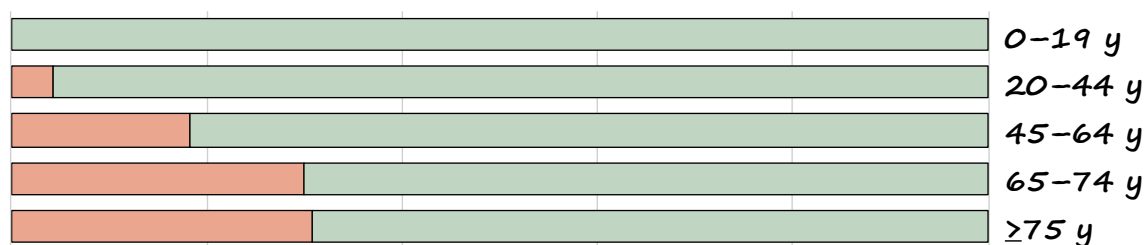


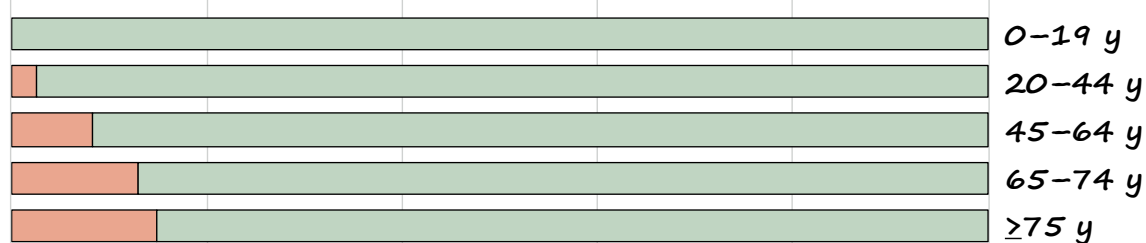
Report 2018

Finnish Registry for Kidney Diseases

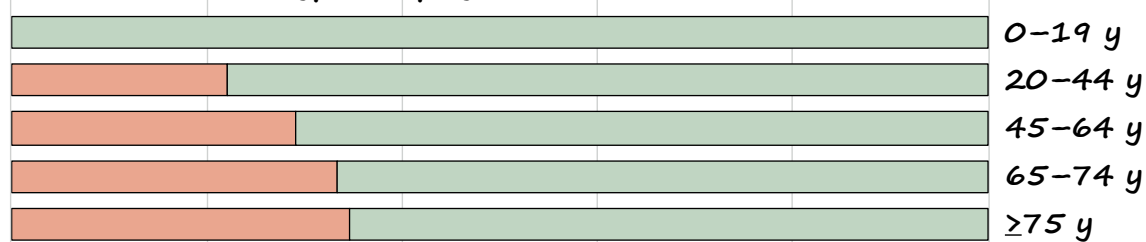
Coronary heart disease



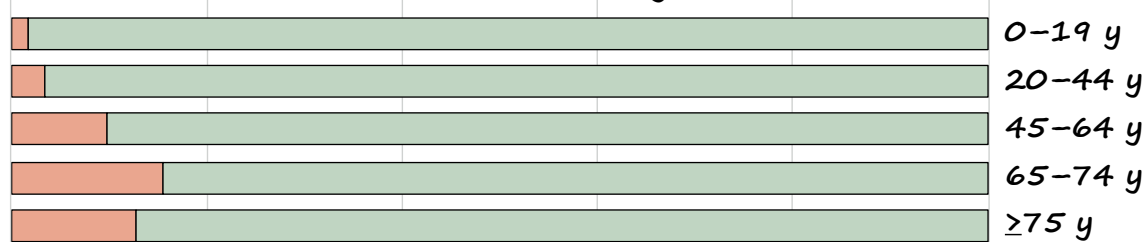
Heart failure



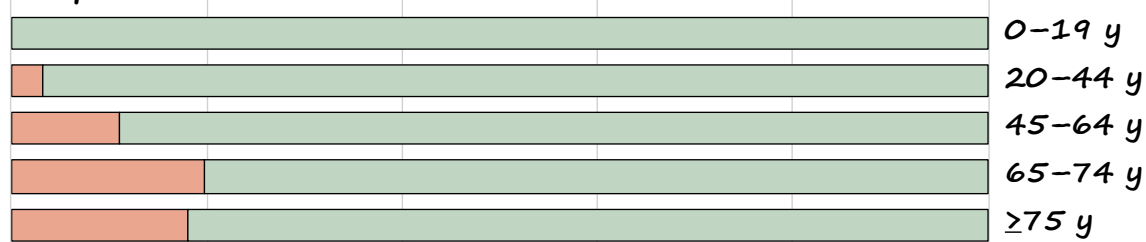
Left ventricular hypertrophy



Cerebrovascular infarction or hemorrhage



Peripheral vascular disease



0% 20% 40% 60% 80% 100%

Finnish Registry for Kidney Diseases – Report 2018

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Board of the Finnish Registry for Kidney Diseases

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Finnish Registry for Kidney Diseases 2018

Approximately 5% of the Finnish population has at least moderate kidney damage (Brück et al., *J Am Soc Nephrol*; 27: 2135). Kidney disease is even more common in people with diabetes or hypertension. Sometimes kidney impairment progresses and requires renal replacement therapy (RRT). At the end of 2018, 0.1% of the Finnish population was on RRT, i.e. on chronic dialysis, or living with a functioning kidney transplant. The Finnish Registry for Kidney Diseases has monitored the treatment of dialysis and kidney transplant patients for three decades. The registry has published an annual report since the early 1990s.

In Report 2018, we give, as in earlier years, information on the numbers of patients entering RRT and currently on RRT as well as patients' treatment outcomes. In 2016 and 2017, an unusually high number of patients entered RRT, but in 2018 the number dropped to the previous level and 92 new patients per million inhabitants were admitted. Overall, there have been no major changes in the incidence of RRT since the turn of the millennium. This suggests that indications for starting RRT have stabilized. In the 1990s, the incidence of RRT was still rising sharply.

Although the annual number of new patients entering RRT has not increased, the prevalence of both dialysis and renal transplant patients is continuously growing. At the end of 2018, there were 2005 patients on dialysis and 3087 patients had received a kidney transplant. The increasing number of patients is explained by the fact that RRT patients' mortality has declined steadily. In this year's report, new survival analyses show that since 2000, RRT patients' risk of premature death has decreased by nearly 40%. This indicates that treatments have advanced. Nevertheless, survival prognosis is not good, averaging about 60% five years after starting RRT. The prognosis depends on many factors such as age, kidney disease diagnosis, and comorbidities. On the positive side, patients' prognosis has improved in all regions, and no difference exists between regions.

The Finnish Registry for Kidney Diseases is the only source to provide information on the results and the regional equity of RRT in Finland. The information in the registry is used by hospitals for improving the quality of care and planning future resources. The registry also enables an international comparison of Finnish treatment results. The registry data help to optimize the treatment of dialysis and kidney transplant patients, which may have an immense economic impact, as these patient groups comprise costs to society of over 100 million euros per year.

The activities of the Finnish Registry for Kidney Diseases have long been threatened due to the lack of a statutory status and uncertain funding. The registry operates on the basis of patients' written consent. After the EU General Data Protection Regulation came into force in 2018, this cannot continue. The Finnish Registry for Kidney Diseases has applied for a statutory position in the enrollment procedure of the National Institute for Health and Welfare, which ended on 30 November 2019. It is important that the Finnish Registry for Kidney Disease obtains a statutory status and that its future is secured.

The Finnish Registry for Kidney Diseases receives most of its funding from the Funding Centre for Social Welfare and Health Organisations (STEA). We thank STEA and also the Kidney and Liver Association for funding. The cornerstone of the registry's activities is excellent cooperation with all nephrology units in Finland. We warmly thank all of our collaborators!

Jaakko Helve
Deputy Administrative Director

Patrik Finne
Administrative Director

Per-Henrik Groop
Chairman of the Board

Summary of Report

Finnish population (pages 9–10)

The Finnish population increased by 4.0% in 2008–2018. The population has grown in seven healthcare districts, most in Helsinki-Uusimaa, Åland, Pirkanmaa, and Pohjois-Pohjanmaa, and the population has decreased in 13 healthcare districts, most in Itä-Savo and Kainuu. The proportion of inhabitants older than 65 years has increased in all healthcare districts in 2008–2018. In 2018, the proportion of inhabitants under the age of 20 years was highest in the northern region (24%), inhabitants aged 20–64 years in the southern region (60%), and inhabitants over 75 years in the eastern region (11%).

Incidence of RRT, number of patients entering RRT (pages 11–17)

In 2018, the incidence of RRT was 92 new patients per million inhabitants. Age- and sex-standardized incidence decreased in 2018 after a few years of higher incidence, and variation between regions has been small. However, significant variation has existed in the incidence of RRT between healthcare districts in 2014–2018, ranging from 65 new patients per year per million inhabitants in Lappi to 130 in Keski-Pohjanmaa. The difference is explained at least partly by differences in the age structure of the population. The incidence of RRT in age groups has remained stable for the past ten years. Of new RRT patients, the group of patients aged 45–64 years is the largest, but the incidence of RRT is the highest in the age group 65–74 years due to the smaller background population. In contrast to other regions, the incidence of RRT in the southern region was the highest in the age group over 75 years. The incidence of RRT in Finland is still low in an international comparison, while in the United States and Japan it is more than threefold that in Finland.

In 2018, the most common kidney disease diagnosis of patients entering RRT was type 2 diabetes, as in the last 20 years. Type 1 diabetes remained the second and glomerulonephritis the third most common kidney disease diagnosis. The incidence of polycystic

degeneration and nephrosclerosis has increased in this millennium, while the incidence of amyloidosis and tubulointerstitial nephritis has been decreasing. In 2018, three months after the start of RRT, one-third of the patients were on home dialysis (peritoneal dialysis or home hemodialysis). Only 3% had received a kidney transplant, but the proportion had increased.

Prevalence of RRT, number of patients at end of year (pages 18–25)

At the end of 2018, there were 2005 dialysis patients and 3087 kidney transplantation patients in Finland. The prevalence of RRT was 923 per million inhabitants. The prevalence has increased by 20% in ten years, and the rise has taken place in all regions. The prevalence has increased in the age group 45 years and over, remaining unchanged among the younger age groups. The prevalence ranged from 741 to 1266 patients per million inhabitants in healthcare districts. Of all dialysis patients, 18% were on peritoneal dialysis (PD) and 8% on home hemodialysis (HHD) at the end of 2018. In the healthcare districts, the proportion of home dialysis (PD and HHD) varied from 0% to 65%. The proportion of hemodiafiltration as a treatment modality in in-center dialysis units ranged from 8% to 100%. The most frequent kidney disease diagnosis of kidney transplantation patients was glomerulonephritis, and the number of patient-years of patients with type 2 diabetes and kidney transplantation has doubled during the last ten years. The most frequent kidney disease diagnosis of hemodialysis patients was type 2 diabetes and of peritoneal dialysis patients type 1 diabetes.

Changes in type of treatment (page 26)

In 2018, altogether 509 new patients started RRT, 418 patients died, and dialysis was discontinued in 15 patients after kidney function resumed. Treatment was terminated in 79 patients, most of whom had been on hemodialysis (72 patients). During the year 238 patients received a kidney transplant. The number of hemodialysis and kidney transplantation

patients increased by 2%, while the number of peritoneal dialysis patients decreased by 7%.

RRT patients' mortality (page 27)

In 2018, the mortality of RRT patients was 82 deaths per 1000 patient-years. During the past ten years age- and sex-standardized mortality has decreased in all regions, and the difference in mortality between regions has diminished markedly.

Survival of RRT patients (pages 28-31)

One-year survival of the patients entering RRT between 2014 and 2018 was 91% and two-year survival 82%. There was no regional variation in survival after adjustment, and the survival has steadily improved over the last two decades. Higher age at onset of RRT significantly reduces the chances of survival, but this is not affected by gender. The risk of death for patients with polycystic degeneration is the lowest, being highest for patients with amyloidosis.

Quality of care (pages 33-40)

Since Report 2012, analyses of quality of care have been presented openly according to healthcare district and region. The most central analyses are repeated in each annual report. New in this report are the analyses of hemodialysis patients with fistula or graft and a need for vascular operation.

