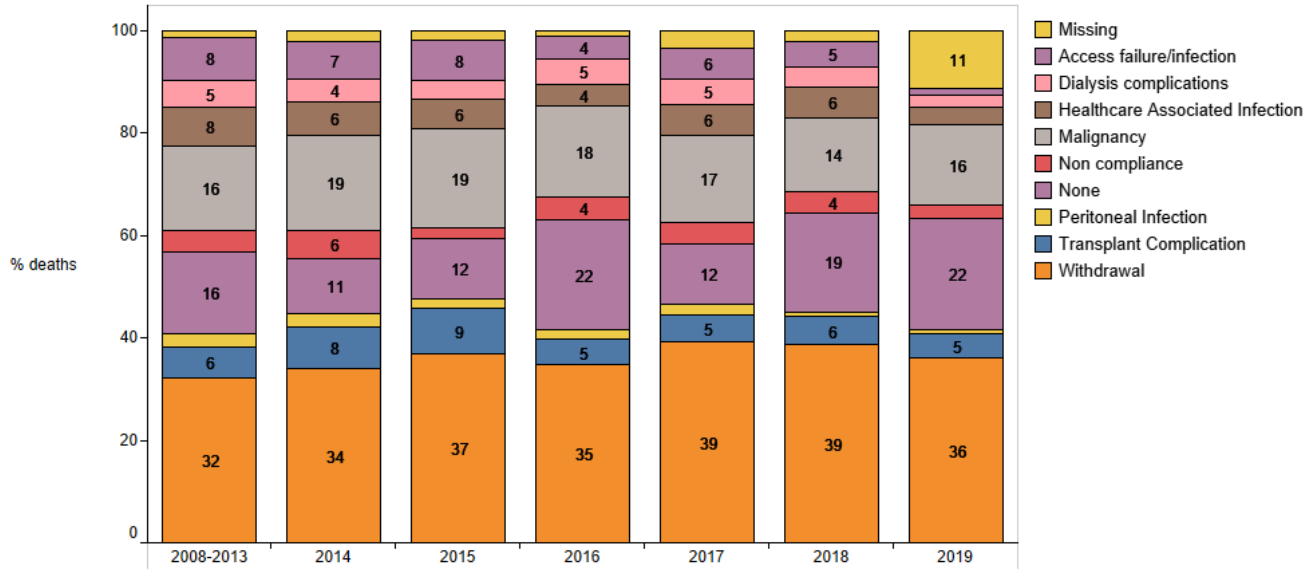
• Vascular Access
Deaths attributed to complications of vascular access. Examples include fatal blood loss (intentional and accidental), inadequate dialysis following failure to address poor vascular access or cardiovascular compromise from AVF formation.

• 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.

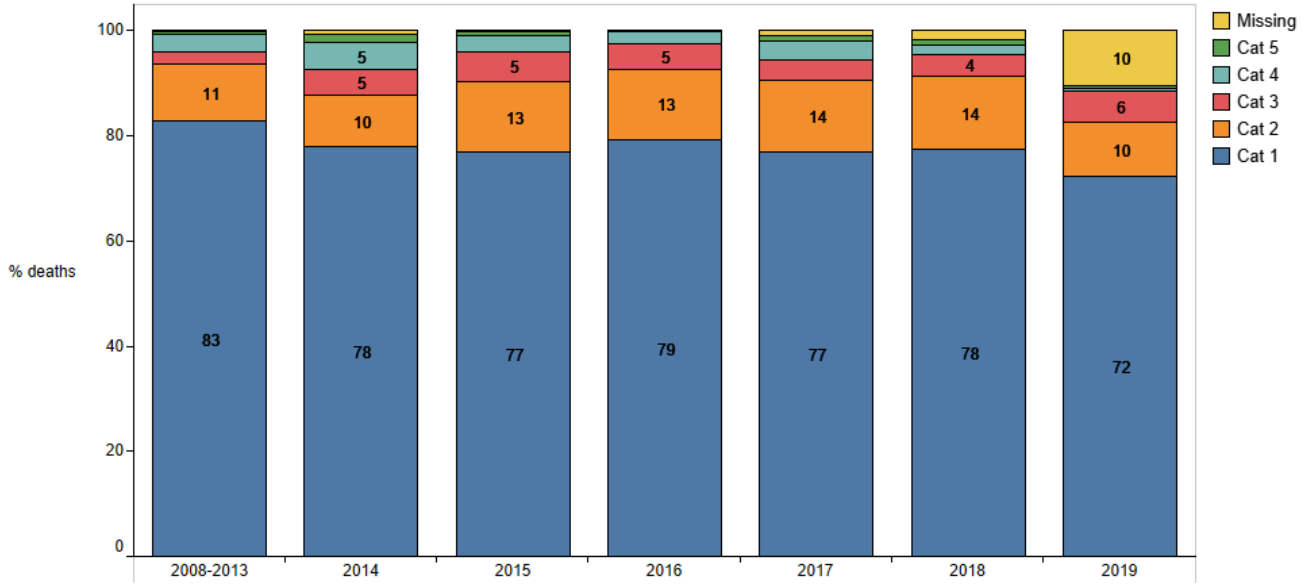
• Other
Deaths attributed to other areas of concern which do not fit into one of the above categories e.g. deaths following a fall-related fracture, unexpected deterioration during dialysis or noncompliance.

The SMARRT Steering Group are planning to review these themes.

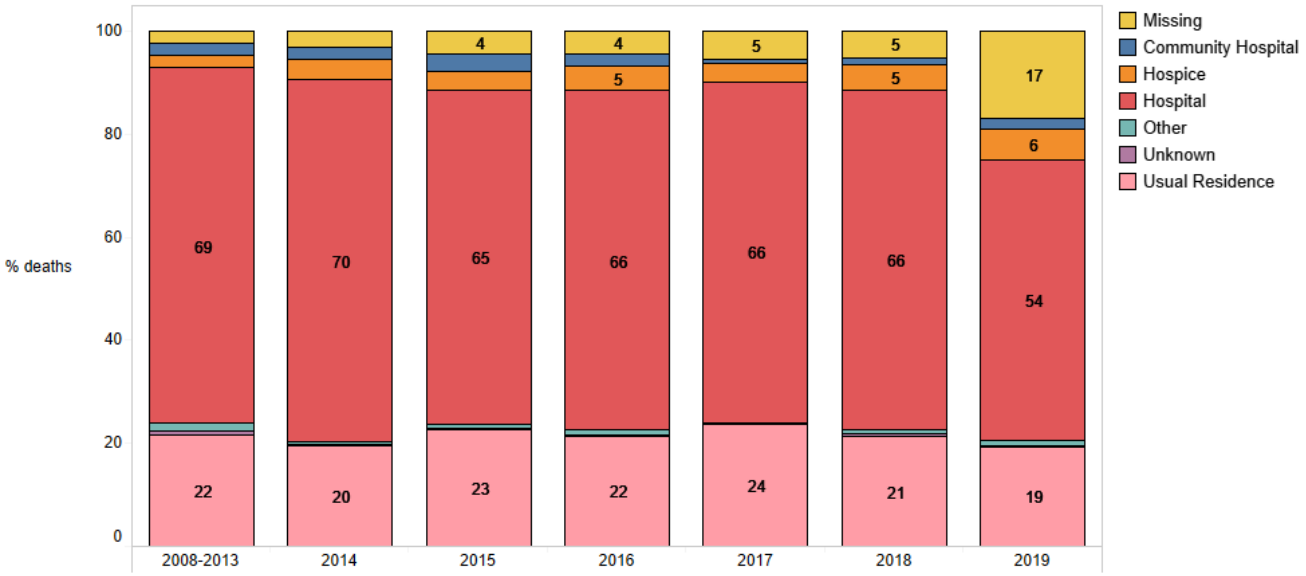
Factors contributing to death 2008-2019



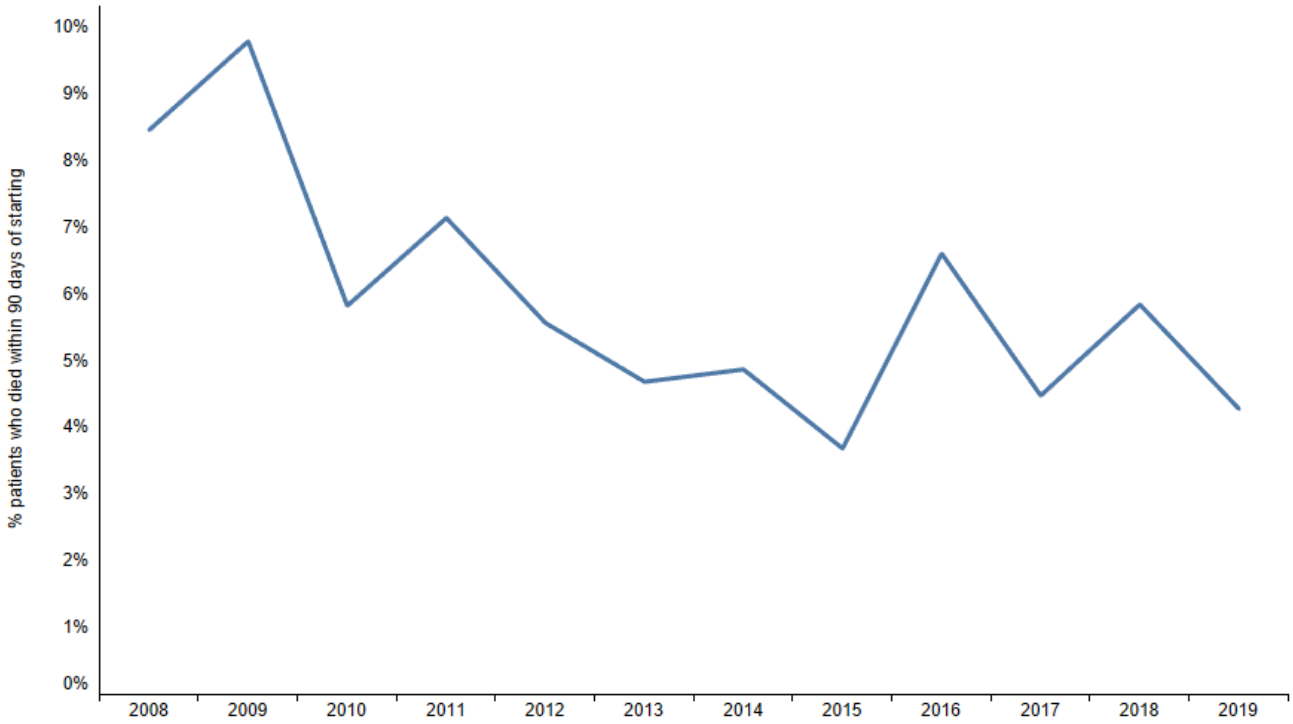
Categories of deaths by year 2008-2019



Location of death by year 2008-2019



Death within 90 days of starting RRT, 2008-2019



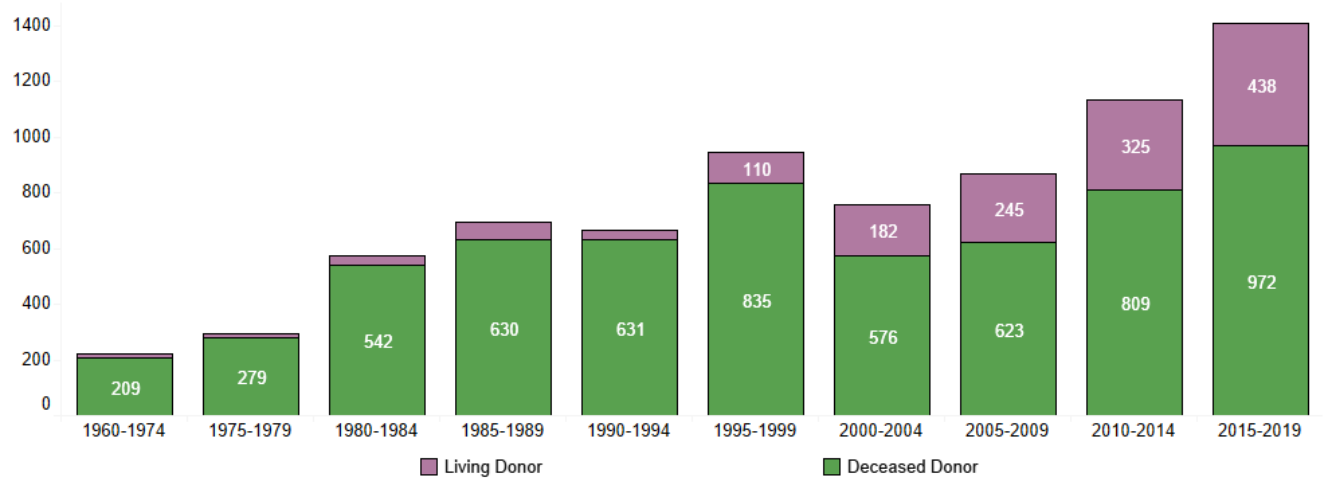
Transplantation

Between 1960 and 31 December 2019, 7567 kidney transplants were performed in Scotland in 6374 patients with postcode of residence in Scotland at the time of transplantation.

The kidney donor was deceased for 6106 (81%) transplants, 1461 (19%) of transplanted kidneys were donated by live donors. 6115 first kidney transplants were performed, 975 second transplants, 183 third transplants, 32 fourth and 3 fifth kidney transplants.

247 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.

Frequency and donor type, kidney transplants performed in Scotland 1960 - 2019



Frequency, transplant type and donor type, kidney transplants performed in Scotland 2010-2019

	Deceased donor kidney alone		Kidney and liver		Kidney and pancreas		Live donor kidney		All
Year	n	%	n	%	n	%	n	%	n
2010-2014	739	65	4	0	66	6	325	29	1134
2015	159	65	1	0	11	4	77	31	248
2016	159	65	1	0	16	5	73	29	249
2017	209	67	0	0	14	4	90	29	313
2018	183	60	0	0	14	5	106	35	303
2019	187	63	0	0	18	6	92	31	297

Note: Between 2010 - 2019 there has been 6 simultaneous Islet and kidney transplants. These are included within deceased donor kidney transplants numbers.

Age of patients at time of kidney transplantation

Year of transplant	First kidney transplants					Second and subsequent transplants				
	n	Mean Age	SD	Age (min)	Age (max)	n	Mean Age	SD	Age (min)	Age (max)
1960-1974	202	31	12	8	64	20	29	10	11	55
1975-1979	258	35	11	11	65	38	30	9	12	47
1980-1984	478	38	15	2	68	98	36	11	15	68
1985-1989	568	39	16	1	77	126	35	13	3	63
1990-1994	561	42	16	0	76	103	37	13	12	69
1995-1999	778	41	15	2	78	167	37	13	3	65
2000-2004	633	42	15	4	78	125	38	11	16	71
2005-2009	732	44	15	2	77	136	42	11	16	69
2010-2014	972	47	15	3	79	162	43	12	14	75
2015-2019	1192	49	15	1	83	218	46	12	19	71

Year of first kidney transplant and primary renal diagnosis group

	Glomerulonephritis		Interstitial		Multisystem		Diabetic nephropathy		Unknown	
Year of transplant	N	%	N	%	N	%	N	%	N	%
1960-1974	88	44	64	32	17	8	0	0	32	16
1975-1979	103	40	102	40	30	12	0	0	23	9
1980-1984	138	29	204	43	59	12	28	6	49	10
1985-1989	161	28	212	37	85	15	41	7	69	12
1990-1994	158	28	202	36	88	16	47	8	66	12
1995-1999	225	29	284	37	93	12	88	11	88	11
2000-2004	161	25	231	36	76	12	76	12	89	14
2005-2009	157	21	289	39	91	12	105	14	90	12
2010-2014	232	24	375	39	121	12	132	14	112	12
2015-2019	290	24	414	35	157	13	220	19	108	9

* One patient who received a first kidney transplant between 1960-1974 has missing PRD

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).