At the end of 2018, 81% of dialysis patients reached a hemoglobin concentration ≥ 100 g/l, but the proportion of patients with a hemoglobin concentration < 100 g/l has increased in ten years from 12% to 19%. No temporal changes have occurred in serum phosphorus concentrations, nor have significant differences emerged between healthcare districts and regions in the treatment of hyperphosphatemia. In 2018, the

proportion of fistula or graft for vascular access in new hemodialysis patients was 47%, and the proportion has varied significantly between healthcare districts and regions in recent years. In all patients on hemodialysis, the proportion of catheters has increased steadily over the past ten years, reaching 17% at the end of 2018. The proportion of fistulae or grafts requiring vascular operation in 2018 was 24%, and this proportion has not changed during the past ten years. There was no change in 2008–2018 in proportion of dialysis patients reaching therapeutic goals in blood pressure management, but the proportion of kidney transplant patients reaching the blood pressure target level $< 130/80$ mmHg increased from 15% to 22%. In 2018, 64% of the kidney transplant patients reached a target serum LDL cholesterol level < 2.6 mmol/l, but the proportion varied significantly between healthcare districts and regions.

Comorbidities at onset of RRT (pages 41-43)

At onset of RRT, information on comorbidities (coronary heart disease, heart failure, left ventricular hypertrophy, cerebrovascular disease, or peripheral arterial disease) is collected. Coronary heart disease and heart failure were more common in the eastern and northern regions, and left ventricular hypertrophy was less frequent in the northern region than in other regions in 2014–2018. Left ventricular hypertrophy was the most common comorbidity (29%), while heart failure was the least common (10%). The prevalence of all comorbidities increased with age, and comorbidities were most common in patients aged over 65 years. The prevalence of coronary heart disease, heart failure, and peripheral arterial disease among new RRT patients has decreased over this millennium.

Table 1. The Finnish population (as thousands of inhabitants) and its distribution in healthcare districts
Finnish Registry for Kidney Diseases 2008–2018

Healthcare district		Year					Change (%) 2008–2018
		2008	2013	2016	2017	2018	
1	Helsinki-Uusimaa	1497	1581	1634	1652	1667	11.3
3	Varsinais-Suomi	465	474	479	481	481	3.6
4	Satakunta	226	225	222	220	219	-3.4
5	Kanta-Häme	173	175	174	173	171	-1.0
6	Pirkanmaa	504	522	530	532	535	6.1
7	Päijät-Häme	212	213	213	212	211	-0.4
8	Kymenlaakso	176	174	171	169	167	-5.1
9	Etelä-Karjala	134	132	131	130	129	-3.7
10	Etelä-Savo	107	104	102	102	100	-6.4
11	Itä-Savo	46	44	43	42	41	-11.2
12	Pohjois-Karjala	170	169	168	166	166	-2.7
13	Pohjois-Savo	248	248	248	247	246	-1.1
14	Keski-Suomi	246	251	253	253	253	2.7
15	Etelä-Pohjanmaa	199	199	197	196	194	-2.1
16	Vaasa	164	169	170	170	170	3.3
17	Keski-Pohjanmaa	78	78	79	78	78	0.0
18	Pohjois-Pohjanmaa	390	404	408	409	409	5.1
19	Kainuu	80	77	75	74	73	-8.3
20	Länsi-Pohja	66	64	63	62	61	-6.7
21	Lappi	118	118	118	117	117	-0.9
22	Åland	27	29	29	29	30	8.5
Region							
	South	1807	1888	1936	1950	1963	8.6
	Southwest	883	896	900	900	900	1.9
	West	1088	1109	1113	1113	1112	2.2
	East	818	817	813	810	805	-1.6
	North	731	741	742	740	739	1.1
Entire country		5326	5451	5503	5513	5518	3.6

Figure 1. Healthcare districts and regions in Finland
Finnish Registry for Kidney Diseases 2018

On 31 December 2018, the population of Finland was 5.518 million (Table 1, Source: Statistics Finland). During the past ten years the population of the country has increased by 3.6%, with the fastest increase occurring in the southern region. The population in the eastern region has decreased. Of the healthcare districts, the population has increased most (more than 5%) in Helsinki-Uusimaa, Åland, Pirkanmaa, and Pohjois-Pohjanmaa. In the healthcare districts of Itä-Savo, Kainuu, Länsi-Pohja, Etelä-Savo, and Kymenlaakso, the population has decreased especially rapidly.

The numbers in Figure 1 refer to the healthcare districts listed in Table 1. In this report, “region” refers to a university hospital region.

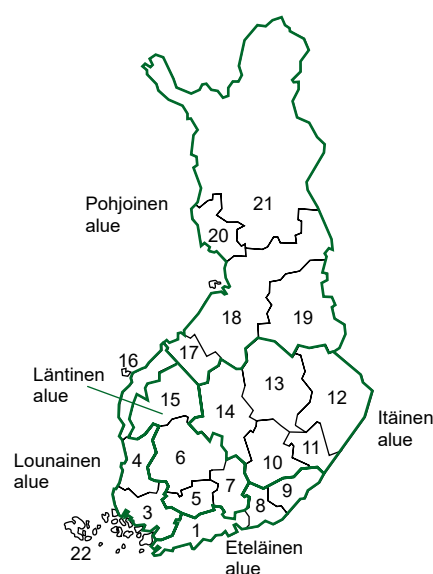


Table 2. The Finnish population (as thousands of inhabitants) according to region, age group, and sex
Finnish Registry for Kidney Diseases 2008–2018

Region	2008					2018				
	0– 19 y (%)	20– 64 y (%)	65– 74 y (%)	≥75 y (%)	Total	0– 19 y (%)	20– 64 y (%)	65– 74 y (%)	≥75 y (%)	Total
South										
Men	211 (24)	562 (64)	64 (7)	39 (4)	876 (100)	215 (22)	588 (61)	99 (10)	58 (6)	960 (100)
Women	203 (22)	572 (61)	79 (8)	77 (8)	931 (100)	205 (20)	585 (58)	118 (12)	94 (9)	1003 (100)
Total	414 (23)	1134 (63)	143 (8)	116 (6)	1807 (100)	420 (21)	1173 (60)	217 (11)	152 (8)	1963 (100)
Southwest										
Men	101 (23)	264 (61)	39 (9)	28 (7)	432 (100)	95 (21)	254 (57)	58 (13)	37 (8)	445 (100)
Women	96 (21)	259 (57)	44 (10)	51 (11)	450 (100)	91 (20)	245 (54)	63 (14)	56 (12)	455 (100)
Total	197 (22)	523 (59)	84 (9)	80 (9)	883 (100)	186 (21)	500 (56)	120 (13)	93 (10)	900 (100)
West										
Men	126 (24)	328 (62)	47 (9)	33 (6)	533 (100)	120 (22)	313 (57)	71 (13)	43 (8)	548 (100)
Women	121 (22)	317 (57)	55 (10)	62 (11)	555 (100)	115 (20)	302 (54)	78 (14)	69 (12)	564 (100)
Total	247 (23)	645 (59)	101 (9)	94 (9)	1088 (100)	235 (21)	615 (55)	149 (13)	112 (10)	1112 (100)
East										
Men	92 (23)	247 (61)	38 (9)	27 (7)	404 (100)	82 (21)	227 (57)	56 (14)	34 (9)	399 (100)
Women	88 (21)	235 (57)	43 (10)	48 (12)	414 (100)	79 (19)	216 (53)	58 (14)	52 (13)	406 (100)
Total	180 (22)	482 (59)	81 (10)	75 (9)	818 (100)	161 (20)	443 (55)	114 (14)	86 (11)	805 (100)
North										
Men	95 (26)	221 (60)	30 (8)	20 (6)	367 (100)	90 (24)	208 (56)	45 (12)	28 (7)	372 (100)
Women	91 (25)	206 (56)	34 (9)	34 (9)	364 (100)	86 (23)	195 (53)	46 (13)	40 (11)	367 (100)
Total	186 (25)	426 (58)	64 (9)	55 (8)	731 (100)	176 (24)	403 (55)	92 (12)	68 (9)	739 (100)
Entire country										
Men	625 (24)	1621 (62)	218 (8)	147 (6)	2612 (100)	603 (22)	1591 (58)	329 (12)	200 (7)	2723 (100)
Women	599 (22)	1589 (59)	255 (9)	272 (10)	2715 (100)	575 (21)	1544 (55)	364 (13)	312 (11)	2795 (100)
Total	1224 (23)	3210 (60)	473 (9)	419 (8)	5326 (100)	1178 (21)	3135 (57)	693 (13)	512 (9)	5518 (100)

Table 2 shows the age and sex distribution of the Finnish population at the end of 2008 and 2018. The age of the Finnish population has increased during the past ten years. The proportion of inhabitants older than 75 years has increased from 8% to 9%, and the proportion of 65–74-year-olds from 9% to 13%.

At the end of 2018, the proportion of inhabitants older than 65 years was the smallest, 19%, in the southern region, while it was 22–25% in the other regions. During the past ten years the proportion of inhabitants older than 65 years has increased by 35% in the entire country, similarly

in all regions.

The proportion of inhabitants aged 20–64 years was largest in the southern region, 60%, while it was 55–56% in the other regions. The proportion of 20–64-year-olds country-wide has decreased from 60% to 57%.

At the end of 2018, the proportion of inhabitants younger than 20 years was the largest, 24%, in the northern region, and the smallest in the eastern region, 20%. The number of inhabitants younger than 20 years has decreased by 4% during the past ten years.

Table 3. Number of new RRT patients and incidence of RRT by healthcare district and region
Finnish Registry for Kidney Diseases 2008–2018

Healthcare district		Number of new RRT patients						Incidence of RRT/million inhabitants					
		2008	2013	2016	2017	2018	2014–2018 on average	2008	2013	2016	2017	2018	2014–2018 on average
1	Helsinki-Uusimaa	121	134	144	153	143	138	81	85	88	93	86	85
3	Varsinais-Suomi	55	37	57	56	43	50	118	78	119	117	89	105
4	Satakunta	27	17	32	28	23	25	119	76	144	127	105	113
5	Kanta-Häme	16	22	23	22	19	22	92	125	132	127	111	128
6	Pirkanmaa	42	58	57	55	48	53	83	111	108	103	90	100
7	Päijät-Häme	27	15	24	25	11	20	127	70	113	118	52	93
8	Kymenlaakso	23	7	15	9	13	14	131	40	88	53	78	83
9	Etelä-Karjala	23	16	21	14	14	15	172	121	161	108	109	115
10	Etelä-Savo	5	5	11	9	11	11	47	48	107	89	110	108
11	Itä-Savo	4	7	4	6	1	4	87	158	93	142	24	94
12	Pohjois-Karjala	14	18	15	23	26	20	82	106	89	138	157	119
13	Pohjois-Savo	26	26	32	18	29	27	105	105	129	73	118	108
14	Keski-Suomi	26	16	27	25	18	22	106	64	107	99	71	87
15	Etelä-Pohjanmaa	13	12	25	24	17	21	65	60	127	123	87	107
16	Vaasa	14	22	18	23	15	16	85	130	106	136	88	97
17	Keski-Pohjanmaa	6	9	8	8	12	10	77	115	102	102	154	130
18	Pohjois-Pohjanmaa	37	39	33	40	35	33	95	97	81	98	85	80
19	Kainuu	4	11	11	6	8	9	50	143	147	81	109	123
20	Länsi-Pohja	15	7	6	6	10	8	229	109	96	97	163	122
21	Lappi	6	8	9	6	10	8	51	68	76	51	85	65
22	Åland	5	3	2	2	3	3	182	105	68	68	101	82
Region	South	167	157	180	176	170	167	92	83	93	90	87	87
	Southwest	101	79	109	109	84	94	114	88	121	121	93	105
	West	98	107	129	126	95	116	90	96	116	113	85	104
	East	75	72	89	81	85	84	92	88	109	100	106	103
	North	68	74	67	66	75	67	93	100	90	89	102	91
Entire country		509	489	574	558	509	528	96	90	104	101	92	96
	Children <15 y	4	8	3	11	7	9	4	9	3	12	6	9

Table 3 shows the number of new RRT (dialysis and kidney transplantation) patients and the incidence of RRT according to healthcare district and region. In 2018, the incidence was 92 new patients per million inhabitants. In 2014–2018, the average incidence was highest in the southwestern region and lowest in the southern region. In the healthcare districts, the average incidence during the same period was lowest in Lapland (65 new RRT patients per million inhabitants) and highest in Keski-Pohjanmaa (130 per million inhabitants).