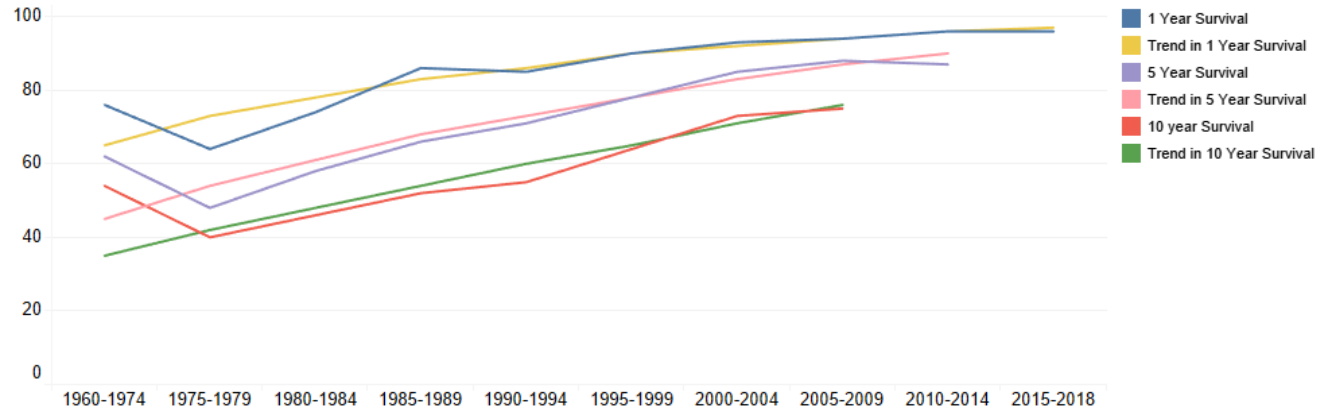
Graft survival of first kidney transplants by year of transplantation 1960 – 2018

	Grafts surviving 1 year		Grafts surviving 5 years		Grafts surviving10 years	
Year	n	%	n	%	n	%
1960-1974	122	76	81	62	62	54
1975-1979	149	64	107	48	83	40
1980-1984	339	74	249	58	178	46
1985-1989	467	86	328	66	230	52
1990-1994	451	85	347	71	242	55
1995-1999	673	90	555	78	417	64
2000-2004	568	93	486	85	386	73
2005-2009	673	94	592	88	458	75
2010-2014	907	96	781	87	-	-
2015	190	95	-	-	-	-
2016	204	96	-	-	-	-
2017	252	96	-	-	-	-
2018	242	96	-	-	-	-

Survival of first kidney transplants (including those as part of combined kidney-liver and kidneypancreas 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.

Trends in first graft survival by year of transplantation 1960-2018



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)

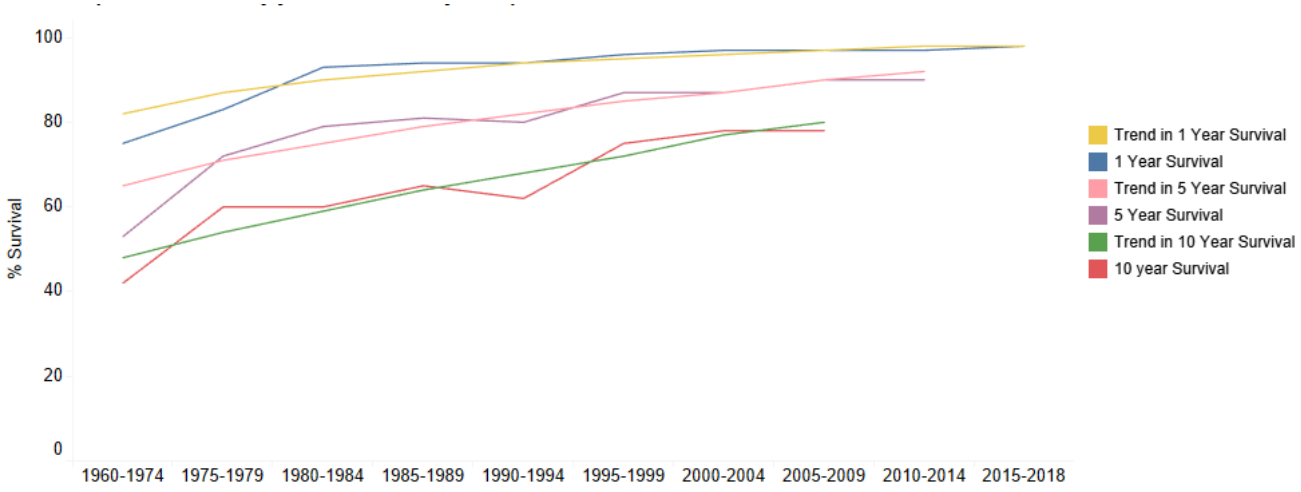
	Number of first kidney transplant 2009-2018	1 year		Number of first kidney transplant 2009-2017	2 years		Number of first kidney transplant 2009-2014	5 years	
	n	n	%	n	n	%	n	n	%
NHS Ayrshire and Arran	137	130	95	120	111	93	58	49	84
NHS Borders	56	54	96	47	45	96	26	24	92
NHS Dumfries and Galloway	53	50	94	47	43	91	30	24	80
NHS Fife	121	113	93	105	98	93	70	60	86
NHS Forth Valley	124	118	95	107	102	95	62	59	95
NHS Greater Glasgow and Clyde	522	502	96	452	422	93	270	245	91
NHS Grampian	212	206	97	181	169	93	117	101	86
NHS Highland	116	112	97	103	97	94	60	54	90
NHS Lanarkshire	273	263	96	241	224	93	139	123	88
NHS Lothian	263	254	97	222	210	95	141	122	87
NHS Orkney	4	4	100	3	3	100	0	0	0
NHS Shetland	5	5	100	5	5	100	3	3	100
NHS Tayside	141	136	96	116	112	97	60	54	90
NHS Western Isles	9	8	89	8	7	88	2	2	100
Scotland	**2036**	**1955**	**96**	**1757**	**1648**	**94**	**1038**	**920**	**89**

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

Patient survival after first kidney transplant by year of transplantation 1960-2018

Year	Patients surviving 1 year		Patients surviving 5 years		Patients surviving 10 years	
	n	%	n	%	n	%
1960-1974	151	75	108	53	85	42
1975-1979	215	83	187	72	155	60
1980-1984	445	93	376	79	289	60
1985-1989	535	94	458	81	368	65
1990-1994	526	94	448	80	349	62
1995-1999	745	96	673	87	580	75
2000-2004	612	97	552	87	492	78
2005-2009	709	97	658	90	569	78
2010-2014	947	97	876	90	-	-
2015	201	97	-	-	-	-
2016	211	99	-	-	-	-
2017	261	99	-	-	-	-
2018	250	96	-	-	-	-

Trends in patient survival by year of first kidney transplantation 1960-2018



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

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 1.04 (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)

Transplant Kidney Function

Transplanted kidney function at one year in adult recipients after first kidney transplant performed 2010-2018

	Transplants performed	Surviving patients with functioning graft		Patients with creatinine result	Serum creatinine (micromole/L)		eGFR (ml/min)	
	n	n	%	n	IQR	Median	IQR	Median
2010-2014	945	907	96	813	92-142	115	43.9-76.4	56
2015	201	190	95	181	95-147	112	41.3- 76.3	58
2016	210	204	97	189	92-151	113	40.0-76.7	60
2017	262	252	96	238	95-147	120	42.5-72.0	56
2018	253	242	96	235	90-148	116	40.2-74.3	57

Transplanted kidney function at five years in adult recipients after first kidney transplant performed 1995-2014

	Transplants performed	Surviving patients with functioning graft		Patients with creatinine result	Serum creatinine (micromole/L)		eGFR (ml/min)	
	n	n	%	n	IQR	Median	IQR	Median
1995-1999	577	466	81	441	119-185	143	32.6-57.2	46
2000-2004	568	486	86	455	108-166	135	35.1-60.5	49
2005-2009	665	592	89	559	95-154	121	39.2-70.2	54
2010-2014	885	781	88	743	95-153	119	39.2-70.0	55

Transplanted kidney function one year in adult recipients after first kidney transplant performed 2009-2018 by donor type

	Transplants performed	Surviving patients with functioning graft		Patients with creatinine result	Serum creatinine (micromole/L)		eGFR (ml/min)	
	n	n	%	n	IQR	Median	IQR	Median
Deceased - DBD	815	784	96	723	90-144	115	42.5-77.3	57
Deceased - DCD	472	443	94	421	102-172	128	34.4-64.5	48
Live donor	584	568	97	512	88-132	109	51.4-78.5	62

Transplanted kidney function one year in adult recipients after first kidney transplant performed 2009-2018 by primary renal diagnosis group

	Transplants performed	Surviving patients with functioning graft		Patients with creatinine result	Serum creatinine (micromole/L)		eGFR (ml/min)	
	n	n	%	n	IQR	Median	IQR	Median
Glomerulo nephritis	462	442	96	409	100-150	123	42.7-70.5	56
Interstitial	695	670	96	608	90-141	113	43.1-77.2	57
Multisystem	226	212	94	194	91-153	118	40.8-72.4	57
Diabetic nephropathy	294	284	97	271	86-138	110	44.9-77.6	61
Unknown	191	184	96	171	91-149	116	41.9-76.4	56

Transplanted kidney function one year in adult recipients after first kidney transplant performed 2009-2018 by transplanting unit

	Transplants performed	Surviving patients with functioning graft		Patients with creatinine result	Serum creatinine (micromole/L)		eGFR (ml/min)	
	n	n	%	n	IQR	Median	IQR	Median
GLAS	954	908	95	800	98-153	121	40.4-69.3	55
RIE	848	821	97	796	92-144	112	44.2-75.9	58

Percentage of RRT patients with functioning kidney transplant or on transplant waiting list 31 December 2019 by NHS Board of residence

	All RRT Patients on 31/12/19	Patients with Kidney Transplant		Transplant or transplant listed	
		n	%	n	%
NHS Ayrshire and Arran	411	236	57	280	68
NHS Borders	117	76	65	92	79
NHS Dumfries and Galloway	156	98	63	116	74
NHS Fife	361	208	58	237	66
NHS Forth Valley	294	196	67	225	77
NHS Grampian	544	346	64	399	73
NHS Greater Glasgow and Clyde	1274	836	66	994	78
NHS Highland	337	212	63	249	74
NHS Lanarkshire	727	484	67	556	76
NHS Lothian	726	463	64	523	72
NHS Orkney	16	11	69	15	94
NHS Shetland	17	8	47	10	59
NHS Tayside	423	249	59	282	67
NHS Western Isles	31	19	61	20	65
Scotland	**5434**	**3442**	**63**	**3998**	**74**

The percentage of patients in each NHS 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.

Frequency of first kidney transplants by NHS Board of residence at transplantation 2015-2019

	n	Pre-emptive transplants		LD Tx in first year of RRT*
		Total Number	Number from DD	
NHS Ayrshire and Arran	80	18	11	12
NHS Borders	32	4	0	8
NHS Dumfries and Galloway	31	8	1	12
NHS Fife	74	15	4	26
NHS Forth Valley	75	20	11	16
NHS Grampian	113	30	12	22
NHS Greater Glasgow and Clyde	304	64	39	50
NHS Highland	67	14	7	15
NHS Lanarkshire	165	29	11	28
NHS Lothian	142	25	9	28
NHS Orkney	6	1	1	1
NHS Shetland	4	0	0	0
NHS Tayside	91	16	6	24
NHS Western Isles	8	3	1	2
Scotland	**1192**	**247**	**113**	**244**

Note: * Includes pre-emptive LD transplants

247 patients received a pre-emptive transplant in 2015-2019, 134 from a live donor (LD), 113 from a deceased donor (DD). 244 patients received a LD transplant within one year of starting RRT.

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 in the first year following kidney transplantation in Scotland 2015-2018, to determine the incidence of biopsy proven acute rejection episodes in the first twelve months following a kidney transplant.

Kidney Biopsy in first 12 months following transplant performed 2015-2018

Year	Total number adult transplants	At least 1 biopsy in first 12 months post Transplant	
	n	n	%
2015	242	103	42.6
2016	244	86	35.2
2017	302	88	29.1
2018	289	88	30.5

Kidney Biopsy in first 12 months following transplant 2018 by donor type

Year	Total Transplants 2018	Patients undergoing biopsy in first 12 months	
	n	n	%
Deceased	192	63	32.8
Live Donor	97	25	25.8

Biopsy proven rejection in first 12 months following transplant

	Number of Patients 2018	% of transplants 2018	% of Transplants 2015-2017
T Cell Medicated Rejection*	20	6.9	4.1
Antibody Mediated Rejection	0		0.4
Borderline Rejection	4	1.4	1.5
Mixed T-cell and Antibody Mediated Rejection	0		0.2

* Includes chronic allograft arteriopathy

For kidney transplants performed in Scotland in 2018 8.3% of cases had biopsy proven acute rejection in the first year after transplantation compared with 6.2% for kidney transplants performed 2015-17. The first biopsy diagnosis and severity of rejection for each case is shown in the table.

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 nine adult renal units in Scotland since 1999.

The PD population in Scotland has remained stable with 202 patients on PD at the end of 2019. Overall, 76% of PD patients in Scotland use APD, although there is variation between units.

Number of patients treated with PD during 2019 and PD population with % APD at end 2019

Renal Unit	Total treated by PD 2019	PD population end 2019	APD population end 2019	APD % end 2019
ARI	37	21	12	57
XH	97	43	31	72
DGRI	21	12	11	92
GLAS	55	38	24	63
MONK	28	21	21	100
NINE	38	27	24	89
RAIG	33	21	13	62
RIE	11	8	8	100
VHK	17	11	10	91
Scotland	337	202	154	76

Table above shows that a total of 337 patients were on PD at some point during 2019, reflecting a relatively high turnover of patients.

Reasons for starting and stopping PD in adult renal units 2015-2019

Renal Unit	New	From HD	Transfer in	From Tx	Total start	Death	To Tx	To HD	Transfer Out	Re-covered	Total stop
ARI	54	10	0	8	72	5	26	47	1	4	**83**
XH	51	13	3	1	68	35	19	27	0	0	**81**
DGRI	24	3	0	4	31	8	10	17	1	1	**37**
GLAS	126	55	5	14	200	34	69	103	3	3	**212**
MONK	63	10	0	8	81	10	16	36	0	5	**67**
NINE	43	18	6	1	68	11	14	32	1	0	**58**
RAIG	33	16	1	1	51	1	17	39	0	1	**58**
RIE	81	26	4	5	116	15	26	45	3	8	**111**
VHK	42	12	2	0	56	12	18	34	0	0	**64**
Scotland	**517**	**163**	**21**	**42**	**743**	**131**	**215**	**380**	**9**	**22**	**771**

The table shows the source of patients starting PD and reasons for stopping PD 2015-2019; with 49% stopping because of technique failure (transfer to HD), 28% transplanted and 17% dying whilst on PD. The proportion of patients dying on PD varies between units (from 2% in RAIG to 43% in XH during 2015-2019) and there are several possible explanations for this including the availability of assisted PD in some units allows PD to continue in frailer patients, and not all units have consistent assisted PD programs.

More detailed data collection would be required to establish whether there are differences between units in the likelihood of continuing PD and likelihood of withdrawal from dialysis for end of life care.

PD associated peritonitis rates in adult renal units 2000-2019

Year	2000-2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Months between episodes	19.9	18.5	18.7	18.8	23.4	27	22.1	24.2	19.9	15.8	17	22.7	22.2
Episodes per PD treatment year	0.6	0.6	0.6	0.6	0.5	0.4	0.5	0.5	0.6	0.7	0.7	0.5	0.54

Peritonitis rates have improved in the past 3 years, but remain high in Scotland with an overall rate of 1 episode every 22.2 months/0.54 episodes per PD treatment year in 2019.

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

PD associated peritonitis in adult renal units 2015-2019

Renal Unit	No. of peritonitis episodes	Total patient months on PD	Peritonitis rate (months between episodes)	Peritonitis rate (episodes per PD treatment year)
ARI	62	1528	24.6	0.5
XH	98	1837	18.7	0.6
DGRI	34	518	15.2	0.8
GLAS	117	2921	25.0	0.5
MONK	68	1085	16.0	0.8
NINE	38	1124	29.6	0.4
RAIG	56	749	13.4	0.9
RIE	122	1939	15.9	0.8
VHK	58	938	16.2	0.7
Scotland	**653**	**12639**	**19.4**	**0.6**

The Renal Association 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 standard. 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 including relapses, recurrences and repeat episodes (which will result in a higher overall rate). Since 2017 the method of data changed to allow tracking of individual patients and identify whether peritonitis episodes were single or relapsed/recurrent/repeat. The ISPD recommend omitting relapsed episodes from rate calculations; using these criteria the rate by unit for the 2017-2019 audit period is shown in the table below, demonstrating that the PD-associated peritonitis rate in Scotland just meets the minimum standard of less than 0.5 episodes per patient year. The outcome of peritonitis by unit is also shown. In 2017-2019, 73.3% of peritonitis episodes were cured, 27% resulted in PD catheter removal, and there were 3 deaths (1%) associated with peritonitis. 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.