Table 4. Number of new RRT patients by age group in healthcare districts and regions
Finnish Registry for Kidney Diseases 2014–2018

Healthcare district		Average annual number of new RRT patients in 2014–2018 by age group (y)						Incidence*/million inhabitants in 2014–2018 by age group (y)					
		0–19	20–44	45–64	65–74	≥75	Total	0–19	20–44	45–64	65–74	≥75	Total
1	Helsinki-Uusimaa	3.6	19.8	50.4	36.0	28.4	138	10	34	121	219	260	85
3	Varsinais-Suomi	1.6	6.6	16.8	16.8	8.4	50	16	44	134	281	182	105
4	Satakunta	0.4	4.0	10.2	6.4	4.0	25	9	67	168	206	160	113
5	Kanta-Häme	0.0	3.4	7.6	5.8	5.4	22	0	72	157	254	309	128
6	Pirkanmaa	2.0	7.4	20.0	14.6	8.8	53	18	43	150	233	182	100
7	Päijät-Häme	0.2	3.2	8.4	5.6	2.4	20	5	55	144	184	109	93
8	Kymenlaakso	0.2	1.8	7.0	3.2	2.0	14	6	40	144	130	104	83
9	Etelä-Karjala	0.0	2.4	5.6	4.4	2.6	15	0	67	152	243	171	115
10	Etelä-Savo	0.0	2.2	4.4	2.8	1.6	11	0	87	147	180	126	108
11	Itä-Savo	0.0	0.6	1.2	1.0	1.2	4	0	62	93	145	209	94
12	Pohjois-Karjala	0.4	2.8	7.8	5.4	3.6	20	12	61	165	235	201	119
13	Pohjois-Savo	0.8	4.0	10.6	8.4	3.0	27	16	57	153	263	117	108
14	Keski-Suomi	0.6	2.6	9.0	5.8	4.0	22	11	33	141	193	174	87
15	Etelä-Pohjanmaa	0.8	2.6	7.2	6.4	4.0	21	18	49	137	254	191	107
16	Vaasa	1.0	1.4	4.0	5.2	4.8	16	26	27	97	260	284	97
17	Keski-Pohjanmaa	0.2	2.0	2.4	2.4	3.2	10	10	91	123	247	429	130
18	Pohjois-Pohjanmaa	0.8	5.0	10.4	9.8	6.8	33	7	39	105	235	216	80
19	Kainuu	0.2	0.8	4.6	2.4	1.2	9	14	43	206	227	139	123
20	Länsi-Pohja	0.0	0.8	3.4	2.4	1.0	8	0	50	192	284	152	122
21	Lappi	0.0	2.0	2.2	2.4	1.0	8	0	61	64	161	84	65
22	Åland	0.0	0.6	0.8	0.8	0.2	2	0	70	99	222	76	82
Region South		3.8	24.0	63.0	43.6	33.0	167	9	36	125	210	230	87
Southwest		3.0	12.6	31.8	29.2	17.4	94	16	47	135	255	192	105
West		3.0	16.6	43.2	32.4	20.6	116	13	50	148	230	190	104
East		1.8	12.2	33.0	23.4	13.4	84	11	53	148	218	158	103
North		1.2	10.6	23.0	19.4	13.2	67	7	49	119	227	200	91
Entire country		12.8	76.0	194.0	148.0	97.6	528	11	44	134	226	198	96

*Average annual incidence of RRT in subgroup

Table 4 presents the average annual number of new RRT patients and the incidence of RRT in 2014–2018 according to healthcare district, region, and age group. The incidence was highest among 65–74-year-olds and varied in this age group from 130 to 284 in the healthcare districts.

In the age group of 75 years and over, the incidence was 198 new RRT patients per million age-related inhabitants, with a range of 76–429 in healthcare districts and a range of 158–230 in regions.

Table 5. Number of new RRT patients by age group and sex
Finnish Registry for Kidney Diseases 2008–2018

Age group		Number of new RRT patients					Incidence of RRT/million inhabitants				
		2008	2013	2016	2017	2018	2008	2013	2016	2017	2018
0–19 y	Men	5	12	2	9	8	8	19	3	15	13
	Women	1	2	4	6	3	2	3	7	10	5
	Total	6	14	6	15	11	5	12	5	13	9
20–44 y	Men	53	42	61	49	39	62	49	69	55	44
	Women	23	23	31	29	24	28	28	37	35	29
	Total	76	65	92	79	63	45	39	54	46	37
45–64 y	Men	119	125	133	117	120	156	168	184	164	170
	Women	71	59	74	69	66	92	78	102	96	93
	Total	190	184	208	186	191	124	123	143	130	135
65–74 y	Men	96	89	106	112	102	440	319	344	348	310
	Women	38	49	46	61	48	149	156	135	171	132
	Total	134	138	152	173	150	283	233	234	255	216
≥75 y	Men	57	62	77	66	66	387	359	401	340	330
	Women	48	27	40	40	28	176	93	130	130	90
	Total	105	89	117	106	94	250	192	234	211	184
Total	Men	330	330	379	353	335	126	123	140	130	123
	Women	181	160	195	205	169	67	58	70	73	60
	Total	511	490	575	559	509	96	90	104	101	92

Table 5 shows the number of new RRT patients and the incidence of RRT according to age group and sex in 2008–2018. In 2015–2017, the number of new patients had increased. The increase was mainly observed in the age groups of 65 years and over.

In 2018, the incidence of RRT declined relative to the years 2015–2017. The decrease in incidence occurred mainly in the age groups of 65 years and over. Of the new RRT patients in 2018, 66% were men, and this proportion has remained virtually unchanged during the past ten years.

Figure 2. Standardized incidence of RRT in regions Finnish Registry for Kidney Diseases 2008–2018

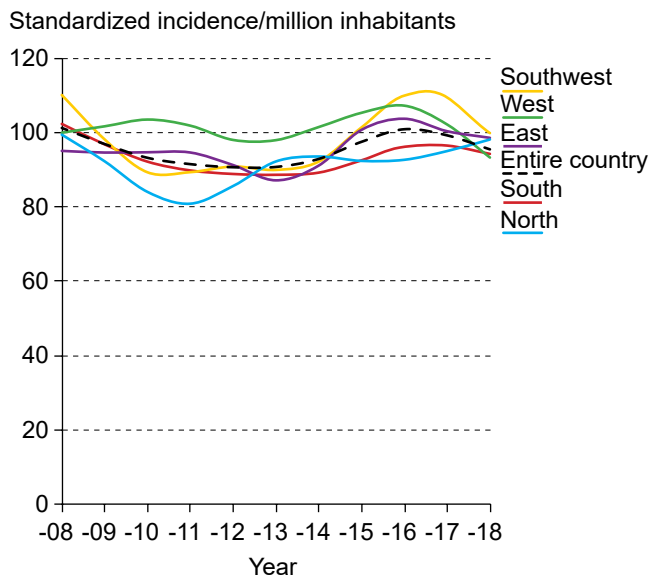


Figure 2 shows the regional incidence of RRT in 2008–2018 as smoothed averages. The incidence rates are age- and sex-standardized using the Finnish general population on 31 December 2018 as the reference. Population changes in 2008–2018 have been taken into consideration. Standardization removes the effect of age and sex on regional differences in incidence rates. Nationwide, the standardized incidence declined during 2008–2012, but has increased since 2014. Regional differences in standardized incidence are small.

Figure 3. Standardized incidence of RRT in regions 90 days after start of RRT Finnish Registry for Kidney Diseases 2008–2018

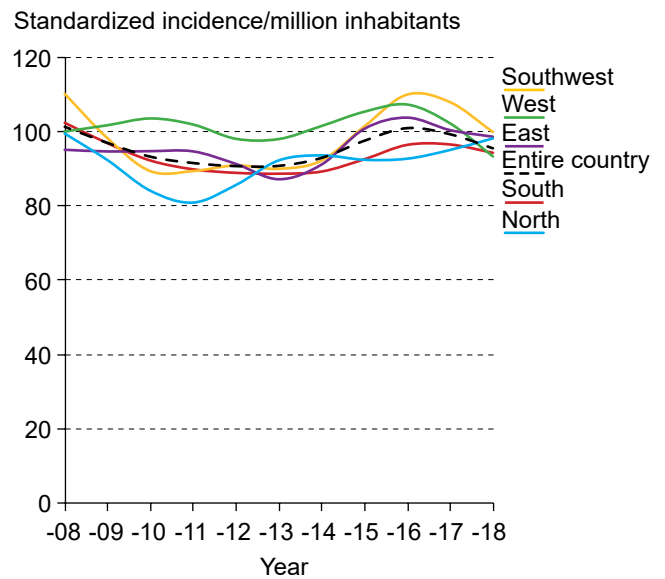
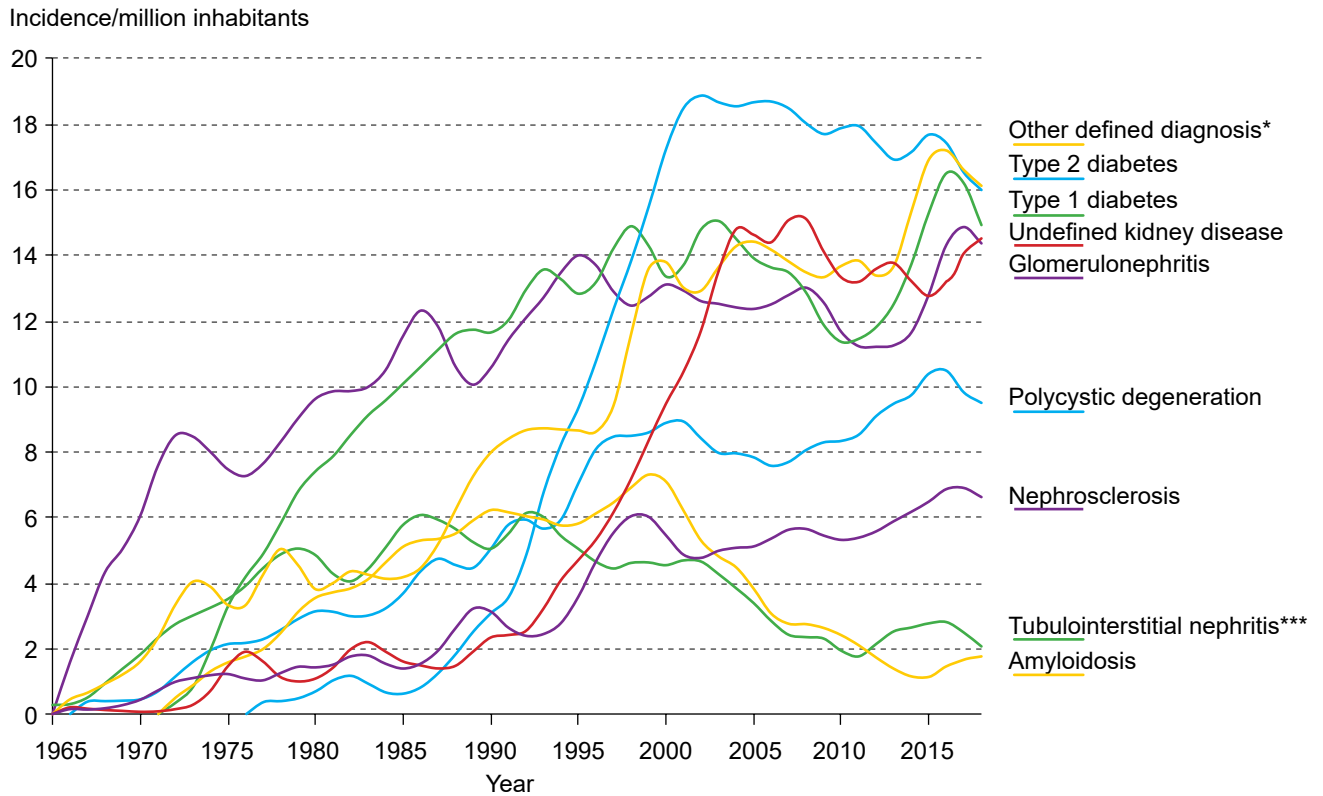


Figure 3 shows the age- and sex-standardized regional incidence of RRT 90 days after the start of RRT. The Finnish Registry for Kidney Diseases does not store data on patients who have regained renal function within 90 days of start of RRT because in that case RRT is not considered chronic. However, the registry does store information on patients who died or moved abroad within 90 days of start of RRT, but these patients were excluded from Figure 3.