Proportion of patients experiencing peritonitis, type and outcome of peritonitis by unit (2017-2019 data)

Renal Unit	Type of peritonitis					Outcome of Peritonitis		
	Recurrent	Relapse	Repeat	Peritonitis rate **including** relapsed peritonitis*	Peritonitis rate **excluding** relapsed peritonitis*	% Cure	% Catheter Removed	% Death
	%	%	%					
ARI	0	14	3	26.1(0.5)	30.6(0.4)	66	34	0
XH	6	0	15	21 (0.6)	21.0(0.6)	94	4	2
DGRI	7	7	0	14.9 (0.8)	16.0(0.8)	87	13	0
GLAS	4	11	8	22.4(0.5)	24.6(0.5)	78	22	0
MONK	3	5	8	19.5(0.6)	20.6(0.6)	63	37	0
NINE	0	11	0	35.6(0.3)	39.7(0.3)	42	53	5
RAIG	6	3	6	13.2(0.9)	13.6(0.9)	59	41	0
RIE	4	11	7	18.2(0.7)	20.6(0.6)	75	24	1
VHK	0	16	3	15.0(0.8)	17.8(0.7)	75	25	0
Scotland	4	8	8	20.3(0.6)	22.0(0.5)	73	27	1

* Rate in months between episodes of peritonitis (and episodes per patient year).

The organisms cultured vary between units shown in the table below. The culture negative rate 2015-2019 is 28%, above the Renal Association suggested standard of under 20%. The data shows that the culture negative rate varies from 8-37% between units. This 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. 2018 and 2019 results show a reduction in the proportion of culture negative peritonitis in all units

Rate (PD treatment months between episodes) of causative organisms of PD peritonitis in adult renal units 2015-2019

Renal Unit	Staph aureus	Coagulase negative staph	Gram negative bacilli	Fungi	Other	Culture negative	Total Rate
ARI	510	90	127	0	90	127	24.7
XH	184	97	153	0	92	51	18.8
DGRI	259	129	104	0	47	47	15.2
GLAS	243	108	292	974	86	94	25.0
MONK	72	0	121	-	108	36	16.0
NINE	125	102	225	0	112	375	29.6
RAIG	83	94	125	0	58	44	13.4
RIE	65	215	215	0	51	59	16.3
VHK	117	39	72	0	156	134	16.2
Scotland	129	103	156	1404	79	70	19.4

- Indicates no cases.

% of culture-negative PD associated peritonitis rates in adult renal units 2015-2019

Renal Unit	2015	2016	2017	2018	2019	2015-2019
ARI	29	7	23	0	31	19
XH	42	56	50	0	11	37
DGRI	22	20	40	20	32	32
GLAS	33	13	23	29	30	25
MONK	38	82	60	14	33	16
NINE	0	5	0	50*	11	8
RAIG	33	40	27	20	29	30
RIE	10	28	33	46	17	28
VHK	13	11	10	0	29	12
Scotland	27	30	30	24	25	28

(*NINE had only 2 cases of peritonitis, of which one was culture negative).

2017 was the first year the SRR have reported the rate and causative organisms of PD catheter exit site infections and this year the table below includes cumulative data for 2017-2019. Exit site infection is defined as clinical evidence of infection with positive growth on an exit site swab. Units vary in their use of exit site prophylaxis but this does not correlate with the incidence of exit site infections (information about prescribed treatments are not reported by the registry therefore these data are not shown).

Number of episodes by causative organism and overall rate of PD catheter exit site infections in 2017-2019

Renal Unit	Staph aureus	Pseudomonas	Coliforms	Other	Total	Rate (months between episodes)	Rate (episodes per PD treatment year)
ARI	-*	-	-	-	-	-	-
XH	18	5	6	5	34	29	0.4
DGRI	1	0	0	0	1	166	0.1
GLAS	60	9	2	6	77	22	0.5
MONK	2	2	1	1	6	124	0.1
NINE	8	1	1	4	14	48	0.2
RAIG	13	1	0	6	20	22	0.5
RIE	6	0	0	2	8	162	0.1
VHK	2	0	1	1	4	120	0.1
Scotland	110	18	11	25	164	45	0.3

*indicates no cases

Number of patients with total (peritoneal and renal) creatinine clearances (litres/week/1.73m2) in each 6 months audit period 2015-2016 and full years of 2017-2019 with percentage of patients with inadequate (<50) and borderline (50-60) creatinine clearances.

	Adequacy							
Year	**< 50**	**50-60**	**61-70**	**>70**	**Not assessed**	**Total**	**% < 50**	**% 50-60**
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
2018	24	26	20	129	133	203	11.8	12.8
2019	16	26	32	137	114	211	**7.6**	**12.3**
TOTAL	**173**	**194**	**163**	**687**	**627**	**1601**	**10.8**	**12.1**

*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 but all units aim to repeat adequacy tests if there is a concern about inadequate dialysis which may result in over-representation of inadequate PD clearances in this data collection. 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 was presented for the first time in the 2018 report, and the table below includes data from 2017-2019 inclusive. Of the 63.9% of patients with a residual urine volume reported, 13% are functionally anuric (urine output <100mls in 24 hours). Note the variation between units, notably MONK with no reported anuric patients compared to NINE with 30% anuric.

Residual urine volume at the time of 24 hour urine collection for most recent adequacy check (2017-2019 data)

Renal 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	101-1000	>1000
ARI	88	77.2	13.6	48.9	37.5
XH	60	52.1	30.0	34.0	36.0
DGRI	16	61.4	6.3	50.0	43.8
GLAS	149	56.2	15.4	54.4	30.2
MONK	57	54.4	0.0	17.5	82.5
NINE	72	86.1	16.7	52.8	30.6
RAIG	56	86.0	12.5	62.5	25.0
RIE	70	62.6	11.4	44.3	44.3
VHK	42	58.0	9.5	47.6	42.9
Scotland	**610**	**63.9**	**13.0**	**48.7**	**38.4**

Cause (number and percentage)of technique failures in each adult renal unit 2015-2019

Renal Unit	Peritonitis		Access*		Under-dialysis		Poor UF**		High IP***		Wish HD		Stop Dial		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
ARI	13	33	1	3	14	35	2	5	6	15	4	10	0	0	40
XH	4	15	1	4	9	35	3	12	2	8	7	27	0	0	26
DGRI	4	24	2	12	8	47	0	0	1	6	2	12	0	0	17
GLAS	28	27	4	4	19	19	9	9	12	12	29	28	1	1	102
MONK	15	44	4	12	9	26	0	0	2	6	4	12	0	0	34
NINE	13	38	5	15	6	18	2	6	3	9	4	12	1	3	34
RAIG	21	55	4	11	7	18	0	0	1	3	5	13	0	0	38
RIE	25	49	5	10	3	6	0	0	4	8	9	18	5	10	51
VHK	15	43	4	11	3	9	1	3	0	0	10	29	2	6	35
Scotland	138	37	30	8	78	21	17	5	31	8	74	20	9	2	377

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

The causes of technique failure have remained consistent overall in Scotland, with 37% 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.

Vascular Access for haemodialysis

Patients starting first RRT as haemodialysis across Scotland

Details of vascular access used for haemodialysis for all hospital and home haemodialysis patients were collected during the SRR census week during May* 2019. 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 renal failure 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 2019 and 31 December 2019 there were 416 incident adult haemodialysis patients in Scotland. 167 (40.1%) of these commenced dialysis with AV access and 249 (59.9%) with a central venous catheter (CVC).

Between the 01 January 2020 and 30 June 2020 there were 206 incident haemodialysis patients. 77 (37.4%) patients commenced with AV access and 129 (62.6%) with a CVC.

SRR has 100% complete data for all incident adult haemodialysis patients for the time period shown in the table below.

*Please note there were significant disruptions to theatre lists as a result of COVID-19 which may have impacted on 2020 results.

Types of Vascular Access used for first haemodialysis 2015-2020

		Arteriovenous				Central Venous Catheter			
		Fistula		Graft		Non-Tunnelled		Tunnelled	
	Number starting RRT	N	%	N	%	N	%	N	%
2015	477	187	39.20%	14	2.94%	109	22.85%	167	35.01%
2016	433	184	42.49%	21	4.85%	92	21.25%	136	31.41%
2017	498	197	39.56%	34	6.83%	101	20.28%	166	33.33%
2018	455	180	39.56%	26	5.71%	110	24.18%	139	30.55%
2019	416	148	35.58%	19	4.57%	73	17.55%	176	42.31%
2020*	206	70	33.98%	7	3.40%	49	23.79%	80	38.83%

*Started between 01 January 2020-30 June 2020.

In the five years 2015-2019 56% of patients started RRT via a central venous catheter. 62% were male, the distribution of primary renal diagnoses also reflected the incident RRT population as a whole, 30.5% had a primary renal diagnosis of diabetic nephropathy.

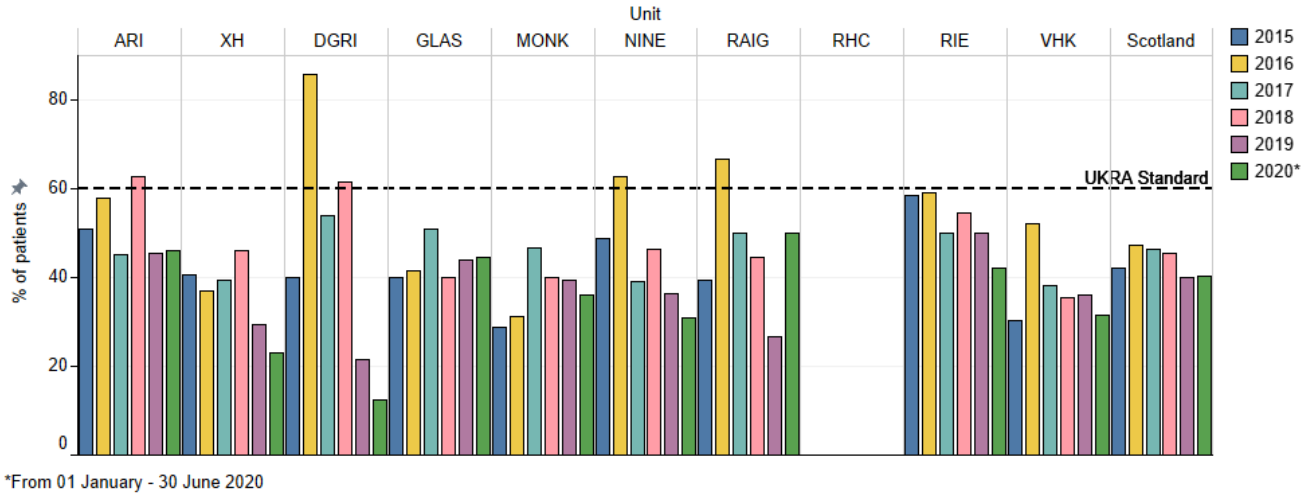
It is not possible from Registry data to tell if a planned live donated kidney transplant, or knowledge of a life limiting malignancy influenced the decision not to form AV access for haemodialysis for these individuals.

Relationship between time of first referral to nephrology and access used for first HD 01 January 2012 - 30 June 2020

	Total Number on HD	Number with first referral date	Early referral (n)	Early referral (%)	Late referral (n)	Late referral (%)	Median Time (months)	Median Time (IQR)
AV	1467	1434	1406	51.7	28	5.3	62.0	31.3, 117
Catheter	1847	1810	1314	48.3	496	94.7	22.4	2.1, 69.8
Total	3314	3244	2720		524		41.1	10.4, 94.1

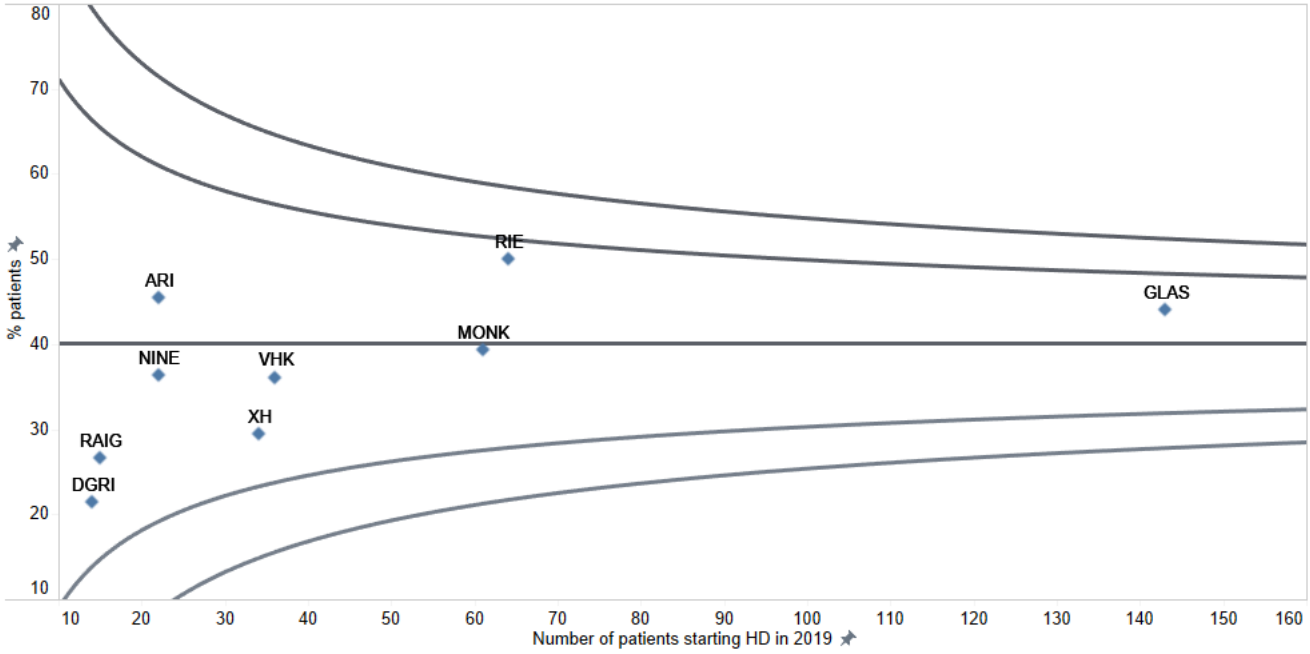
Date of referral to renal services was available for 3244 (97.9%) of the incident haemodialysis patients. Late referral was defined as less then 3 months between referral and first haemodialysis session. Only 28 patients (5.3%) referred less than 3 months before starting dialysis had AV access for the first haemodialysis session.
Of patients referred within six months of starting haemodialysis 73/790 (9.2%) started haemodialysis using AV access and 149/1021 (14.6%) of those referred within 12 months.

% patients with AV access for first haemodialysis by renal unit 2015 - 2020



*From 01 January - 30 June 2020

Percentage of patients starting haemodialysis with AV access by dialysis in 2019



The Renal Association guideline (2015) suggests that 60% of all incident patients with established renal failure commencing planned haemodialysis should receive dialysis via a functioning arteriovenous fistula (AVF) or arteriovenous graft (AVG).

Although no Renal Unit lies outwith 2 or 3 SD of the Scottish Mean - no unit met the 60% standard.