Figure 4. Incidence of RRT according to diagnosis
Finnish Registry for Kidney Diseases 1965–2018



*For example, other systemic diseases, urinary tract obstruction, congenital diseases, and malignancies
 **ICD-10 codes I12, I13, I70.1, and N28.0
 ***ICD-10 codes N10, N11, and N12

The incidence of RRT according to diagnosis appears as smoothed averages in Figure 4. Until the end of the 1990s, the incidence increased in almost all diagnostic groups, but thereafter the increase stopped. During the past few years the incidence was larger than before, and the proportions arising from especially type 1 diabetes, glomerulonephritis, polycystic kidney disease, nephrosclerosis, and other defined kidney disease have increased, but in 2018 the incidence for all of these diagnoses decreased.

Type 2 diabetes has been the leading cause of end-stage renal disease since 1999, and recently type 1 diabetes has been the second most common cause. Glomerulonephritis ranks as the third most common defined cause of end-stage renal disease. The number of amyloidosis patients entering RRT has decreased since the year 2000, but the

decrease has levelled off from 2015 onwards.

The group of other defined diagnoses has grown considerably, being larger than type 2 diabetes in 2018. In 2018, altogether 88 new RRT patients had been assigned the “other defined diagnosis”. The most common diagnoses were urinary tract obstruction (n=22), vasculitis (n=11), myeloma (n=6), kidney cancer (n=4), congenital nephrosis of Finnish type (n=3), medullary cystic kidney disease (n=3), and unspecified contracted kidney (n=3).

Of the 88 patients, 23 had an ICD-10 code of N18.8, indicating other defined kidney disease, but no further specification was given. Of these 23 patients, 20 had an ERA-ED-TA diagnosis code, specifying the diagnosis for 9 patients, whereas for 11 patients the kidney disease remained unknown.

Figure 5. Type of treatment at 90 days from start of RRT
Finnish Registry for Kidney Diseases 2008–2018

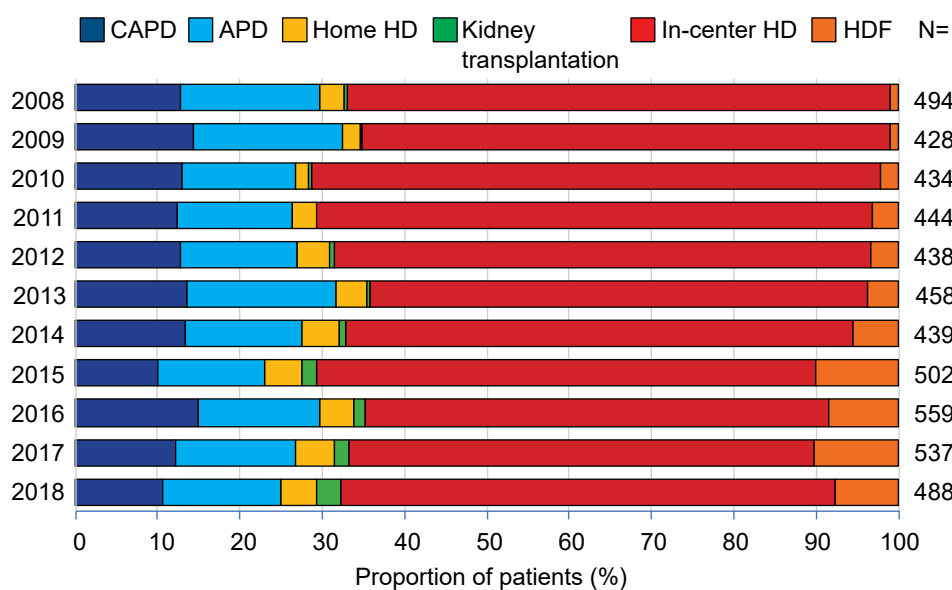


Figure 6. Type of treatment at 90 days from start of RRT in healthcare districts and regions
Finnish Registry for Kidney Diseases 2014–2018

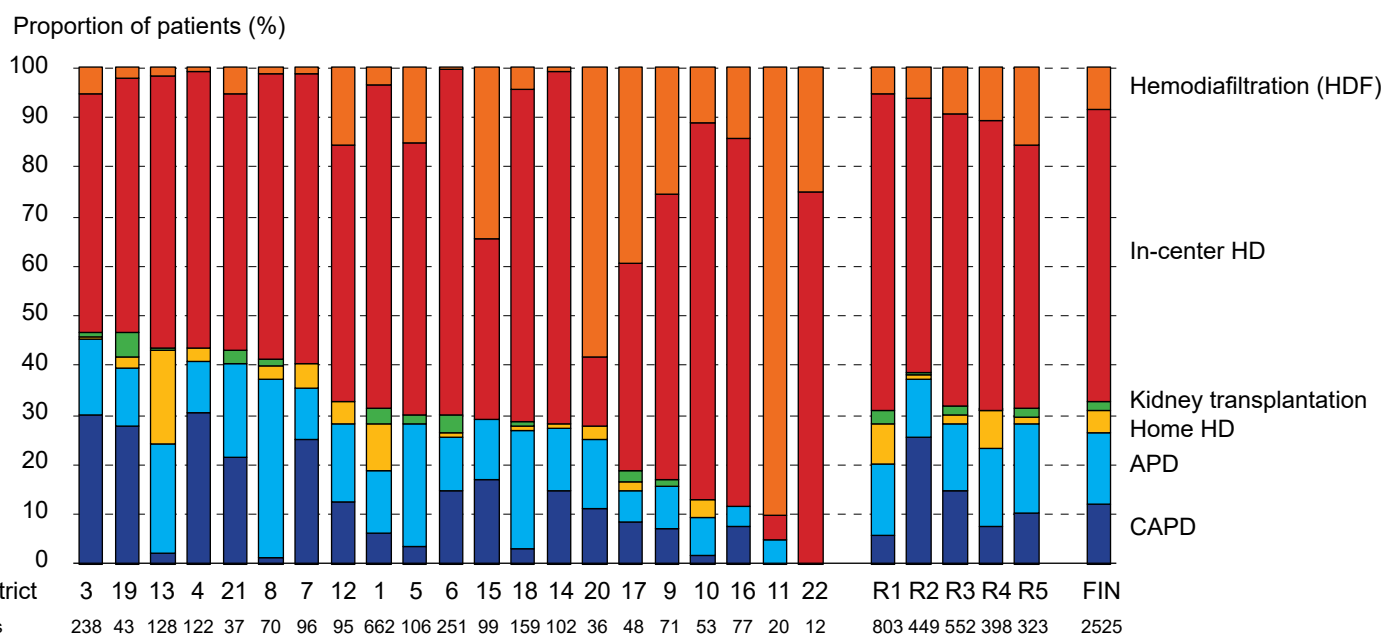


Figure 5 presents the number of RRT patients aged 20 years and over at 90 days from start of RRT in 2014–2018 according to type of treatment. The proportion of patients on in-center hemodialysis and hemodiafiltration has remained stable at an average of 68%. However, the proportion of patients on hemodiafiltration has increased. During the past five years the proportion of patients on home hemodialysis (home HD) has been 4–5%. The proportion of patients receiving a kidney transplant at 90 days from start of RRT has increased from less than 1% to 3%. The proportion of patients on continuous ambulatory peritoneal dialysis (CAPD) or automated peritoneal dialysis (APD) has decreased from

30% to 25%.

Figure 6 shows according to healthcare district and region the distribution of RRT modalities at 90 days from start of RRT in 2014–2018 of patients older than 20 years. The proportion of patients on hemodiafiltration (HDF) varied considerably, from 1% to 90%. Underreporting of HDF may explain part of the variation. The proportion of patients on home dialysis (CAPD, APD, or home HD) varied in healthcare districts from 0% to 46%. There was less variation in distribution of RRT modalities between regions than between healthcare districts.

Figure 7. International comparison of incidence of RRT in 2017
Finnish Registry for Kidney Diseases 2017

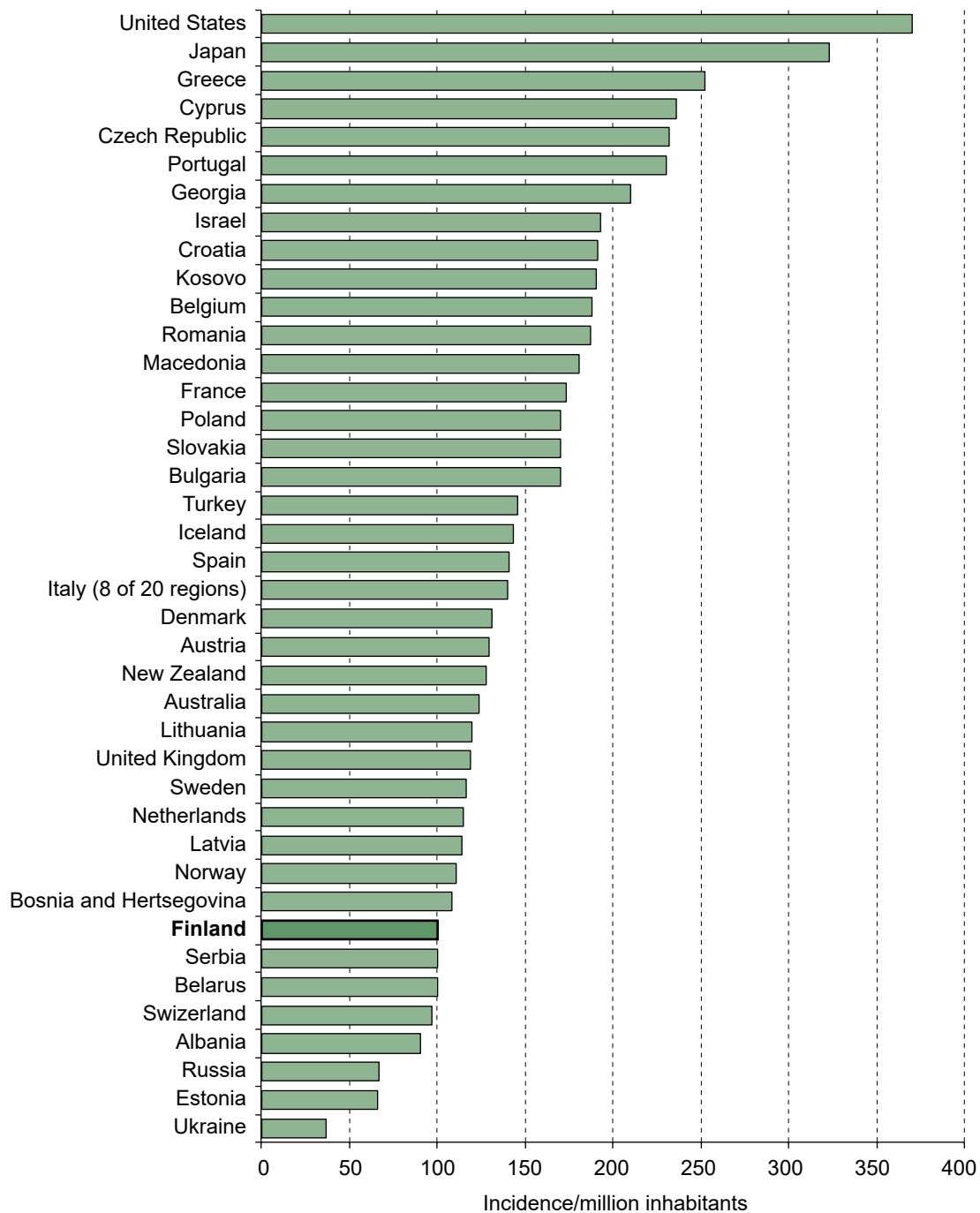


Figure 7 shows the incidence of RRT in 2017 in countries reporting to the ERA-EDTA Registry (Annual Report 2017, <http://www.era-edta-reg.org>) and in the United States, Canada, Australia, New Zealand, and Japan (The 2019 USRDS Annual Data Report Atlas, <http://www.usrds.org>; ANZDATA 24nd Annual Report 2019, www.anzdata.org.au; Dialysis Nation Japan, www.nippon.com). In 2017, the incidence of RRT in Finland was the lowest among the Nordic countries. Relative to Finland, the incidence in Norway was 11% higher, in Sweden 16% higher, in Denmark 31% higher, and in Iceland 43% higher. In Greece, the incidence was 2.5-fold and in the United States almost 4-fold that in Finland.