Patients on haemodialysis across Scotland May 2009-2020

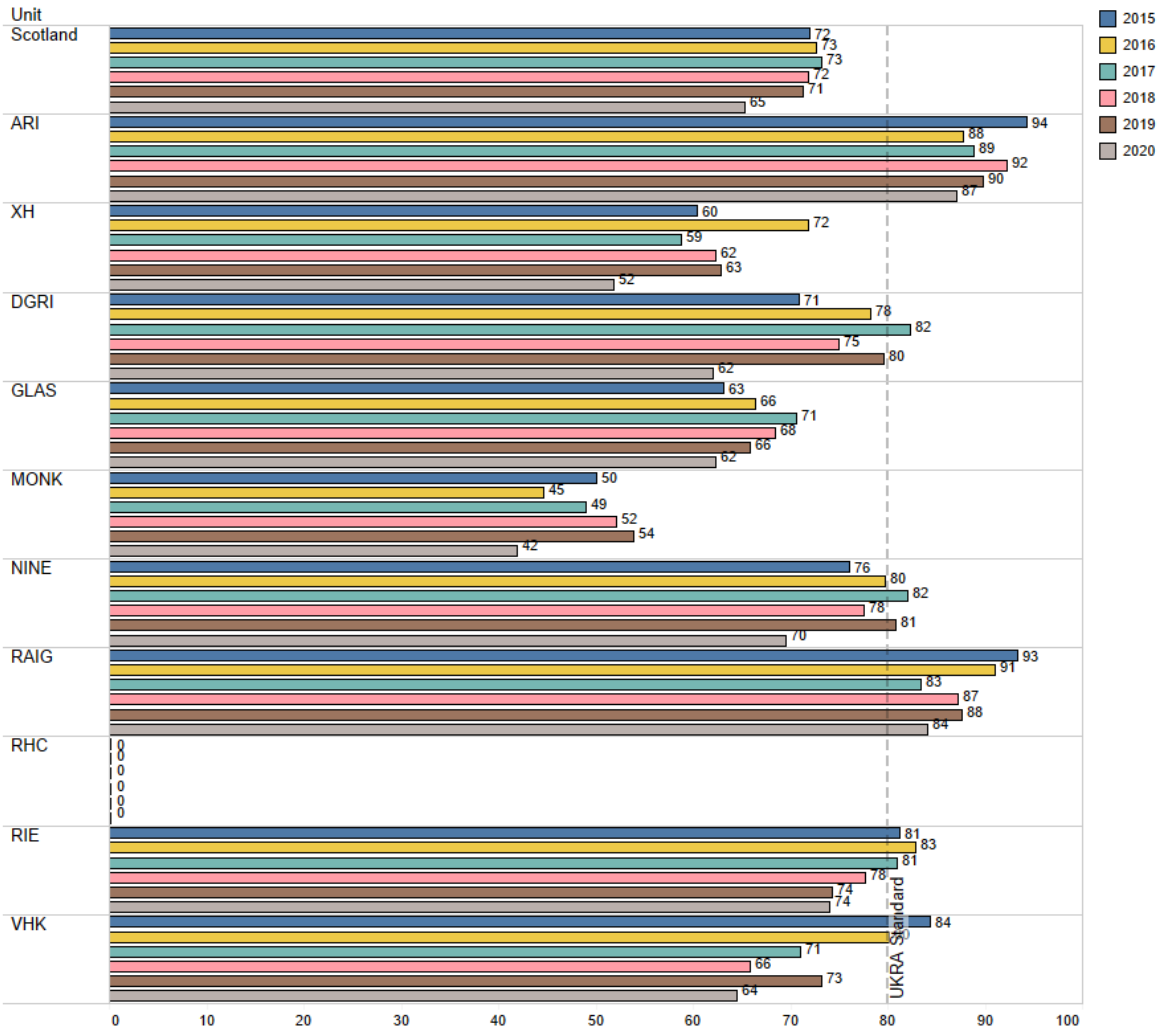
Types of vascular access for prevalent haemodialysis patients each May 2009-2020

Year	Number on HD	Number with data		Arteriovenous					Central Venous Catheter			
		n	%	Fistula	Graft	Unknown	n	%	Non-tunnelled	Tunnelled	n	%
2009	1848	1699	92	1206	58	16	1280	75	34	385	419	25
2010	1868	1748	94	1262	51	2	1315	75	33	400	433	25
2011	1877	1810	96	1275	54	40	1369	76	36	405	441	24
2012	1873	1769	94	1284	72	10	1366	77	24	379	403	23
2013	1885	1680	89	1217	69	0	1286	77	51	343	394	24
2014	1853	1803	97	1256	76	4	1336	74	30	437	467	26
2015	1906	1831	96	1236	79	0	1315	72	34	482	516	28
2016	1878	1817	97	1207	114	1	1322	73	25	470	495	27
2017	1954	1874	96	1221	145	0	1366	73	17	491	508	27
2018	1950	1885	97	1189	164	0	1353	72	24	508	532	28
2019	1917	1836	96	1121	189	0	1310	71	14	512	526	29
2020	1894	1833	97	1095	102	0	1197	65	4	632	636	35

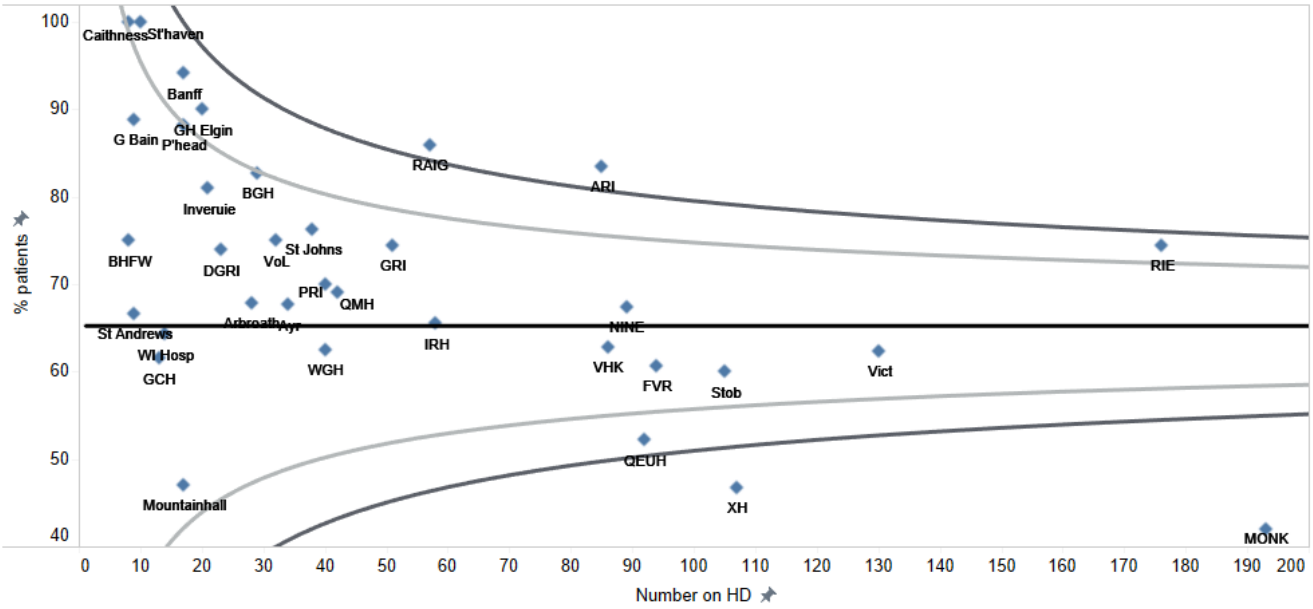
1894 patients with established renal failure were being treated by haemodialysis in May 2020, details of vascular access were available for 1833 (97%). There are large differences between renal units. The chart below shows the percentage of AV access in each unit for 2015-2020.

Several units have reported a drop in vascular access surgery due to the COVID-19 impact. This might explain the drop in prevalent AV access in May 2020 compared with previous years.

% of haemodialysis patients with AV access by adult renal unit during May census each year



Percentage of patients receiving hospital haemodialysis with AV access in May 2020



The Renal Association guideline (2015) suggests that 80% of all prevalent long term dialysis patients should receive dialysis treatment via definitive access: AVF or AVG.

May 2020 census data shows that on average 65% of patients in Scotland received dialysis treatment via AVF or AVG with large variation across renal sites.

Bacteraemia in RRT recipients

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 2019.

All bacteraemia 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 2015 to 31 December 2019. 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.

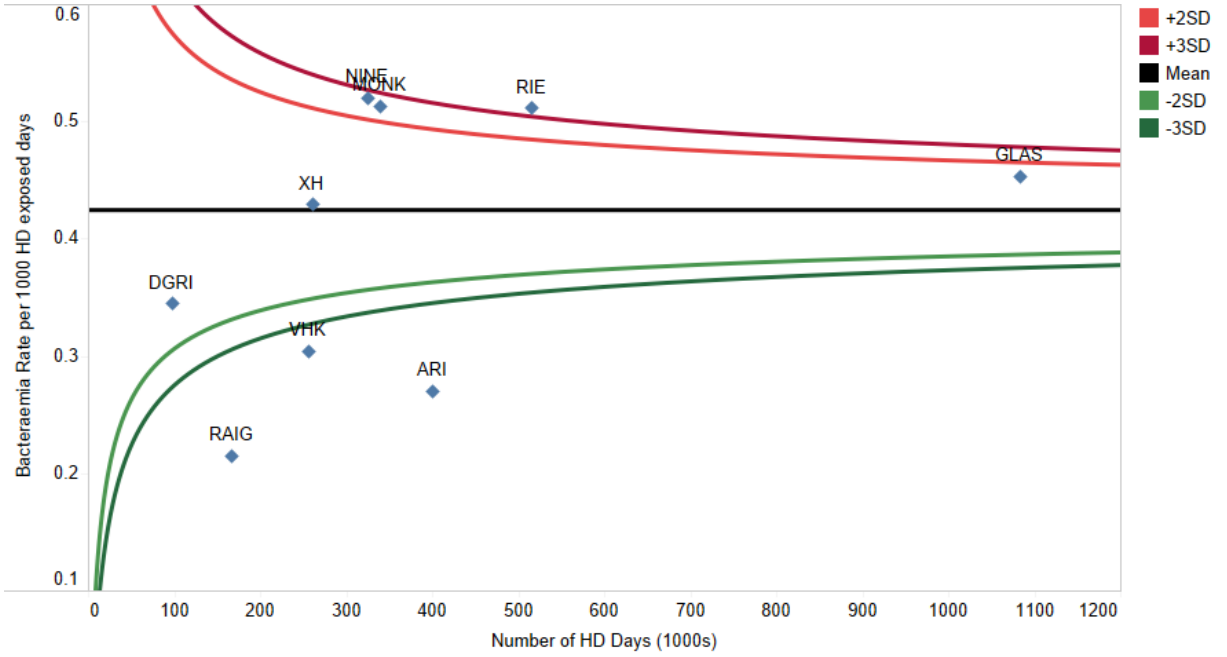
Incidence of Bacteraemia in RRT population 2015-2019 by modality of RRT

	HD		PD		Tx		All	
	n	%	n	%	n	%	n	%
Staphylococcus aureus	431	29	10	20	46	8	487	23
Staphylococcus epidermidis	489	33	21	43	110	20	620	30
Gram Negative	394	26	15	31	351	64	760	36
Streptococcus	177	12	3	6	38	7	218	10
Grand Total	1491	100	49	100	545	100	2085	100

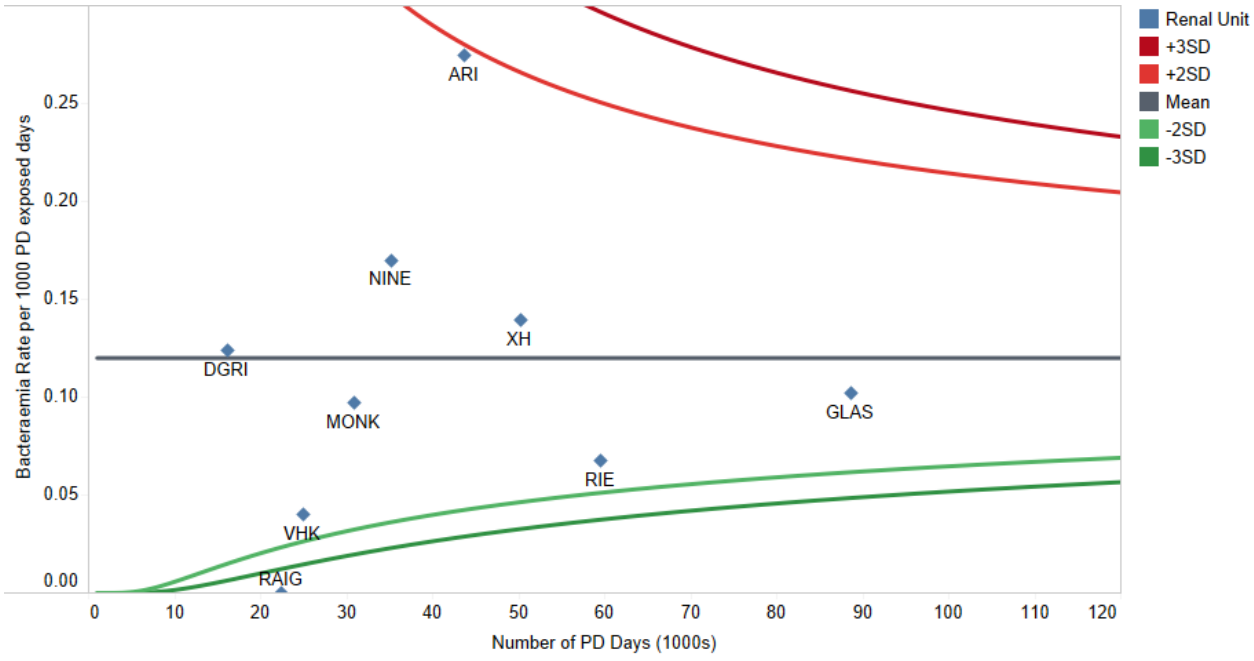
* Gram-negative organism group comprises Escherichia coli, Klebsiella sp. and Pseudomonas sp.

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.

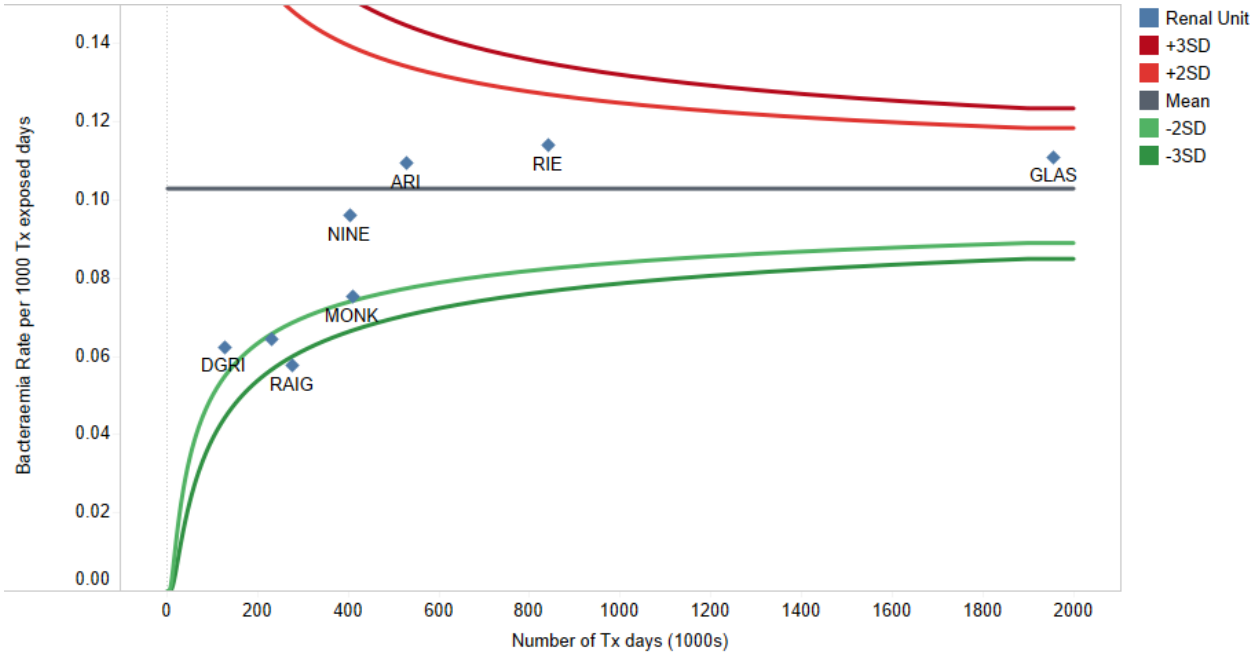
Haemodialysis patient bacteraemia* rate per 1000 HD treatment days by adult renal unit 2015-2019



Peritoneal dialysis patient bacteraemia* rate per 1000 PD treatment days by adult renal unit 2015-2019



Transplanted patient bacteraemia* rate per 1000 Tx treatment days by adult renal unit 2015-2019

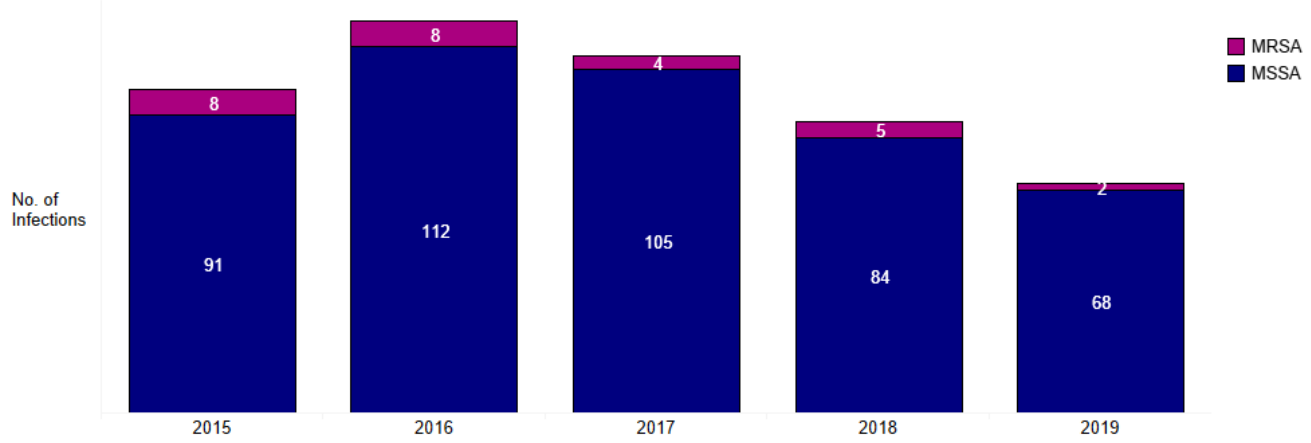


The graphs above show the bacteraemia rate occurring in patients treated by each mode of RRT. The number of treatment days for each modality is the total number of days provided at each adult unit for all patients in the time period 2015-2019.

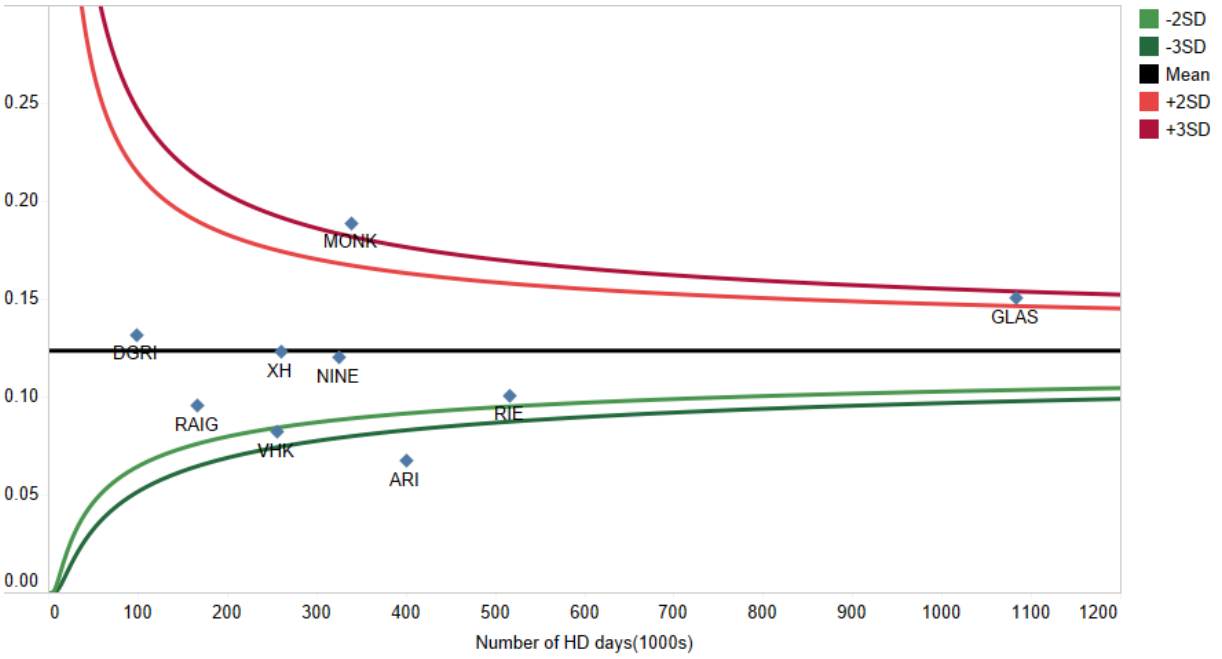
The data would suggest across Scotland as a whole during 2015-2019 one bacteraemia episode occurred in every 2321 days of delivered haemodialysis; every 8081 days of delivered peritoneal dialysis and 9713 days in patients with a kidney transplant.

Staphylococcus aureus bacteraemia reported in Haemodialysis (HD) patients treated during 2015-2019

Incidence of MRSA & MSSA bacteraemia in HD RRT patients in Scotland 2015-2019



SAB rate for HD patients by adult renal unit 2015-2019



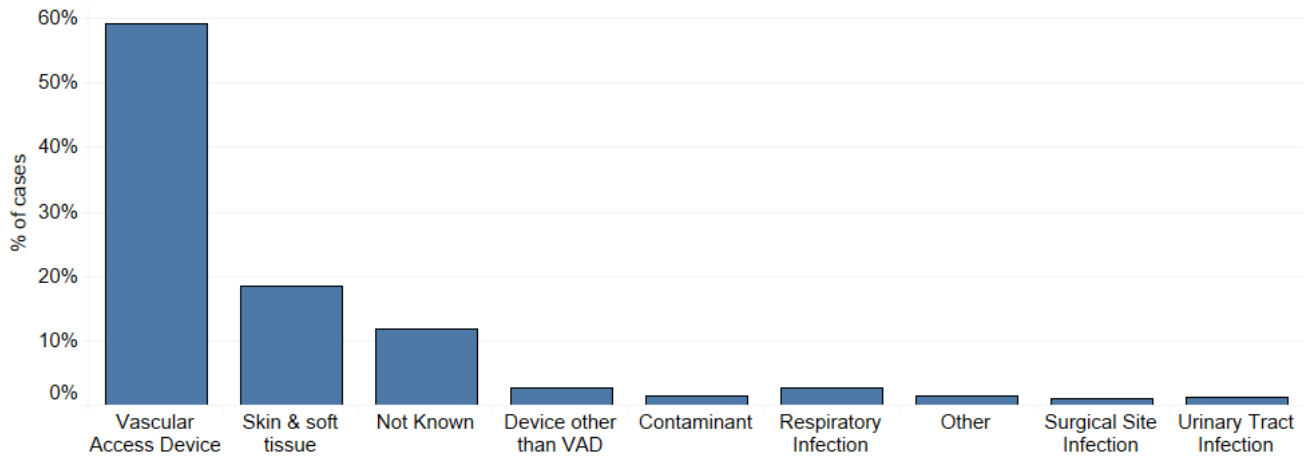
Enhanced Staphylococcus aureus bacteraemia Surveillance Report

Since 2001, Scotland's had a mandatory MRSA bacteraemia surveillance programme, publishing quarterly reports of the numbers and rates of MRSA bacteraemias. In 2006 the programme was extended to include meticillin sensitive *S. aureus* (MSSA) bacteraemias and in 2014, to include enhanced *Staphylococcus aureus* bacteraemia (SAB) surveillance. This is the first year the SRR have used enhanced SAB surveillance data within this report.

More information can be found here: https://www.hps.scot.nhs.uk/web-resources-container/protocol-for-national-enhanced-surveillance-of-bacteraemia/

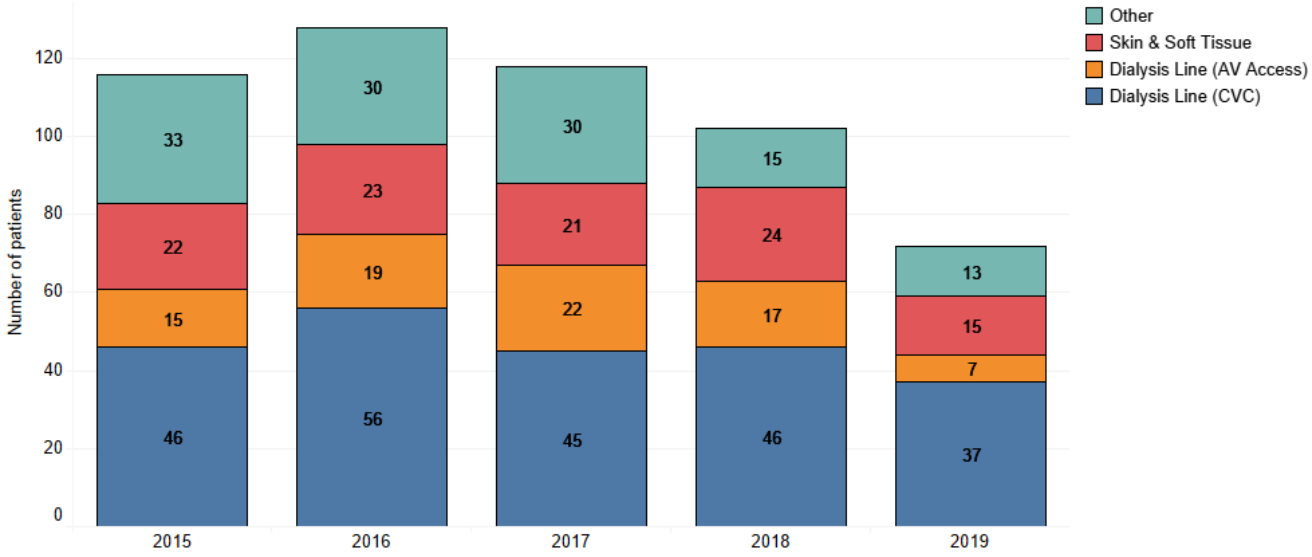
SRR data was linked to the enhanced SAB surveillance dataset with 536 SAB episodes recorded in a total of 481 patients registered on the SRR. The vast majority of patients 79.8% (n=384) only had 1 SAB during the time period 2015-2019.

Entry Point - breakdown in SAB's detected in those on RRT 2015-2019



From the chart above, over the time period 2015-2019, the majority of cases of SAB were attributed to vascular access devices with 59.1% and a further 18.5% to Skin & soft tissue.

Entry Point - breakdown in SAB's detected in those on RRT yearly 2015-2019



The optimum form of access for haemodialysis is an arteriovenous (AV) fistula which minimises the risk of bacteraemia. The chart above shows that a large number of the bacteraemia recorded had an entry point recorded as Dialysis Line CVC.

The enhanced dataset includes multiple risk factors which could increase their risk of contracting a SAB. The SRR have looked at 2 key risk factors which are known to affect renal patients which are shown in the table below.

Other risk factors - breakdown in SAB's detected in those on RRT 2015-2019

	Yes		No	
	n	%	n	%
Diagnosis of Diabetes	214	39.9	322	60.1
Immunosuppressed	107	20.0	429	80.0

The table above shows that nearly 40% of SAB between 2015-2019 the patient was recorded as being diabetic and 20% were immunosuppressed.

Of the 99 cases where the entry point of SAB was recorded as Skin & Soft Tissue - Diabetes was recorded as a risk factor for 65% of these cases and 28% were recorded as Immunosuppressed.

Adequacy of Haemodialysis

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

The URR audit was performed in May 2020; all patients in Scotland receiving hospital or home haemodialysis on 01 May 2020 were included in the audit. There were 1840 results from 1894 patients (97.1%).

Due to COVID-19 data on the number of dialysis sessions for each patient is not available this year therefore the information in the analysis includes all adult patients. Due to restricted data collection we are also unable to report on standardised Kt/V or proportion of people receiving haemodiafiltration (HDF). URR data from June was included for units who did not have data in May. However, 95.3% of available URR data were collected in May.

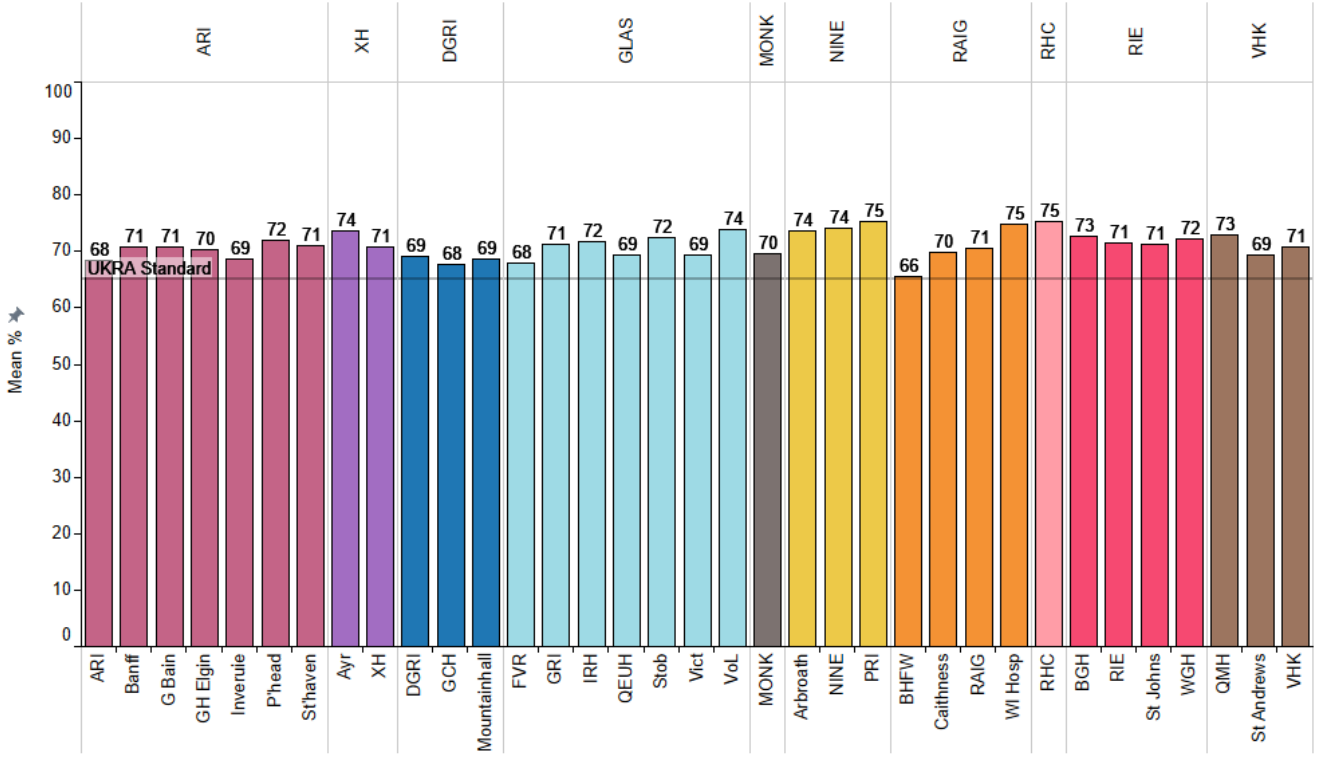
Although most patients continue to receive haemodialysis three times per week, it is clear that a proportion of home and a small proportion of hospital haemodialysis patients are receiving more frequent sessions. Previous years data have shown that approx 95% of the census population had receieved dialysis three times per week.

Comparison against the UKRA standard should be treated with caution and data should not be compared to previous years given the inclusion criteria has changed.

Indicator	Unit										
	ARI	XH	DGRI	GLAS	MONK	NINE	RAIG	RHC*	RIE	VHK	Scotland
Number of patients on HD	191	165	58	574	200	172	94	10	292	138	1894
Number of patients with missing data	4	16	0	12	7	8	4	1	2	0	54
% patients with URR >65%**	77	80	67	79	75	91	74	100	84	84	80
Upper quartile**	74	77	75	75	75	79	76	75	76	75	76
Median URR**	71	70	71	71	75	72	72	72	72	72	72
Lower quartile**	66	67	64	67	65	71	65	72	68	68	68

* Data for RHC. The standards set for adult patients are not applicable to children; data are given for reference purposes only.
** Analysis includes all patients who were receiving dialysis during Audit period in 2020 due to thrice-weekly data not being available due to COVID-19 pandemic.

Mean achieved URR in Hospital HD patients* in May 2020



*Analysis includes all patients who were receiving dialysis during Audit period in 2020 due to thrice-weekly data not being available due to COVID-19 pandemic.

Anaemia

The anaemia audit was performed in May 2020; all patients in Scotland receiving hospital or home haemodialysis on 01 May 2020 were included in the audit. There were 1883 results from 1894 patients (99.4%).