Table 6. Patients on RRT at end of year according to healthcare district and region
Finnish Registry for Kidney Diseases 2008–2018

Healthcare district		Number of RRT patients					Prevalence of RRT/million inhabitants				
		2008	2013	2016	2017	2018	2008	2013	2016	2017	2018
1	Helsinki-Uusimaa	1076	1258	1341	1381	1421	719	795	821	836	852
3	Varsinais-Suomi	386	424	442	455	453	831	894	924	947	941
4	Satakunta	234	214	237	247	258	1034	953	1069	1121	1180
5	Kanta-Häme	120	146	169	176	170	693	832	972	1019	992
6	Pirkanmaa	418	463	497	514	522	829	888	938	966	976
7	Päijät-Häme	173	172	194	204	200	816	806	913	962	947
8	Kymenlaakso	142	133	138	131	130	808	765	808	777	780
9	Etelä-Karjala	142	154	165	167	163	1063	1164	1264	1286	1266
10	Etelä-Savo	81	89	99	95	99	756	852	966	936	988
11	Itä-Savo	41	55	51	54	50	887	1238	1186	1279	1218
12	Pohjois-Karjala	132	131	151	160	163	776	775	901	961	984
13	Pohjois-Savo	221	250	273	269	277	890	1006	1102	1091	1128
14	Keski-Suomi	148	165	197	207	206	602	658	780	818	815
15	Etelä-Pohjanmaa	116	127	138	158	161	584	639	702	808	829
16	Vaasa	105	134	151	156	157	639	794	888	919	925
17	Keski-Pohjanmaa	53	62	71	74	79	682	792	904	947	1017
18	Pohjois-Pohjanmaa	274	295	323	335	335	703	731	791	819	818
19	Kainuu	67	63	73	71	72	841	821	976	960	985
20	Länsi-Pohja	67	55	56	55	59	1022	857	896	890	964
21	Lappi	74	84	85	77	87	625	710	722	656	741
22	Åland	21	28	27	28	30	765	977	924	950	1007
Region	South	1360	1545	1644	1679	1714	753	819	849	861	873
	Southwest	746	800	857	886	898	845	893	953	984	998
	West	827	908	998	1052	1053	760	819	897	946	947
	East	623	690	771	785	795	762	844	948	969	987
	North	535	559	608	612	632	732	754	820	827	856
Entire country		4091	4502	4878	5014	5092	768	826	886	909	923

Table 6 presents the number of RRT patients and the prevalence of RRT on 31 December 2008–2018. In the entire country, the prevalence at the end of 2018 was 923 RRT patients per million inhabitants. On 31 December 2018, the prevalence was the highest in the southwestern region and the lowest in the northern region. In the healthcare districts, the prevalence varied between 741 and 1266 patients per million inhabitants.

In the entire country, the prevalence has increased by 20%

since 2008 and by 12% since 2013. Since 2013, the prevalence has increased in all regions, the least in the southern region (7%) and the most in the eastern region (17%). In the healthcare districts, the prevalence has increased over 25% during the past five years in Etelä-Pohjanmaa, Keski-Pohjanmaa, and Pohjois-Karjala. In Itä-Savo, Kymenlaakso, Lappi, and Åland, the prevalence has increased less than 5%.

Table 7. Patients on RRT according to age group and sex
Finnish Registry for Kidney Diseases 2008–2018

Age group		Number of RRT patients					Prevalence of RRT/million inhabitants				
		2008	2013	2016	2017	2018	2008	2013	2016	2017	2018
0–19 y	Men	69	67	70	71	74	110	109	115	117	123
	Women	52	48	50	53	49	87	81	86	92	85
	Total	121	115	120	124	123	99	95	101	105	104
20–44 y	Men	459	420	470	485	482	534	485	534	549	543
	Women	271	240	260	275	288	330	292	313	330	344
	Total	730	660	730	760	770	435	391	427	442	447
45–64 y	Men	1200	1226	1255	1244	1255	1575	1643	1738	1746	1782
	Women	721	731	758	769	780	939	971	1042	1072	1104
	Total	1921	1957	2013	2013	2035	1256	1306	1389	1408	1442
65–74 y	Men	496	740	831	879	908	2274	2653	2694	2733	2762
	Women	315	395	441	481	474	1237	1261	1291	1351	1302
	Total	811	1135	1272	1360	1382	1715	1917	1957	2007	1995
≥75 y	Men	311	405	479	482	488	2114	2345	2492	2483	2440
	Women	197	230	264	275	294	724	789	858	894	942
	Total	508	635	743	757	782	1212	1367	1486	1509	1527
Total	Men	2535	2858	3105	3161	3207	971	1066	1145	1163	1178
	Women	1556	1644	1773	1853	1885	573	593	635	663	675
	Total	4091	4502	4878	5014	5092	768	826	886	909	923

Figure 8. Standardized prevalence of RRT in regions
Finnish Registry for Kidney Diseases 2008–2018

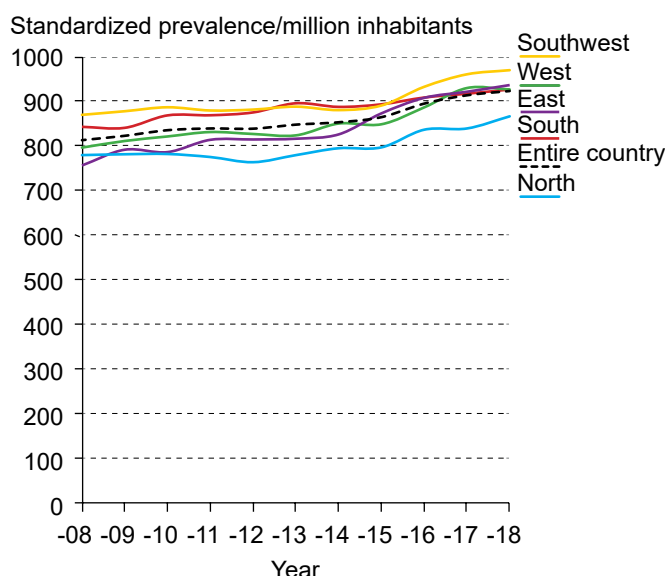
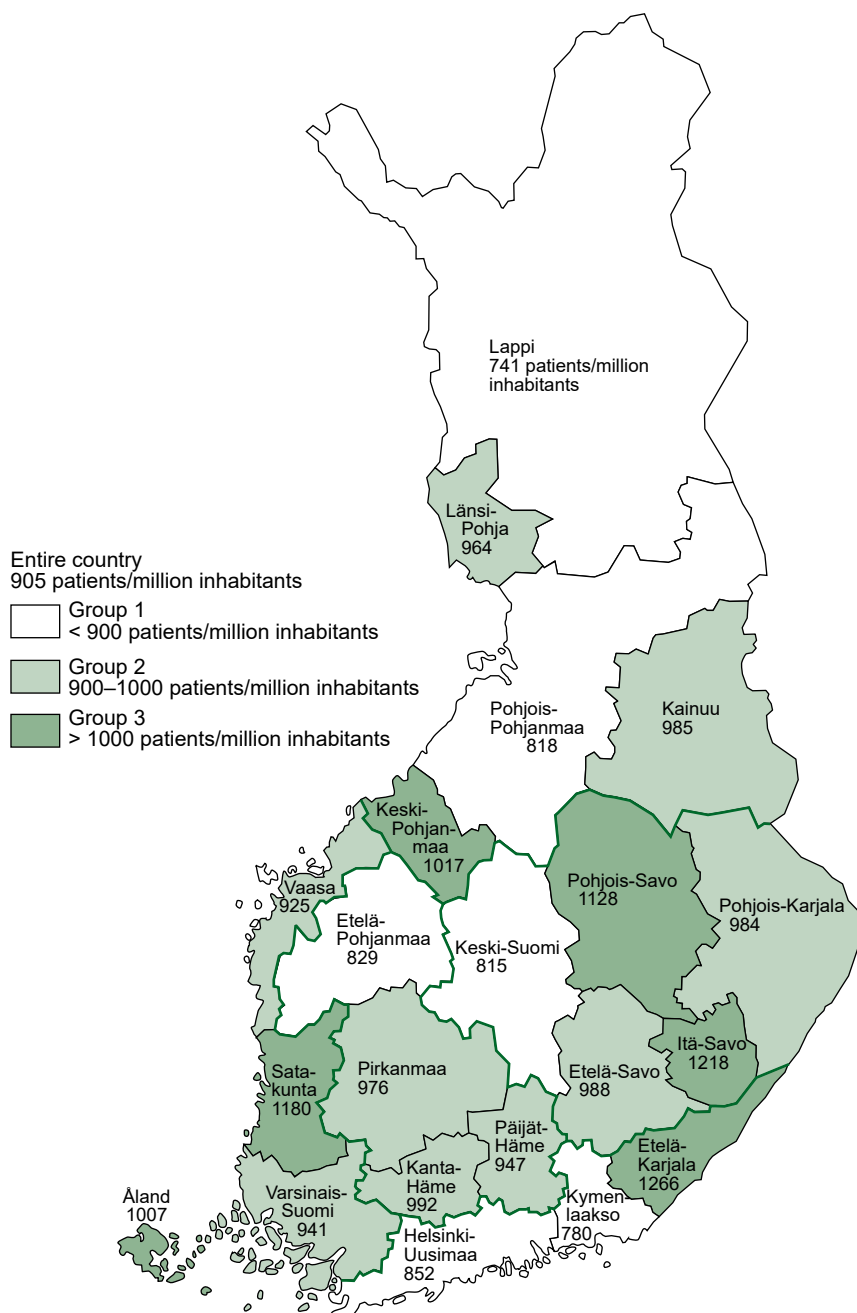


Table 7 shows the number of RRT patients and the prevalence of RRT on 31 December 2008–2018 according to age group and sex. The prevalence of RRT has increased by 26% since 2008. The prevalence has increased by 26% in the age group 75 years and over, by 16% in 65–74-year-olds, and by 15% in 45–64-year-olds. In the younger age groups, the prevalence of RRT has been stable during the last ten years. The highest prevalence, observed among men aged 65–74 years at the end of 2018, was 2762 cases per million age-related inhabitants. At the end of 2018, the prevalence was 75% greater among men than among women, and the sex difference was even more pronounced in the oldest age group, in which the prevalence was 2.6-fold higher in men than in women.

Figure 8 shows the age- and sex-standardized prevalence rates for 2008–2018 using the Finnish general population on 31 December 2018 as the reference. The changes in the distribution of age and sex in 2008–2018 have been taken into account. The standardized prevalence rates have increased slowly in recent years, and the differences between regions are small.

Figure 9. Prevalence of RRT on 31 December 2018
Finnish Registry for Kidney Diseases 2018



The healthcare districts shown on the map are grouped according to the prevalence of RRT at the end of 2018 (Figure 9). The prevalence per million inhabitants was <900 in six districts, 900–1000 in nine districts, and >1000 in six districts. The borders of the regions are indicated with thick lines.

Figure 10. Prevalence of RRT at end of year according to type of treatment
Finnish Registry for Kidney Diseases 1965–2018

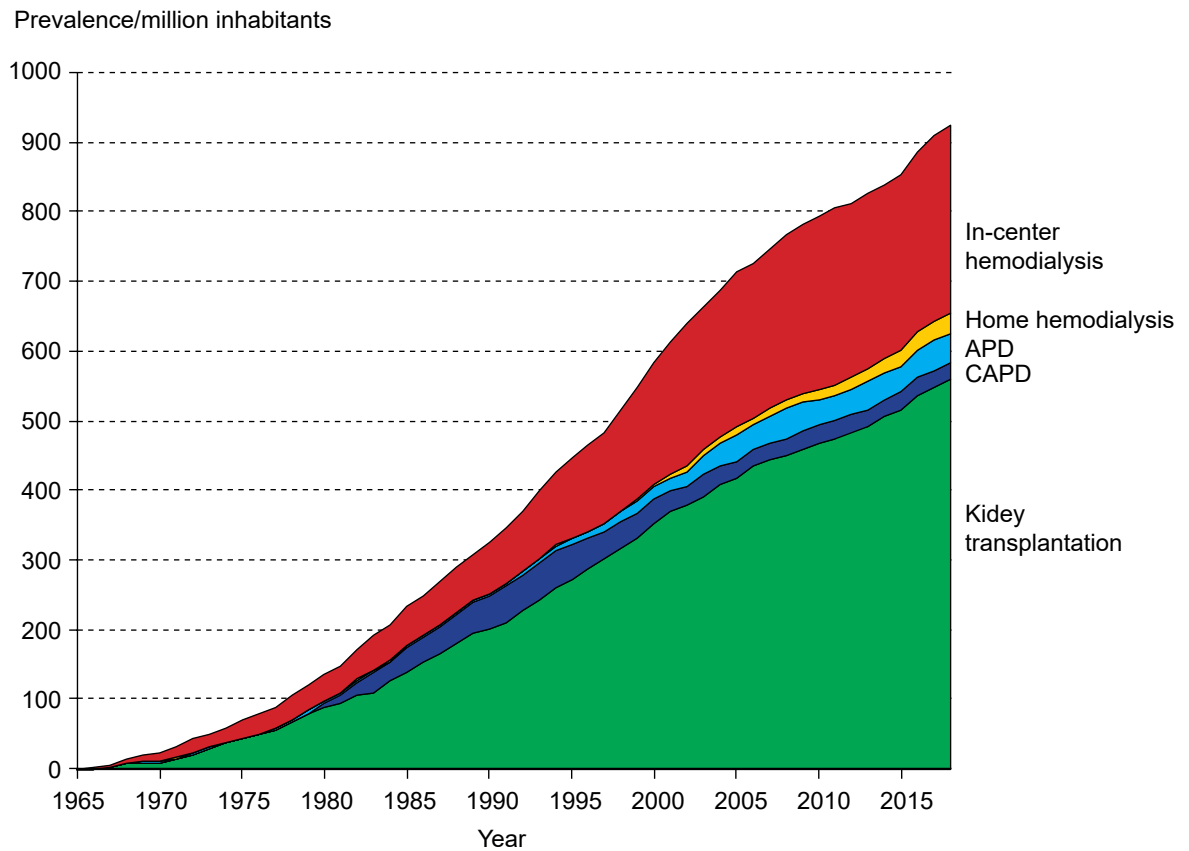


Figure 10 displays the prevalence of RRT according to treatment type. The prevalence of kidney transplantation has grown steadily, increasing by 29% during 2008–2018. The number of in-center hemodialysis patients decreased in 2012–2014, but increased by 7% in 2015–2018. The number of patients on peritoneal dialysis has remained virtually unchanged from 1990, ranging from 253 in 2002 to