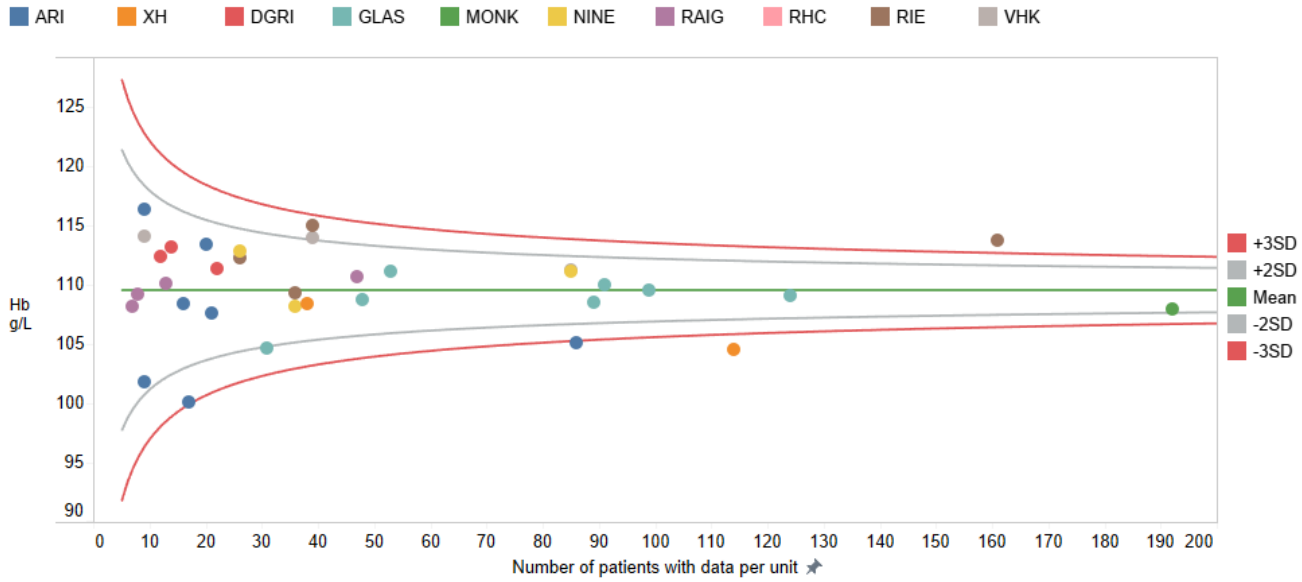
Haemoglobin concentration (Hb) was measured in a pre-dialysis blood sample after the first short interdialytic gap of the audit week, or as soon as possible thereafter. Auditing after the short (2 day) gap is done in order to minimise the potential effect of dilution due to fluid overload.

The UK Renal Association (UKRA) standard 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.

Although ESA use was confirmed on first week of May 2020, due to COVID-19 we permitted Hb data from June for units who did not have data in May. However, 97.1% of available Hb data were from May.

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.

Mean Hb of Hospital HD patients in each dialysis unit May 2020



Patients with Hb >120g/L and confirmed as not receiving ESA therapy (107 patients) are excluded from the funnel plot. All units lie within 3 standard deviations of the population mean (109.6g/L) with the exception of RIE which is more than 3SD above the mean and XH and ARI which were more than 3SD below the mean. All satellite dialysis units achieved the mean Hb within the UKRA standard of 100-120g/L.

	ARI	XH	DGRI	GLAS	MONK	NINE	RAIG	RHC*	RIE	VHK	Scotland
Number of patients	191	165	58	574	200	172	94	10	292	138	1894
Missing data	2	0	0	3	3	1	1	0	1	0	11
% patients with Hb data	99.0	100	100	99.5	98.5	99.4	98.9	100	99.7	100	99.4
Missing ESA Data	3	21	5	9	7	7	0	1	7	0	60
% on ESA Therapy	98.4	87.3	91.4	98.4	96.5	95.9	100.0	90.0	97.6	100.0	96.8
Median Hb all patients**	107	105	113	111	109	114	112	130	116	112	111
% patients with Hb 100-120 g/L***	49.1	51.1	57.6	59.6	63.3	53.7	68.6		60	62.4	58.2
% patients with Hb >120 g/L***	16.6	13.1	30.3	17.8	15.8	26.9	17.1	62.5	27.8	24.8	20.3
Upper quartile***	116	113	121	118	117	121	116	140	122	120	119
Median Hb g/L***	107	104	115	110	109	113	108	135	116	112	111
Lower quartile***	97	97	108	101	101	104	103	115	107	105	101
Range g/L***	68 - 145	67 - 143	88 - 132	70 - 175	76 - 138	65 - 136	82 - 133	111 - 145	67 - 139	68 - 144	65 - 175

* The standards set for adults are not applicable to children.
** All patients with available Hb results (n=1883)
*** UKRA standard. Hb 100-120 g/L on ESA therapy. Patients were excluded if there were no data or were not receiving ESA therapy on the census date (n=1588).

Due to COVID-19 data was not collected on whether patients were receiving IV iron.

Of the 1894 patients with Hb values, 1487 (78.5%) had Hb ≥100g/L.

244 patients were confirmed as not receiving ESA therapy. 20 (8.2%) had Hb <100g/L, 117 (47.9%) had Hb 100 - 120g/L and 107 (43.8%) had Hb >120g/L.

Data on ESA treatment (including patients confirmed as not receiving ESA) were available for 1832 (97.3%) 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 1588 patients confirmed as receiving ESA treatment and who had data and had not recently been transfused, 924 (58.2%) achieved the UKRA standard. Hb was <100g/L in 342 (22.5%) of patients, Hb was >120g/L in 322 (20.3%) and 165 (10.4%) had Hb >125g/L.

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.

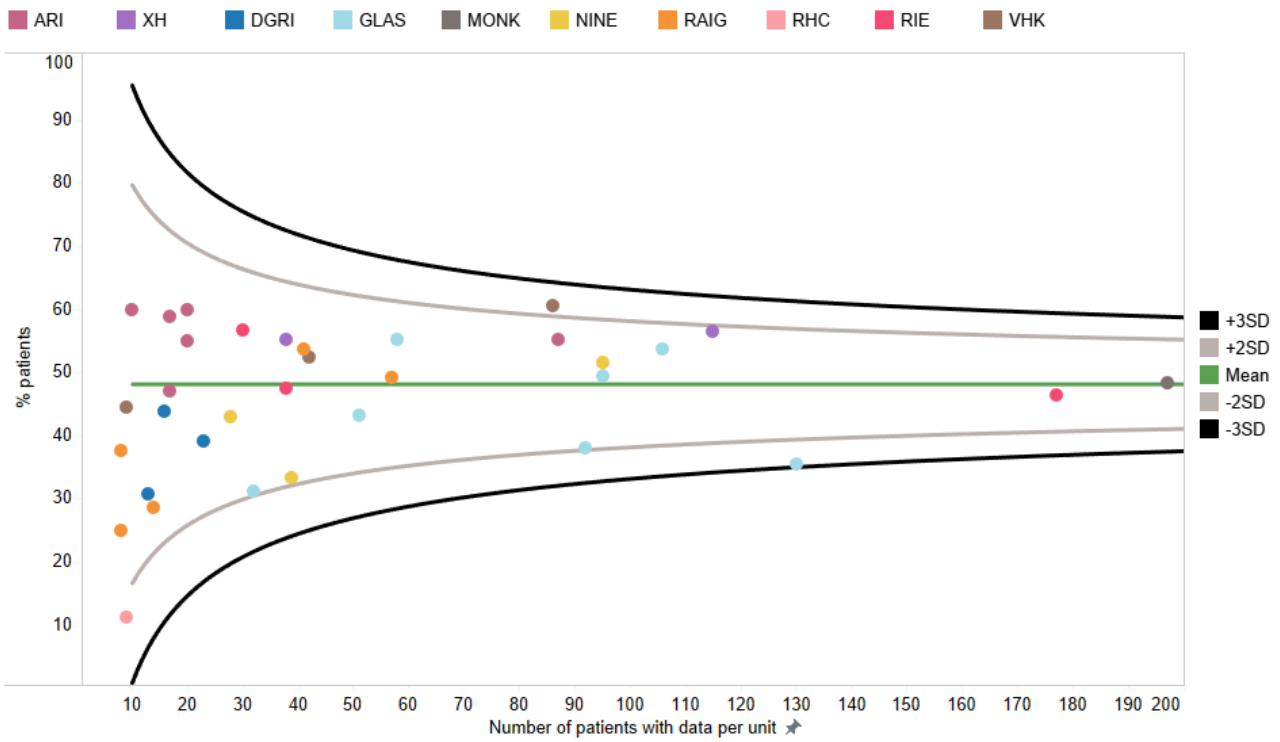
Bone Mineral Metabolism

The laboratory data relating to bone mineral metabolism were audited in May 2020 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. Due to disruption to the census as a result of COVID-19 we permitted data from June where no data were collected in May. 3.7% of patients were in this category.

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

Percentage of hospital HD patients achieving pre-dialysis PO4 target of 1.1-1.7 mmol/L by dialysis unit May 2020



1864 (98.4%) patients had phosphate results. 524 (29.0%) had a phosphate <1.1 mmol/L, 956 (52.9%) achieved the UKRA standard and 328 (18.1%) had phosphate >1.7 mmol/L. All units lie within 3 standard deviations of the Scottish proportion achieving target (48.1%).

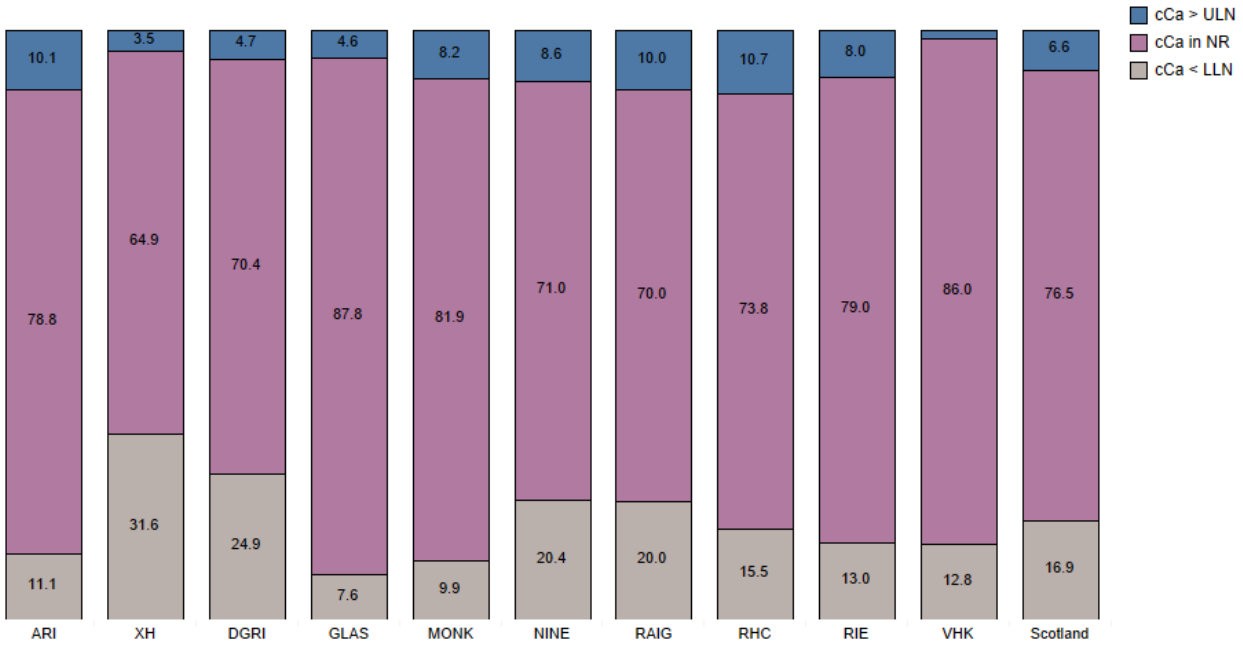
Achievement of guideline targets for phosphate (PO4), corrected calcium (cCa) and PTH in haemodialysis patients by renal unit May 2020

Unit	Number of patients	% with PO4 result	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	191	93.2	1.56	56.2	99	78.8	94.8	50.8
XH	165	99.4	1.55	56.1	99.4	86	93.3	59.1
DGRI	58	98.3	1.81	38.6	98.3	64.9	94.8	61.8
GLAS	574	99.3	1.75	44.2	99.5	70.4	94.8	52
MONK	200	98.5	1.44	48.2	98.5	87.8	95.5	47.1
NINE	172	98.3	1.74	45.6	99.4	81.9	92.4	52.8
RAIG	94	98.9	1.75	43	98.9	71	97.9	50
RHC*	10	100	1.9	10	100	70	100	40
RIE	292	98.6	1.72	48.3	99.3	73.8	98.6	51.4
VHK	138	100	1.63	56.5	100	79	97.1	62.7
Scotland	**1894**	**98.4**	**1.67**	**48.1**	**99.3**	**76.5**	**95.5**	**52.9**

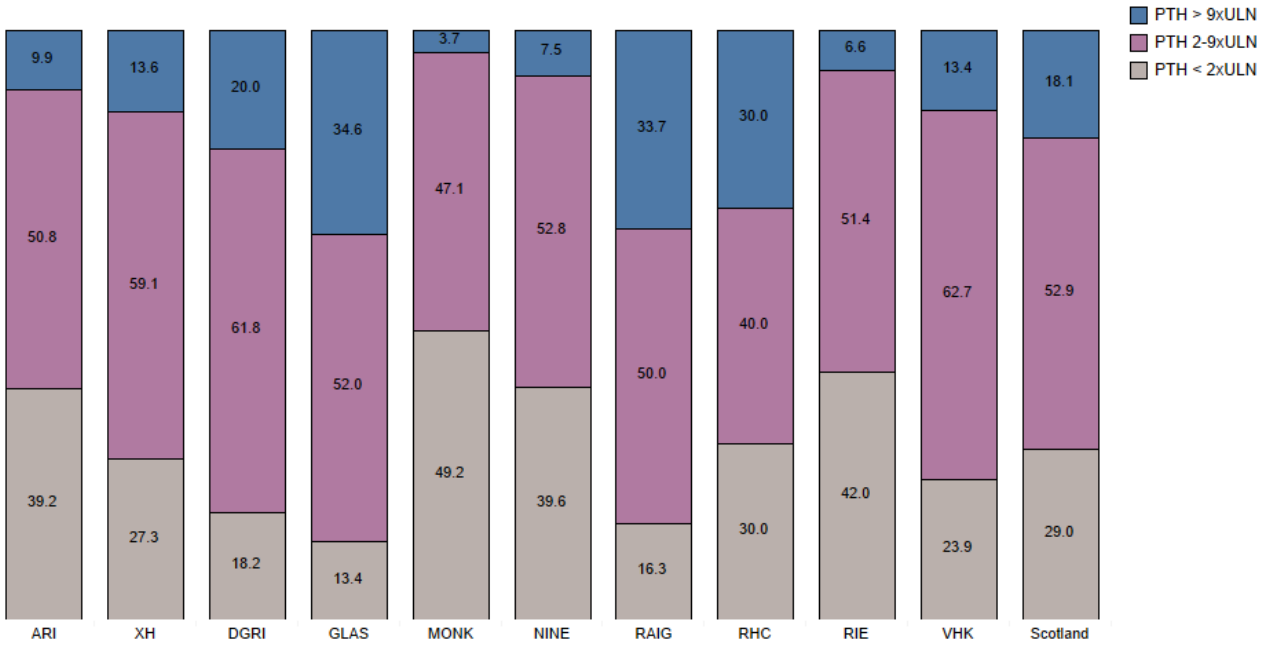
* UL - upper limit of normal

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.

Distribution of pre-dialysis corrected serum calcium in haemodialysis patients by renal unit May 2020



Distribution of pre-dialysis serum PTH in haemodialysis patients by renal unit May 2020



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

The local ranges for corrected calcium for the biochemistry laboratories that serve each dialysis unit and assay specific PTH ranges are available on the SRR website: http://www.srr.scot.nhs.uk/Projects/Projects1.html#calc

Anthropometric Measurements of Haemodialysis patients

Patients' measured height and weight were recorded in the May 2020 census, all prevalent home and hospital HD patients were included.