387 in 2017. The proportion of automated peritoneal dialysis (APD) increased until 2005, while that of continuous ambulatory peritoneal dialysis (CAPD) decreased. Since 2005, the proportion of APD patients of all PD patients has been about 61%. The number of home hemodialysis patients has increased twofold from 2010 to 2018, with 161 patients on home hemodialysis at the end of 2018.

Table 8. Prevalence of dialysis and kidney transplantation in healthcare districts and regions
Finnish Registry for Kidney Diseases 2008–2018

Healthcare district		Number of dialysis patients/ million inhabitants					Number of kidney transplant patients/ million inhabitants				
		2008	2013	2016	2017	2018	2008	2013	2016	2017	2018
1	Helsinki-Uusimaa	280	302	312	328	328	438	494	508	509	524
3	Varsinais-Suomi	334	361	389	406	399	497	534	535	541	542
4	Satakunta	424	370	424	436	476	610	583	645	685	704
5	Kanta-Häme	387	359	460	457	403	306	473	512	562	589
6	Pirkanmaa	371	380	366	370	361	458	508	572	596	615
7	Päijät-Häme	335	300	358	396	360	481	506	555	566	587
8	Kymenlaakso	387	408	381	338	336	421	357	427	439	444
9	Etelä-Karjala	546	484	521	539	505	516	681	743	747	761
10	Etelä-Savo	233	316	361	335	409	523	536	605	601	579
11	Itä-Savo	411	563	442	521	463	476	675	744	758	755
12	Pohjois-Karjala	300	284	400	409	423	476	491	501	553	562
13	Pohjois-Savo	330	390	351	324	366	560	616	751	766	761
14	Keski-Suomi	240	263	301	332	297	362	395	479	486	518
15	Etelä-Pohjanmaa	217	317	371	429	453	368	322	331	378	376
16	Vaasa	274	332	364	412	395	365	462	523	507	530
17	Keski-Pohjanmaa	322	332	382	371	425	360	460	522	576	592
18	Pohjois-Pohjanmaa	295	297	311	342	330	408	434	480	477	488
19	Kainuu	389	287	294	257	287	452	534	682	703	698
20	Länsi-Pohja	579	483	432	437	490	442	374	464	453	474
21	Lappi	203	287	212	145	196	422	423	510	511	545
22	Åland	328	453	308	271	369	437	523	616	678	638
Region	South	310	324	332	343	340	442	494	517	518	533
	Southwest	346	360	390	410	416	500	532	562	574	582
	West	338	350	380	399	383	422	469	517	547	564
	East	289	329	352	356	366	473	515	596	614	621
	North	319	314	311	313	328	413	440	508	513	528
Entire country		320	335	351	363	363	448	491	535	547	559

Table 8 presents the prevalence of dialysis and kidney transplantation per million inhabitants in healthcare districts and regions in 2008–2018. The prevalence of dialysis has increased by 14% and that of kidney transplantation by 25% during the past ten years. Over the past five years, the prevalence of dialysis has increased by 9%. At the end of 2018, the prevalence of dialysis varied in healthcare districts between 196 and 505 per million inhabitants and that of kidney transplantation between 376 and 761 per million inhabitants. In regions, the prevalence of dialysis varied between 328 and 416 per million inhabitants and that of kidney transplantation between 528 and 621 per million inhabitants.

Table 9. Number of RRT patients at end of year according to type of treatment in healthcare districts and regions
Finnish Registry for Kidney Diseases 2018

Healthcare district		Number of patients on 31 December 2018 (%)						
		CAPD	APD	Home HD	In-center HD	HDF	Tx	Total
1	Helsinki-Uusimaa	23 (2)	53 (4)	65 (5)	272 (19)	134 (9)	874 (62)	1421 (100)
3	Varsinais-Suomi	19 (4)	36 (8)	10 (2)	56 (12)	71 (16)	261 (58)	453 (100)
4	Satakunta	20 (8)	6 (2)	10 (4)	57 (22)	11 (4)	154 (60)	258 (100)
5	Kanta-Häme	4 (2)	8 (5)	2 (1)	25 (15)	30 (18)	101 (59)	170 (100)
6	Pirkanmaa	11 (2)	13 (2)	8 (2)	135 (26)	26 (5)	329 (63)	522 (100)
7	Päijät-Häme	12 (6)	9 (5)	8 (4)	41 (21)	6 (3)	124 (62)	200 (100)
8	Kymenlaakso	2 (2)	12 (9)	6 (5)	29 (22)	7 (5)	74 (57)	130 (100)
9	Etelä-Karjala	2 (1)	3 (2)	9 (6)	8 (5)	43 (26)	98 (60)	163 (100)
10	Etelä-Savo	4 (4)	3 (3)	3 (3)	15 (15)	16 (16)	58 (59)	99 (100)
11	Itä-Savo	0 (0)	0 (0)	0 (0)	0 (0)	19 (38)	31 (62)	50 (100)
12	Pohjois-Karjala	8 (5)	5 (3)	12 (7)	20 (12)	25 (15)	93 (57)	163 (100)
13	Pohjois-Savo	2 (1)	18 (6)	15 (5)	44 (16)	11 (4)	187 (68)	277 (100)
14	Keski-Suomi	3 (1)	8 (4)	5 (2)	35 (17)	24 (12)	131 (64)	206 (100)
15	Etelä-Pohjanmaa	8 (5)	7 (4)	0 (0)	11 (7)	62 (39)	73 (45)	161 (100)
16	Vaasa	4 (3)	1 (1)	4 (3)	16 (10)	42 (27)	90 (57)	157 (100)
17	Keski-Pohjanmaa	4 (5)	3 (4)	1 (1)	4 (5)	21 (27)	46 (58)	79 (100)
18	Pohjois-Pohjanmaa	3 (1)	21 (6)	1 (0)	62 (19)	48 (14)	200 (60)	335 (100)
19	Kainuu	1 (1)	5 (7)	0 (0)	8 (11)	7 (10)	51 (71)	72 (100)
20	Länsi-Pohja	1 (2)	3 (5)	0 (0)	1 (2)	25 (42)	29 (49)	59 (100)
21	Lappi	3 (3)	10 (11)	2 (2)	1 (1)	7 (8)	64 (74)	87 (100)
22	Åland	0 (0)	0 (0)	0 (0)	4 (13)	7 (23)	19 (63)	30 (100)
Region South		27 (2)	68 (4)	80 (5)	309 (18)	184 (11)	1046 (61)	1714 (100)
Southwest		43 (5)	43 (5)	24 (3)	133 (15)	131 (15)	524 (58)	898 (100)
West		35 (3)	37 (4)	18 (2)	212 (20)	124 (12)	627 (60)	1053 (100)
East		17 (2)	34 (4)	35 (4)	114 (14)	95 (12)	500 (63)	795 (100)
North		12 (2)	42 (7)	4 (1)	76 (12)	108 (17)	390 (62)	632 (100)
Entire country		134 (3)	224 (4)	161 (3)	844 (17)	642 (13)	3087 (61)	5092 (100)

Table 9 presents the number of RRT patients according to type of treatment in healthcare districts and regions at the end of 2018. The proportion of peritoneal dialysis patients was the greatest in the healthcare district of Lappi, where 15% of all RRT patients were receiving either continuous ambulatory peritoneal dialysis (CAPD) or automated peritoneal dialysis (APD). The proportion of patients on home hemodialysis (home HD) was largest, 7%, in the healthcare district of Pohjois-Karjala. Five healthcare districts had no home HD patients.

The proportion of kidney transplantation patients varied between 45% and 74% in healthcare districts and between 58% and 63% in regions.

Of all dialysis patients, 26% were on home dialysis (CAPD, APD, or home HD) at the end of 2018. The proportion of home dialysis was highest (65%) in the healthcare district of Lappi and higher than 35% also in four other healthcare districts (Pohjois-Savo, Päijät-Häme, Pohjois-Karjala, and Kymenlaakso) and lower than 15% in four healthcare districts.

Figure 11. International comparison of prevalence of RRT on 31 December 2017
Finnish Registry for Kidney Diseases 2017

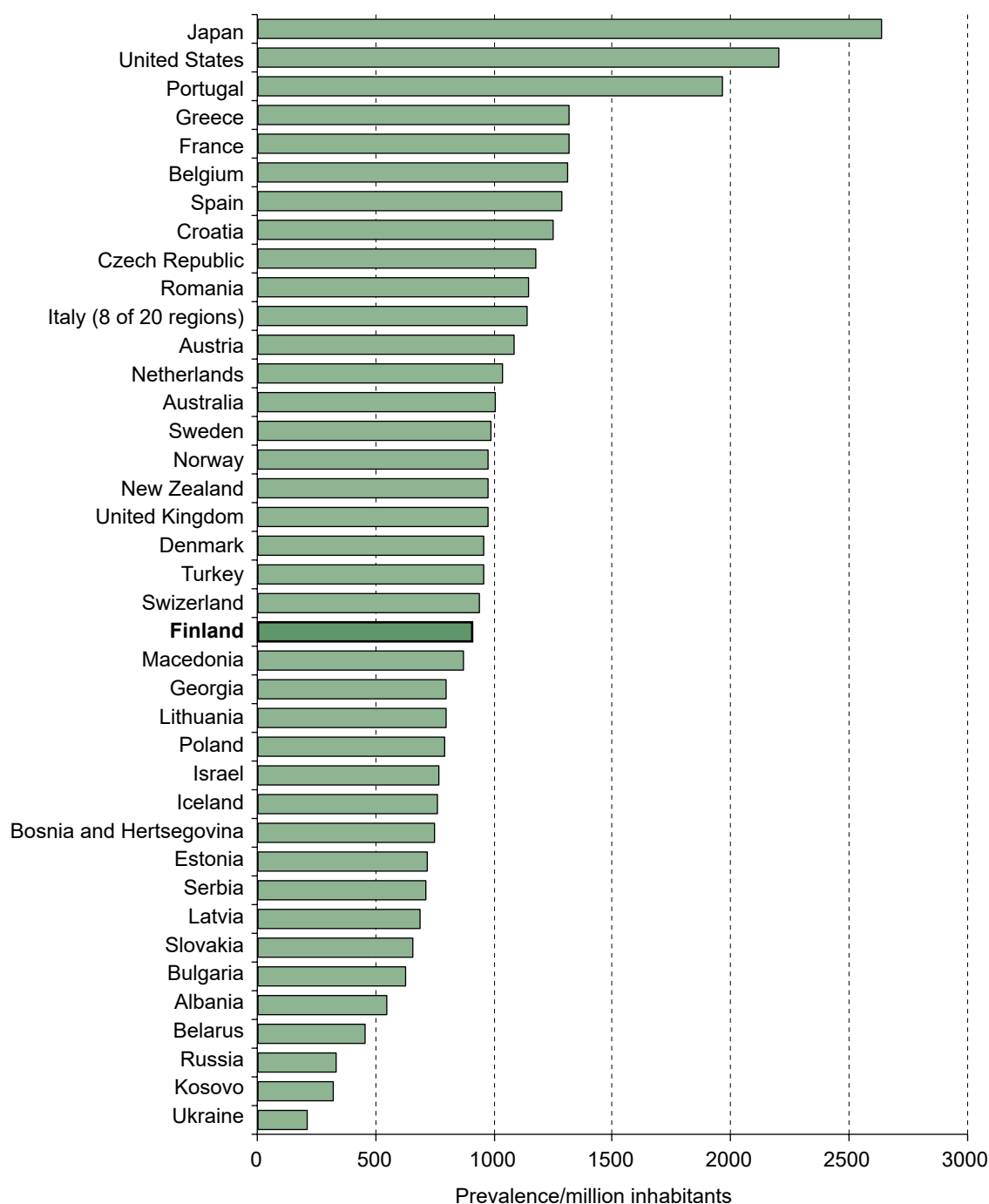


Figure 11 displays the prevalence of RRT on 31 December 2017 in countries reporting to the ERA-EDTA Registry (Annual Report 2017, <http://www.era-edta-reg.org>) and in the United States, Australia, New Zealand, and Japan (The 2019 USRDS Annual Data Report Atlas, <http://www.usrds.org>; ANZDATA 24th Annual Report 2019, www.anzdata.org.au; Dialysis Nation Japan, www.nippon.com). The prevalence rate in Finland was the second lowest of the Nordic countries. Relative to Finland, the prevalence in Denmark was 5% higher, in Norway 7% higher, and in Sweden 9% higher, and in Portugal, the United States, and Japan the prevalence was more than twofold.

Table 10. Number of patient-years of all RRT patients according to diagnosis and type of treatment
Finnish Registry for Kidney Diseases 2008–2018

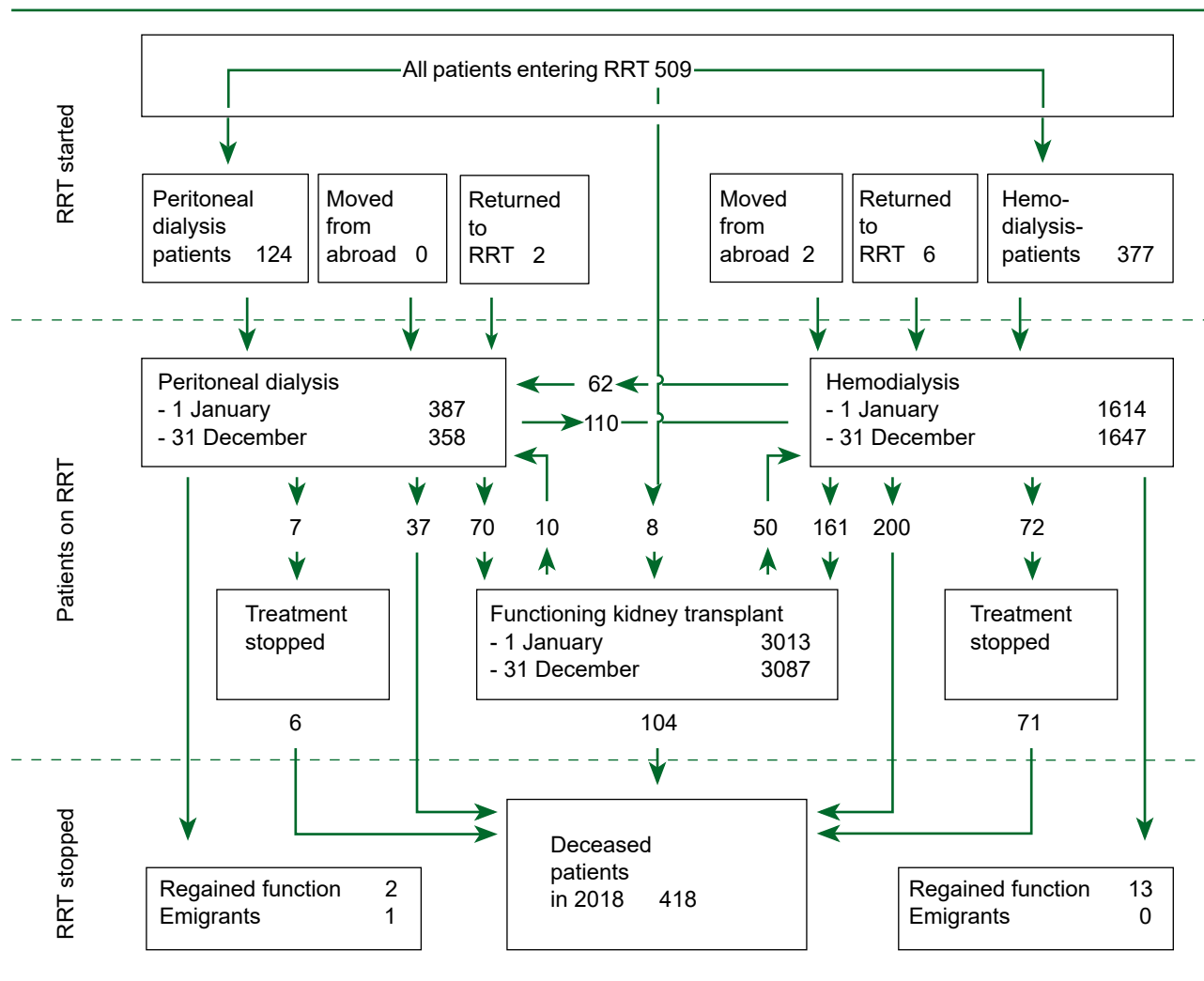
Diagnosis	Number of patient-years in 2008(%)				Number of patient-years in 2018 (%)			
	Peritoneal dialysis	Hemo-dialysis	Trans-plantation	Total	Peritoneal dialysis	Hemo-dialysis	Trans-plantation	Total
Glomerulonephritis	58 (16.5)	200 (15.3)	640 (27.0)	898 (22.3)	73 (19.5)	247 (15.0)	792 (25.9)	1112 (21.9)
Type 1 diabetes	88 (24.9)	153 (11.7)	450 (19.0)	692 (17.2)	99 (26.5)	221 (13.4)	505 (16.5)	826 (16.3)
Polycystic degeneration	16 (4.7)	107 (8.2)	392 (16.6)	515 (12.8)	27 (7.1)	161 (9.7)	561 (18.4)	748 (14.7)
Undefined kidney disease	48 (13.7)	210 (16.1)	95 (4.0)	354 (8.8)	37 (10.0)	244 (14.8)	196 (6.4)	478 (9.4)
Type 2 diabetes	56 (15.9)	263 (20.1)	53 (2.2)	372 (9.2)	45 (12.1)	305 (18.5)	107 (3.5)	457 (9.0)
Tubulointerstitial nephritis	10 (2.9)	54 (4.1)	198 (8.4)	262 (6.5)	13 (3.6)	54 (3.3)	170 (5.5)	237 (4.7)
Nephrosclerosis	20 (5.7)	77 (5.9)	57 (2.4)	154 (3.8)	28 (7.5)	107 (6.5)	92 (3.0)	227 (4.5)
Urinary tract obstruction	7 (2.0)	39 (3.0)	95 (4.0)	141 (3.5)	12 (3.3)	57 (3.4)	133 (4.3)	202 (4.0)
Other systemic diseases	17 (4.8)	66 (5.1)	75 (3.2)	158 (3.9)	14 (3.7)	67 (4.1)	116 (3.8)	197 (3.9)
Other kidney diseases	7 (2.1)	28 (2.1)	61 (2.6)	96 (2.4)	10 (2.7)	91 (5.5)	92 (3.0)	192 (3.8)
Congenital diseases	7 (2.0)	15 (1.2)	104 (4.4)	126 (3.1)	6 (1.5)	19 (1.1)	133 (4.4)	158 (3.1)
Congenital nephrosis, Finnish type	3 (1.0)	4 (0.3)	66 (2.8)	73 (1.8)	4 (1.0)	6 (0.4)	96 (3.1)	105 (2.1)
Amyloidosis	4 (1.0)	45 (3.4)	39 (1.7)	88 (2.2)	3 (0.8)	26 (1.6)	28 (0.9)	56 (1.1)
Malignancies	5 (1.3)	34 (2.6)	7 (0.3)	46 (1.1)	2 (0.6)	33 (2.0)	12 (0.4)	47 (0.9)
Pyelonephritis	3 (1.0)	8 (0.6)	20 (0.8)	32 (0.8)	0 (0.0)	7 (0.4)	12 (0.4)	19 (0.4)
Metabolic diseases	2 (0.7)	4 (0.3)	13 (0.5)	19 (0.5)	0 (0.1)	5 (0.3)	13 (0.4)	18 (0.4)
Total	354 (100)	1306 (100)	2366 (100)	4026 (100)	374 (100)	1648 (100)	3056 (100)	5078 (100)

Table 10 presents the number of patient-years according to diagnosis of kidney disease and type of treatment in 2008 and 2018. The number of patient-years indicates time spent by patients in RRT during the year. Overall, the number of patient-years has increased by 26% since 2008. The number of patient-years has increased by 26% in hemodialysis, by 6% in peritoneal dialysis, and by 29% in kidney transplantation.

Glomerulonephritis is the most common diagnosis among all RRT patients and among kidney transplantation patients; the proportion of patient-years due to glomerulonephri-

tis was 22% in 2018. Type 1 diabetes is the second most common diagnosis among all RRT patients and the most common diagnosis among peritoneal dialysis patients. The number of patient-years of all RRT patients with polycystic degeneration, nephrosclerosis, urinary tract obstruction, and congenital nephrosis has increased almost 50% during the last ten years. Type 2 diabetes is the most common kidney disease diagnosis of hemodialysis patients, and the number of patient-years among kidney transplantation patients with type 2 diabetes has doubled within the last ten years.

Figure 12. Net changes in type of treatment
Finnish Registry for Kidney Diseases 2018



During 2018 altogether 509 new patients entered RRT (Figure 12), eight patients returned to RRT, and two moved from abroad. In all, 5014 patients were receiving RRT at the beginning of the year. Altogether 418 patients died, and dialysis was discontinued for 15 patients because the patient's own kidney function resumed. Of those who died, 104 had a functioning kidney transplant, 70 were receiving peritoneal dialysis, and 200 were on hemodialysis. During 2018 RRT was discontinued for 79 uremic patients. At the end of 2018, the number of peritoneal dialysis patients was 7% smaller, the number of hemodialysis patients was 2%

larger, and the number of kidney transplantation patients was 2% larger than at the beginning of the year.

A total of 238 patients received a kidney transplant. Of these patients, 23 received a combined pancreas and kidney transplantation, one received a combined liver and kidney transplantation, and one received a combined heart and liver transplantation (source: Kidney Transplantation Unit, Helsinki University Central Hospital). Thirty-two kidney transplants were received from living donors, of which 20 were from relatives and three were ABO-incompatible.