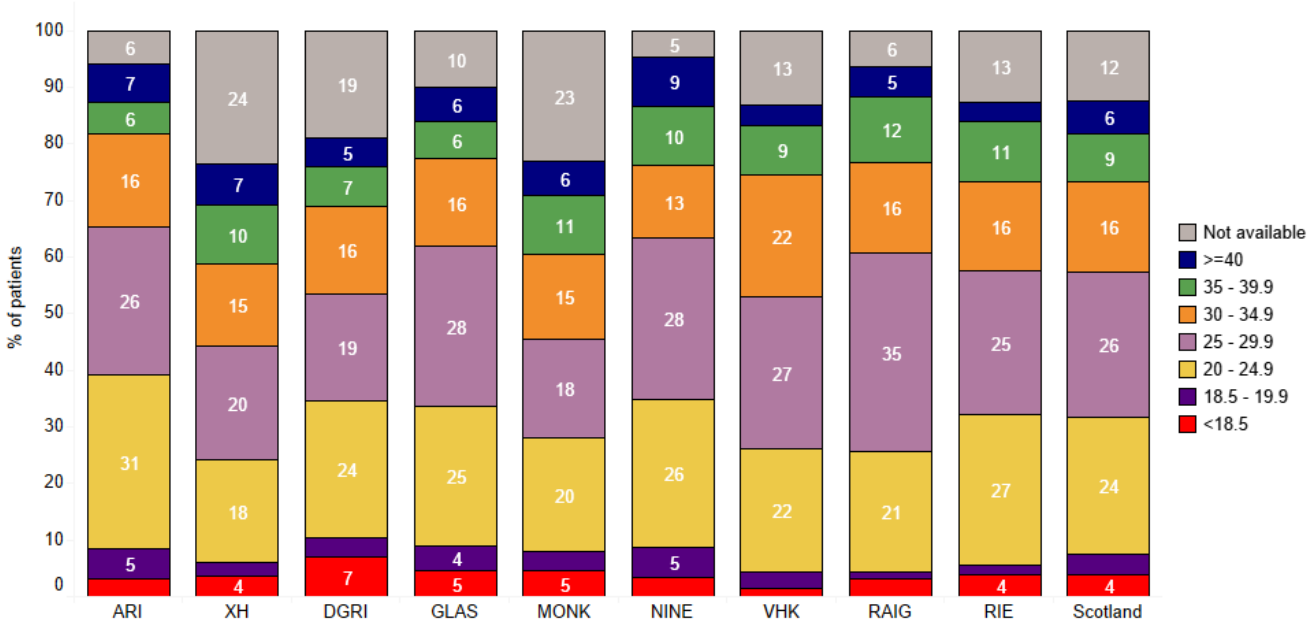
Body mass index (BMI) can be calculated using height and weight in adult patients. Patients aged under 18 are excluded from the analyses.

BMI was available for 1651 (87.6%) of 1884 adult patients.

The data collection form and methods are available on the SRR website:

http://www.srr.scot.nhs.uk/Projects/Main.html#census

Distribution of BMI (kg/m$^{2)}$ by renal unit May 2020

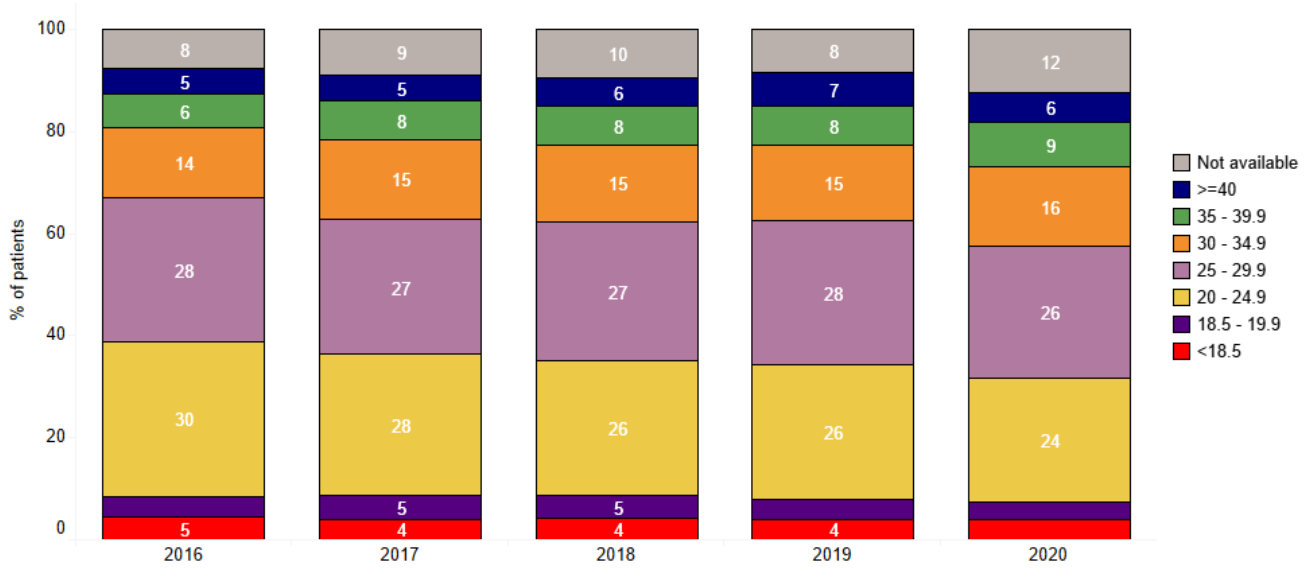


The WHO suggest that BMI <18.5 kg/m^2 is underweight in the normal population, that BMI ≥ 25kg/m^2 is overweight and ≥ 30 kg/m^2 denotes obesity.

A BMI of <20kg/m^2 is suggested as an audit measure by Renal Association clinical guidelines as a measure of under nutrition.

The Renal Association guideline regarding evaluation and selection for potential renal transplant states that patients with BMI >30 kg/m^2 present technical difficulties, and those with BMI >40 kg/m^2 are less likely to benefit from transplantation.

Distribution of BMI (kg/m$^{2)}$ by year 2016-2020



The median BMI of haemodialysis patients across Scotland at the annual May census has increased each year from 26.0 in 2016 to 27.1 in 2020.

Survey of Transplant Kidney Biopsy in Scotland 2019

All centres in Scotland were able to provide data for all transplant renal biopsies performed in the calendar year 2019. Indication and biopsy diagnosis were selected from bespoke codesets agreed by the SRR Biopsy Steering Group. Biopsies at the time of transplant ('implantation biopsies', 'time zero biopsies') were not included.

The total number of reported transplant biopsies was 248 in 191 patients giving an incidence of 45.4 transplant biopsies per million population (pmp) which is lower than 51.4 pmp reported in 2018 (51.2 pmp in 2017, 59.0 pmp in 2016 and 70.6 pmp in 2015). 248 transplant biopsies amounts to 0.08 biopsies per prevalent transplant recipient using the Scottish Renal Registry reported prevalent transplant patient data from 31/12/2018 and this is similar to 0.09 reported in 2018.

Total number of biopsies and total number of patients having transplant renal biopsy in each centre were expressed per million people (pmp) and per prevalent transplant patient and for each centre based on the populations shown below. Some centres perform no transplant biopsies or only a proportion of the transplant biopsies for patients from their NHS Board area with the others being performed at the relevant transplant centre. For this reason all analyses include a comparison of the NHS 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).

Number of transplant kidney biopsies by renal unit and NHS Board

Unit	NHS Board	Mid Year Population 2019	Prevalent transplant patients 31/12/2018	Total transplant biopies (n)	Total number patients having biopsy*	Transplant biopsies pmp/year	Patients having transplant biopies pmp/year	Transplant biopsies per prevalent transplant patient/yr
ARI	GRAM + SHET + ORKN	630,890	329	21	16	33.3	25.4	0.06
XH	A&A	369,360	172	6	6	16.2	16.2	0.03
DGRI	D&G	148,860	83	0	0	0.0	0.0	0.00
GLAS	GG&C + FV	1,489,760	1,167	94	73	63.1	49.0	0.08
MONK	LAN	661,900	277	0	0	0.0	0.0	0.00
NINE	TAY	417,470	260	14	11	33.5	26.3	0.05
RAIG	HIGH + WI	348,420	170	2	2	5.7	5.7	0.01
RIE	LOTH + BORD	1,023,090	519	107	80	104.6	78.2	0.21
VHK	FIFE	373,550	139	4	3	10.7	8.0	0.03
East	East	2,793,420	1,417	146	112	52.3	39.4	0.10
West	West	2,669,880	1,699	102	79	37.5	30.3	0.06
Scotland		5,463,300	3,116	3,116	248	191	45.4	34.9

Time since transplant 2019

Unit	1-28 days	1 -3 months	3 - 12 months	1 - 5 years	5 - 10 years	> 10 years
ARI	7	3	4	1	4	2
XH	0	1	1	3	1	0
DGRI	0	0	0	0	0	0
GLAS	30	15	12	26	9	2
MONK	0	0	0	0	0	0
RAIG	0	2	0	0	0	0
NINE	4	2	2	4	2	0
VHK	1	1	0	0	1	1
RIE	31	14	17	23	16	6
West	30	16	13	29	10	2
East	43	22	23	28	23	9
Scotland	73	38	36	57	33	11

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

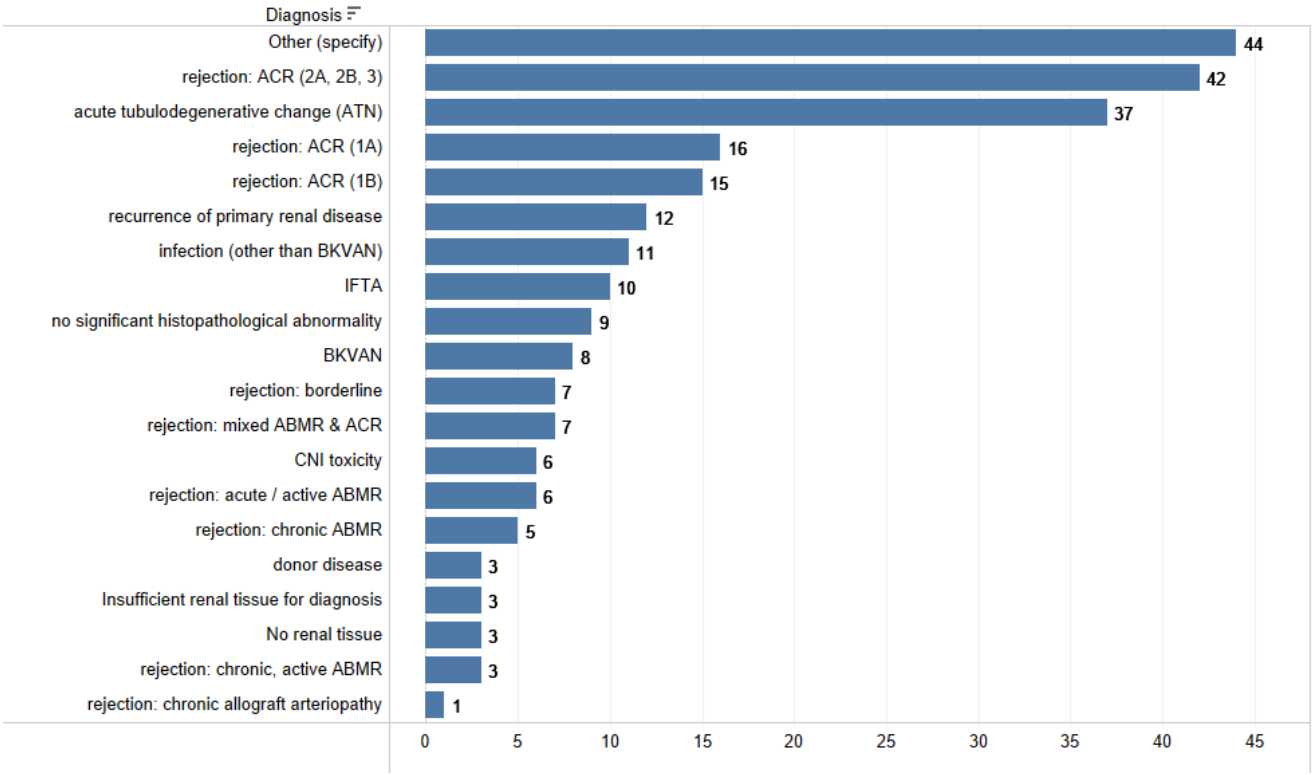
Indication for transplant renal biopsy

Indication	ARI	XH	DGRI	GLAS	MONK	NINE	RAIG	RIE	VHK	East	West	Scotland
Surveillance during delayed graft function	0	0	0	5	0	0	0	18	1	19	5	24
Achieved transplant function lower than expected	0	0	0	12	0	0	0	22	1	23	12	35
AKI	15			31		5	1	15	1	37	31	69
Assessment of response to treatment of rejection	2	0	0	4	0	1	0	19	0	22	4	26
Chronically deteriorating transplant function and proteinuria	1	3		17		0		4	1	6	20	26
Chronically deteriorating transplant function only	1	3	0	22	0	4	0	17	0	22	25	47

Histopathological diagnosis

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

Transplant biopsy histopathological diagnosis 2019



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

This is the fourth consecutive analysis of all transplant renal biopsies in Scotland in a calendar year. Analysing the data by regions served by the two transplanting units (East v West) again demonstrates a higher incidence of transplant biopsies in the East region (55.4 v 45.5 pmp). The difference has narrowed each year (in 2015 the incidences were 92.6 and 45.3 pmp respectively) mainly due to a reduction in incidence of transplant biopsy in the East region each year. The difference in incidence between East and West is accounted for mainly 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 almost the same (40.3 v 38.4 pmp).

The analysis of indication and histopathological diagnosis suggests a lower clinical threshold for performing transplant biopsy early after transplant 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’ and ‘ATN’ were higher in the East.

Survey of Native Kidney Biopsy in Scotland 2019

All centres in Scotland were able to provide data for all native kidney biopsies performed in the calendar year 2019. 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 622 in 609 patients giving an incidence of 112 native kidney biopsies per million population (pmp) per year, which is lower than the incidences of 114 in 2018, 120 pmp in 2017, 139 pmp in 2016, 130 pmp in 2015 and 127 pmp in 2014.

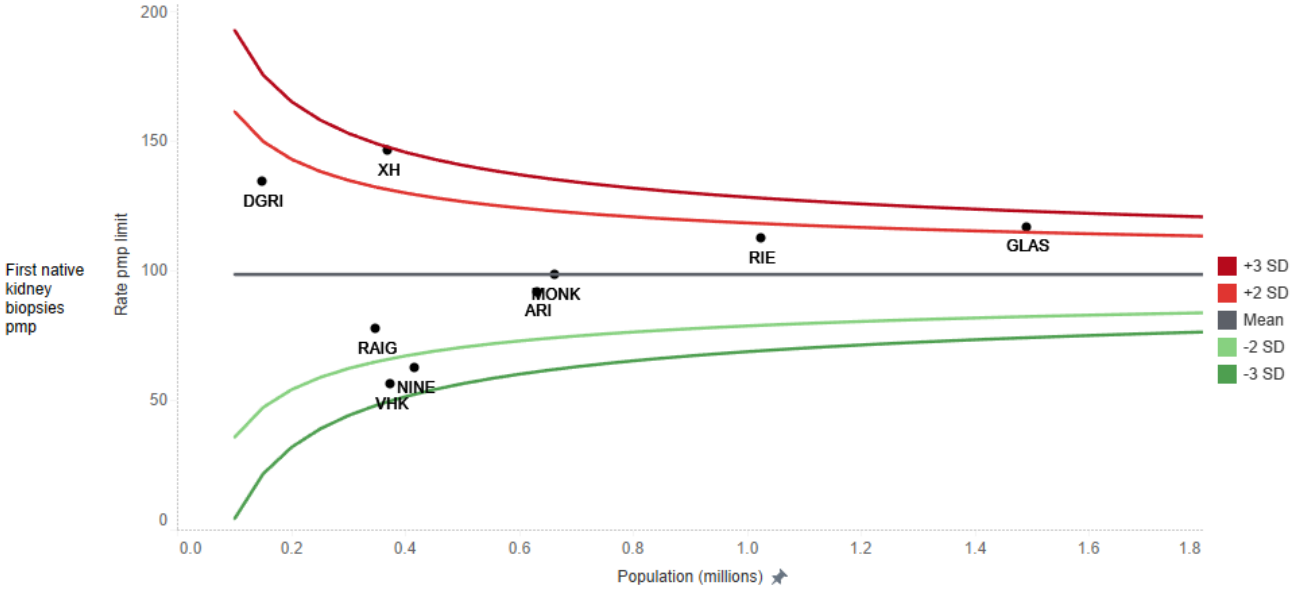
Centres were asked to indicate if this was the first biopsy ever with this diagnosis, to take account of patients having repeat biopsies to monitor disease. 560 patients were having their first kidney biopsy for this diagnosis meaning that 62 biopsies were repeat biopsies.

Total number of biopsies and total number of patients having native kidney biopsy were expressed pmp for each centre based on the populations shown in the table below.

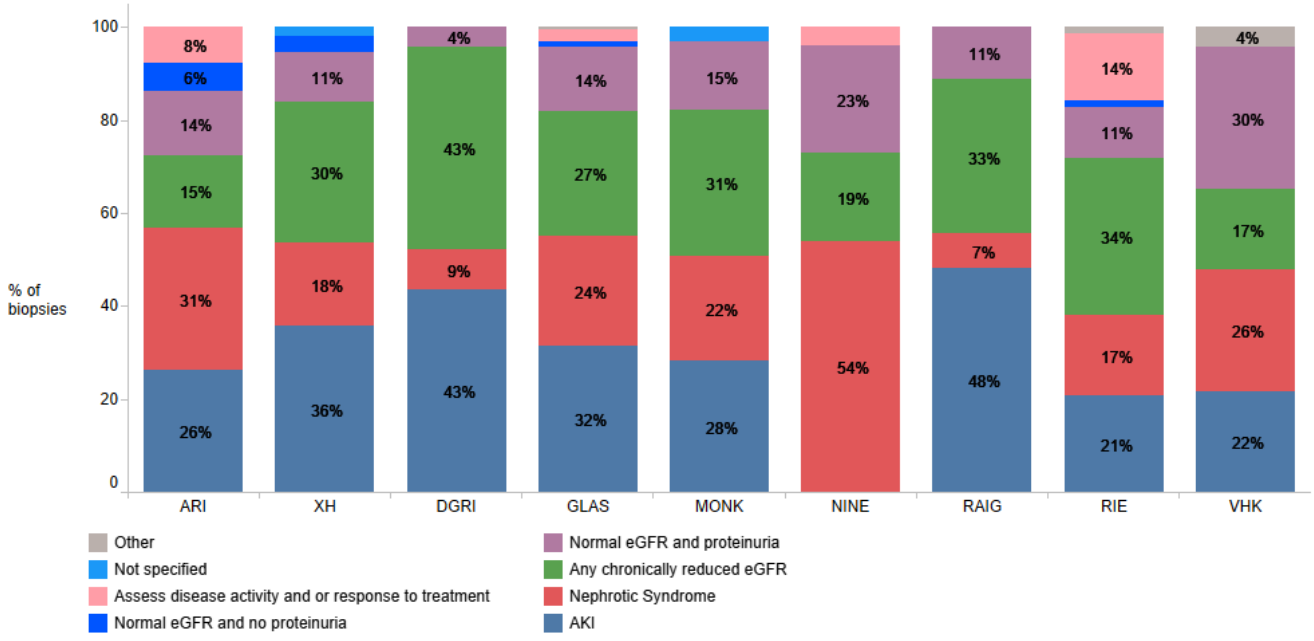
Number of native kidney biopsies 2019 by renal unit and NHS Board

Renal Unit	NHS Board	Mid Year Population 2019	Total native biopies	Second or sub-sequent biopsies	Number of patients having biopsy	Number of patients having 1st renal biopsy	Native biopsies pmp/ year	Patients having first native biopsy pmp/ year	Mean age at biopsy (yrs)	% Male
ARI	GRAM + SHET + ORKN	630,890	65	3	62	54	103	86	53	48
XH	A&A	369,360	56	1	55	54	152	146	59	57
DGRI	D&G	148,860	23	2	21	17	155	114	59	65
GLAS	GG&C + FV	1,489,760	187	3	184	169	126	113	56	55
MONK	LAN	661,900	67	0	67	65	101	98	61	59
NINE	TAY	417,470	26	0	26	25	62	60	52	54
RAIG	HIGH + WI	348,420	27	0	27	26	77	75	69	63
RIE	LOTH + BORD	1,023,090	139	7	132	107	136	105	57	62
VHK	FIFE	373,550	23	0	23	22	62	59	49	52
Scotland		5,463,300	613	16	597	539	112	99	57	57

Incidence per million population of first native kidney biopsies in 2019 by renal unit



Indication for native kidney biopsy in 2019 by renal unit



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 cases.

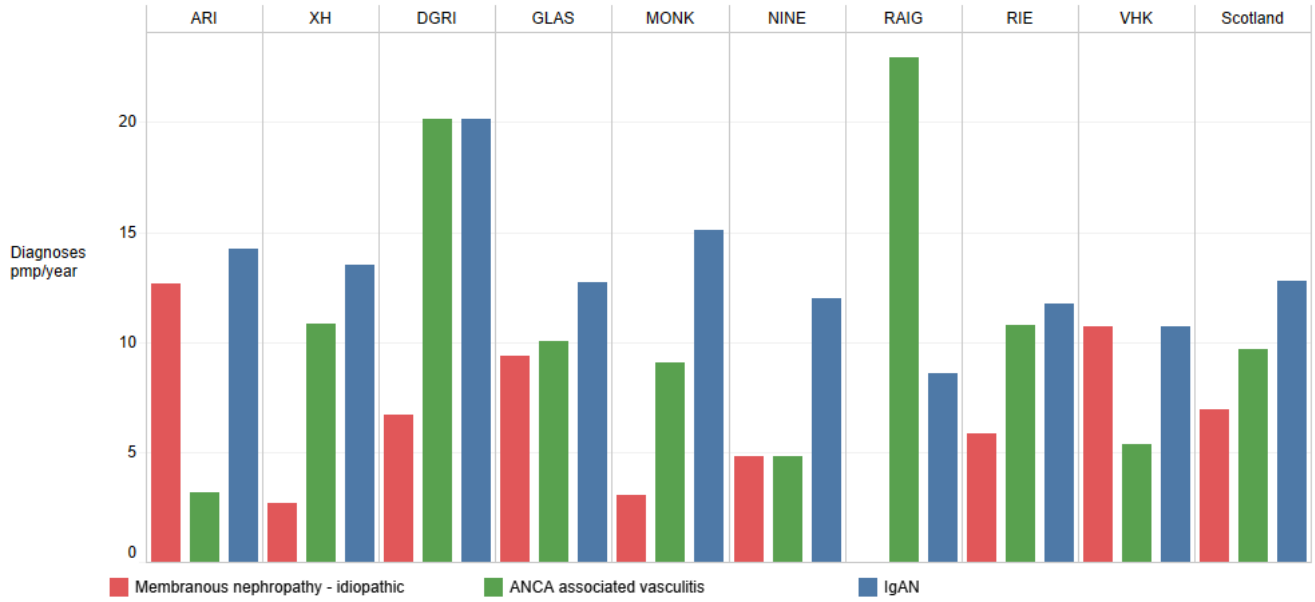
The diagnoses for first biopsies are presented in the table below. If the first biopsy produced insufficient tissue and was repeated the subsequent diagnosis is presented. The top 20 reported diagnoses are shown in table below.

All recorded diagnoses and frequencies in each centre for 2018 can be viewed on the Scottish Renal Registry website
http://www.srr.scot.nhs.uk/Biopsy-Registry/Main.html

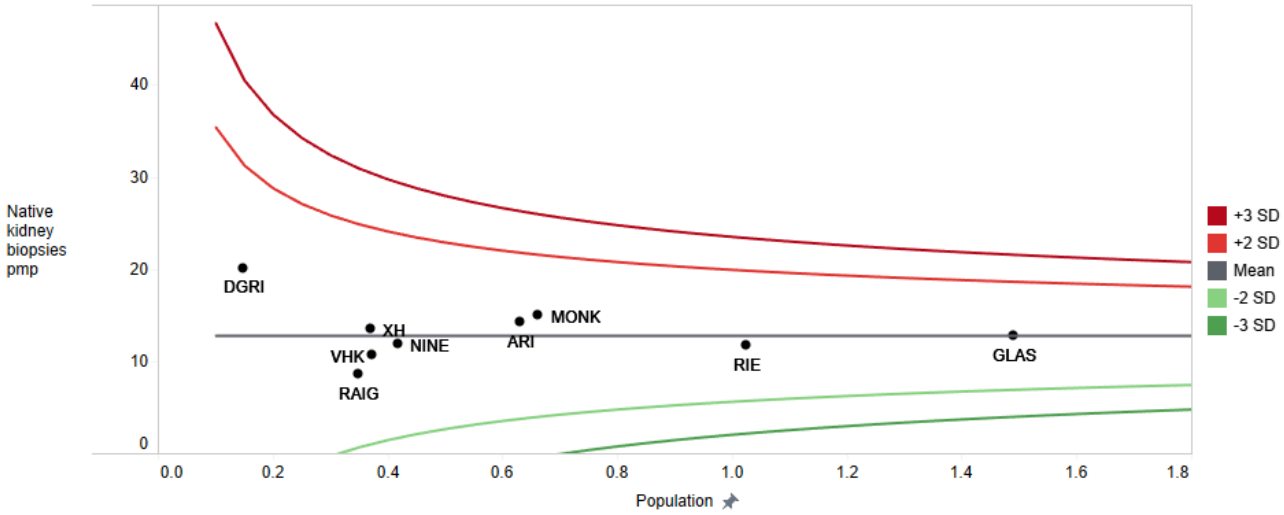
Most frequent 20 recorded in first native kidney biopsy diagnoses 2014-2019

	2014	2015	2016	2017	2018	2019	2014-2019
IgA nephropathy - histologically proven	101	95	106	67	95	74	538
Tubulointerstitial nephritis - histologically proven	61	57	65	48	37	38	306
Membranous nephropathy - idiopathic	41	70	45	40	51	41	288
Microscopic polyangiitis - histologically proven	38	29	55	41	38	25	226
Primary focal segmental glomerulosclerosis (FSGS)	44	25	45	33	23	34	204
Minimal change nephropathy - histologically proven	35	28	31	35	25	29	183
Diabetic nephropathy in type II diabetes - histologically proven	29	32	23	30	24	30	168
Systemic lupus erythematosus / nephritis - histologically proven	28	31	31	24	31	17	162
Granulomatosis with polyangiitis - histologically proven	33	35	24	15	23	20	150
Acute kidney injury	17	14	26	23	14	14	108
Insufficient histological evidence from kidney biopsy for diagnosis	1	41	22	11	17	4	96
Ischaemic nephropathy / microvascular disease - histologically proven	13	10	18	25	13	15	94
Chronic hypertensive nephropathy - histologically proven	8	10	14	18	16	25	91
Other (specify)	9	16	7	12	18	20	82
Chronic kidney disease (CKD / CRF) aetiology uncertain - hist proven	15	11	13	23	11	8	81
AL amyloid secondary to plasma cell dyscrasia	10	14	17	9	6	15	71
Mesangiocapillary glomerulonephritis type 1	21	13	3	7	5	10	59
Mesangial proliferative glomerulonephritis	9	6	15	11	4	6	51
Glomerulonephritis - histologically indeterminate	17	7	10	6	7	4	51

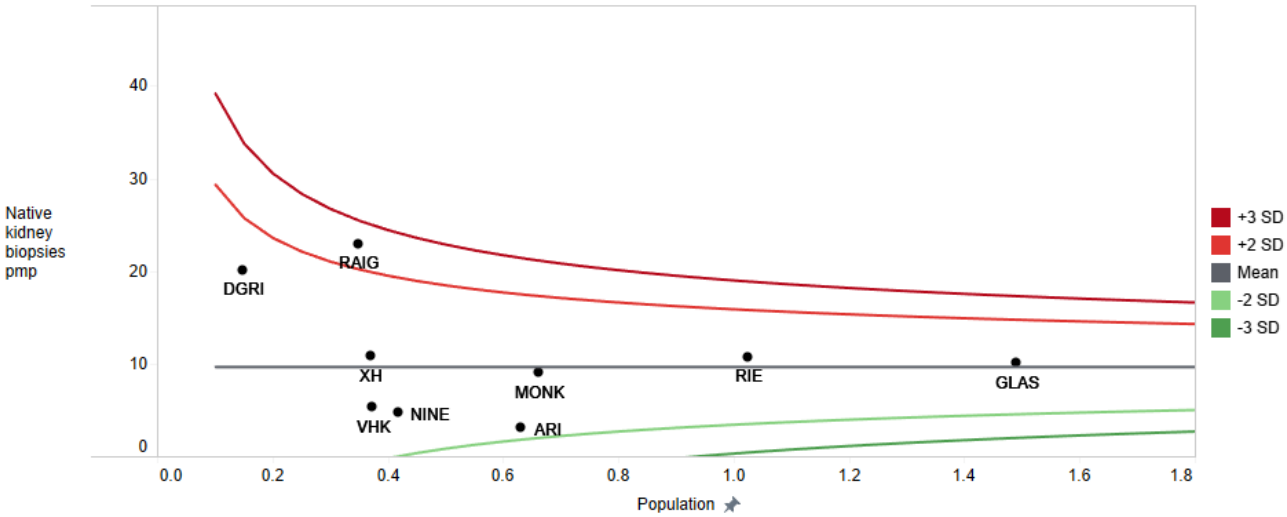
Incidences per million population of selected first native biopsy diagnoses 2019



Incidence per million population of biopsy diagnosis of IgA nephropathy by renal unit 2019



Incidence per million population of biopsy diagnosis of AAV by renal unit 2019



The Scottish renal biopsy registry has now been collecting data for six years and has full coverage of native kidney biopsies performed in Scotland 2014-2019. The incidence of kidney biopsy over the six years in the nine Scottish centres is reported below.

Number of native kidney biopsies by renal unit by year, excluding repeat biopsies during a six-year period

Year	ARI	XH	DGRI	GLAS	MONK	NINE	RAIG	RIE	VHK	Total
2014	80	42	12	171	56	67	27	168	20	653
2015	92	46	10	193	60	71	40	142	23	677
2016	71	51	4	239	75	50	31	157	26	704
2017	62	40	11	182	56	50	33	141	32	607
2018	62	39	14	173	76	29	30	125	30	578
2019	58	54	20	174	65	26	27	115	21	560
Total	425	272	71	1132	388	293	188	848	152	3779
Average	71	45	12	189	65	49	31	141	25	630

Contact

Chrissie Watters, Clinical Coordinator
Scottish National Audit Programme
Email: Chrissie.Watters@phs.scot

Jacqueline Campbell, Senior Information Analyst
Scottish National Audit Programme
Email: Jacqueline.Campbell7@phs.scot

Further Information

Further information and data for this publication are available from the publication page on our website.

The next release of this publication will be Summer 2021.

Rate this publication

Let us know what you think about this publication via. the link at the bottom of this publication page on the PHS website.

Appendices

Appendix 1 – Abbreviations used in report

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
NHS QIS	NHS Quality Improvement Scotland
NHSBT	NHS Blood and Transplant
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

Appendix 2 – Early access details

Pre-Release Access

Under terms of the "Pre-Release Access to Official Statistics (Scotland) Order 2008", PHS is obliged to publish information on those receiving Pre-Release Access ("Pre-Release Access" refers to statistics in their final form prior to publication). The standard maximum Pre-Release Access is five working days. Shown below are details of those receiving standard Pre-Release Access.

Standard Pre-Release Access:

Scottish Government Health Department

NHS Board Chief Executives

NHS Board Communication leads

Early Access for Management Information

These statistics will also have been made available to those who needed access to ‘management information’, ie as part of the delivery of health and care:

Early Access for Quality Assurance

These statistics will also have been made available to those who needed access to help quality assure the publication:

Appendix 3 – PHS and Official Statistics

About Public Health Scotland (PHS)

PHS is a knowledge-based and intelligence driven organisation with a critical reliance on data and information to enable it to be an independent voice for the public's health, leading collaboratively and effectively across the Scottish public health system, accountable at local and national levels, and providing leadership and focus for achieving better health and wellbeing outcomes for the population. Our statistics comply with the Code of Practice for Statistics in terms of trustworthiness, high quality and public value. This also means that we keep data secure at all stages, through collection, processing, analysis and output production, and adhere to the 'five safes'.