Table 11. Mortality of RRT patients by region
Finnish Registry for Kidney Diseases 2008–2018

Region	Deaths/1000 patient-years						Deaths/1000 patient-years ¹⁾					
	2008	2013	2016	2017	2018	2014–2018	2008	2013	2016	2017	2018	2014–2018
South	76	66	75	80	79	79	76	66	73	79	77	77
Southwest	82	77	73	93	78	87	78	76	73	92	77	86
West	91	101	86	74	84	87	90	100	83	72	84	85
East	114	90	79	83	85	79	112	84	76	82	80	76
North	110	105	70	81	90	85	106	100	68	81	90	82
Entire country	91	84	77	82	82	83	89	82	75	81	80	81

¹⁾Patients who died within 90 days of start of RRT excluded

Figure 13. Standardized mortality of RRT patients by region
Finnish Registry for Kidney Diseases 2008–2018

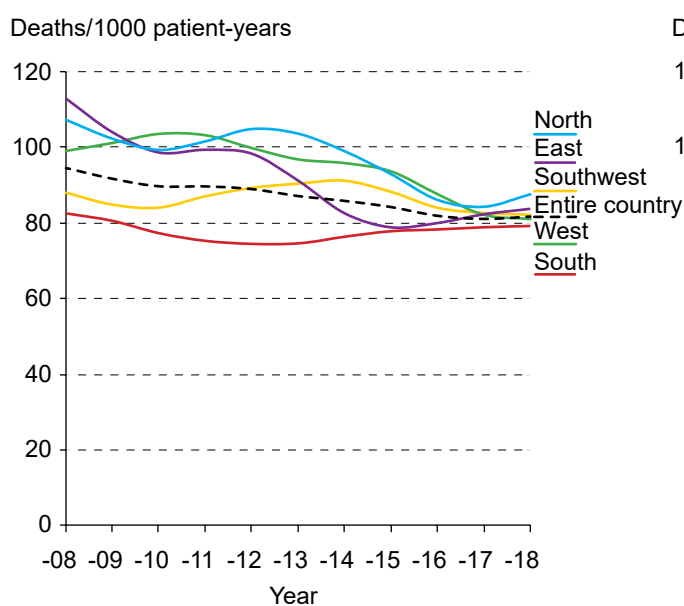


Figure 14. Standardized mortality of RRT patients by region (patients who died within 90 days of start of RRT excluded)
Finnish Registry for Kidney Diseases 2008–2018

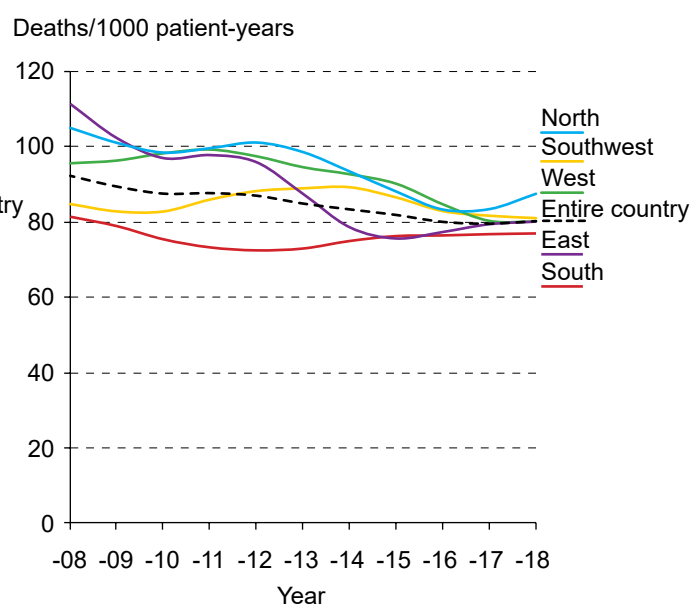


Table 11 shows RRT patients' mortality in 2008–2018 according to region. The mortality of patients who had been on RRT for at least 90 days is presented separately. The average mortality in 2014–2018 was lower in the southern region than elsewhere.

Figures 13 and 14 show regional mortality as smoothed averages. The regional mortality rates for 2008–2018 have

been age- and sex-standardized using all patient-years in 2018 as the reference. Changes in age and sex distribution during this ten-year period have been taken into consideration. Patients who died within 90 days of start of RRT were excluded from Figure 14. During 2008–2018 the standardized mortality rate has declined in all regions, and the differences between regions have become markedly smaller.

Figure 15. RRT patients' survival by region
Finnish Registry for Kidney Diseases 2014–2018

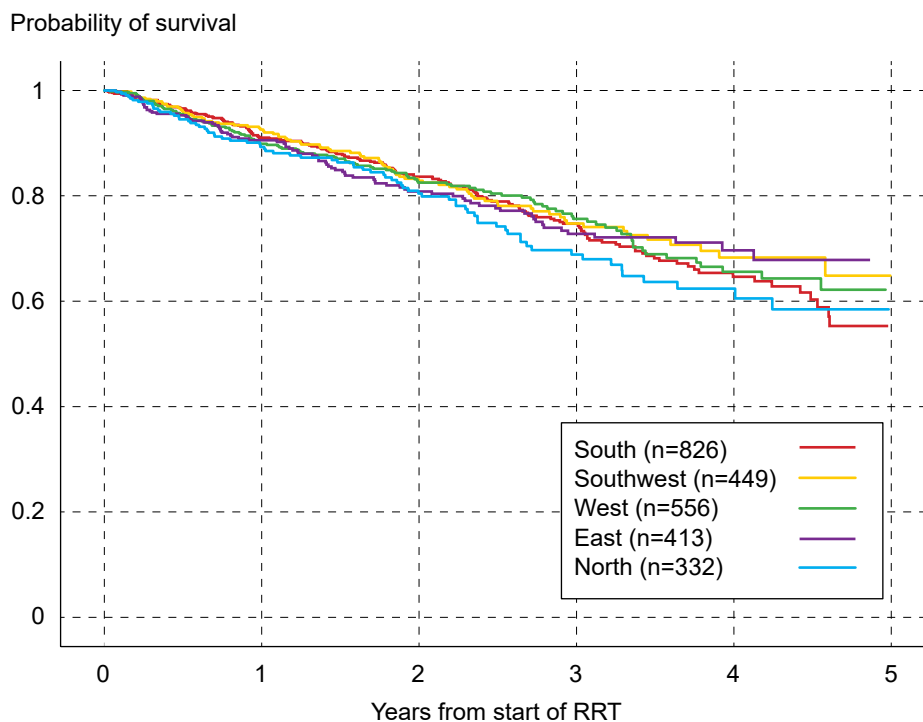


Figure 15 shows survival of patients who entered RRT in 2014–2018 at the age of 20 years or over. Survival probabilities were estimated by region using Kaplan-Meier curves. A total of 2576 patients commenced RRT and 527 patients died during a median follow-up of 1.9 years. Altogether 568 patients received a kidney transplant. Patients were censored from the analysis if kidney function returned (n=56), if moving abroad (n=6), if they disappeared from follow-up (n=0), or at the latest on 31 December 2018 (n=1987).

For the entire cohort, the survival probability was 0.91 at one year and 0.82 at two years from start of RRT. The survival probability did not differ between regions ($P = 0.574$),

and this did not change after adjusting for age and sex using Cox regression ($P=0.580$). According to a study based on data from the Finnish Registry for Kidney Diseases, age, diagnosis of end-stage renal disease, heart failure, peripheral vascular disease, and plasma concentrations of albumin and C-reactive protein have independent effects on RRT patients' survival (Haapio et al., *Kidney International Reports* 2017;2:1176–1185). Because of this, these variables were used for multivariable adjustment, but still the result for the regional comparison in Figure 15 remained unchanged ($P=0.662$).

Figure 16. RRT patients' survival by start period of RRT
Finnish Registry for Kidney Diseases 2000–2018

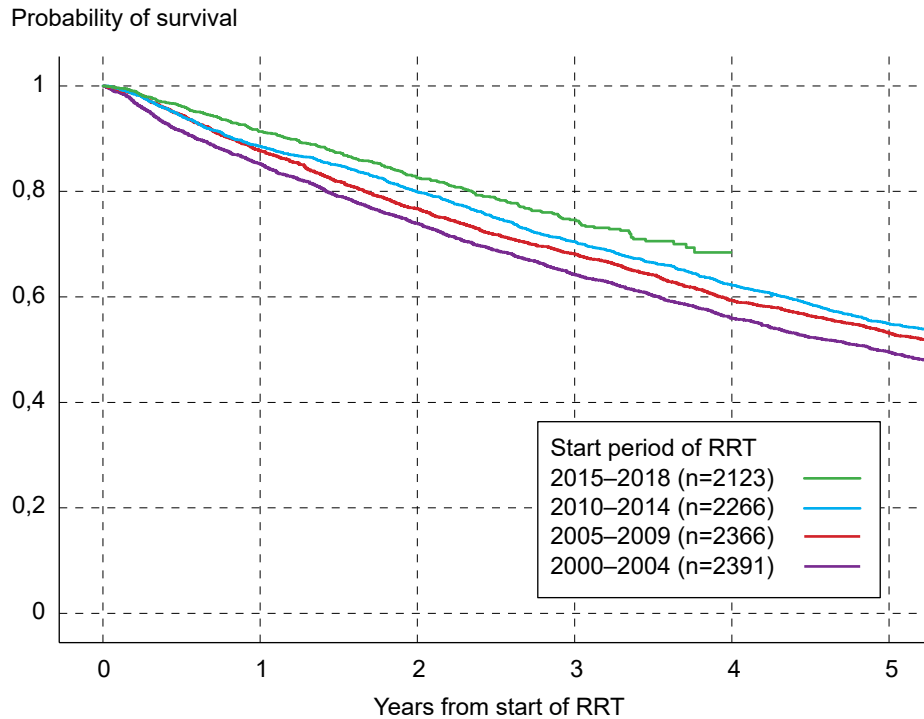


Figure 16 presents the survival probability of patients aged 20 years or over who started RRT in 2000–2018 according to time period. Survival probabilities were estimated using Kaplan-Meier curves. A total of 9146 patients entered RRT 4966 of whom died during a median follow-up of 3.5 years. Altogether 2819 patients received a kidney transplant. Patients were censored from the analysis if kidney function resumed (n=174), if moving abroad (n=17), if they disappeared from follow-up (n=4), or at the latest on 31 December 2018 (n=3985).

The survival prognosis improved continuously during 2000–2018 (log rank test, $P < 0.001$). Of patients who start-

ed RRT in 2015–2018, survival probability was 0.91 at one year and 0.82 at two years from start of RRT. For patients who started RRT in 2000–2004, the corresponding probabilities were 0.85 and 0.74. The survival prognosis improved despite the increasing median age at start of RRT: 61.7 years in 2000–2004 and 64.4 years in 2015–2018.

After adjusting the analysis in Figure 16 for age and sex using Cox regression, the relative risk of death of patients who started RRT in 2015–2018 compared with 2000–2004 was 0.59 (95% confidence interval 0.53–0.67, $P < 0.001$). Multivariable adjustment (as described on page 28) did not change the result.

Figure 17. RRT patients' survival by age group
Finnish Registry for Kidney Diseases 2014–2018

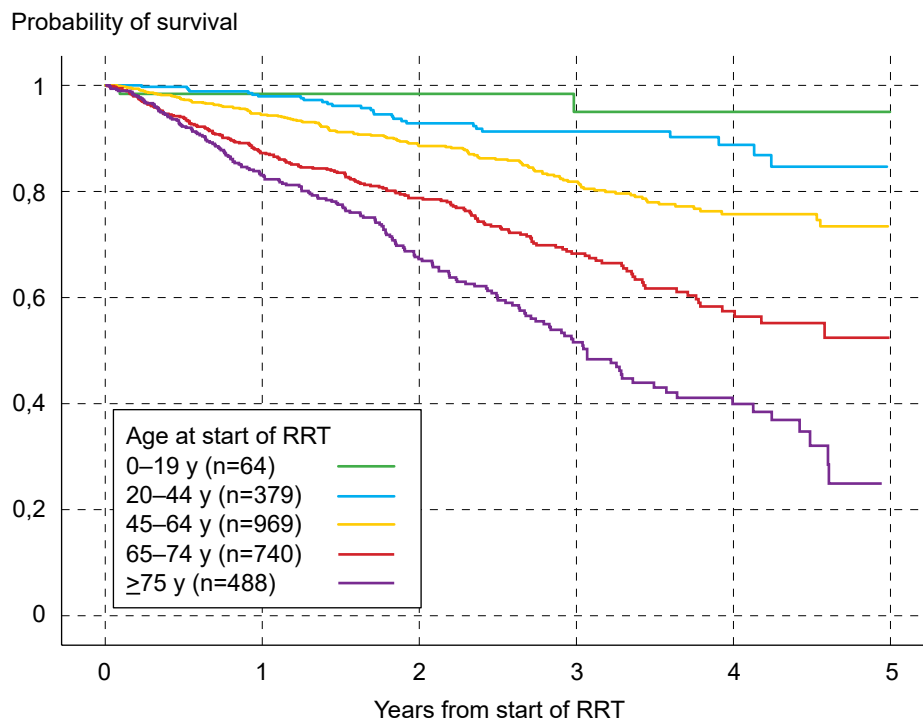


Figure 17 displays survival probabilities according to age group of patients entering RRT in 2014–2018. A total of 2640 patients commenced RRT, and 529 patients died during a median follow-up of 1.9 years. Altogether 625 patients received a kidney transplant. Patients were censored from the analysis if kidney function returned (n=57), if moving abroad (n=8), if they disappeared from follow-up (n=0), or at the latest on 31 December 2018 (n=2047).

Age at start of RRT was associated strongly with survival prognosis. The survival probability at two years from start of RRT was 0.98 for 0–19-year-olds, 0.93 for 20–44-year-olds, 0.89 for 45–64-year-olds, 0.79 for 65–74-year-olds, and 0.67 for patients aged 75 years or over.

The difference in survival probability between males and females was not statistically significant (age-adjusted P=0.054).

Figure 18. RRT patients' survival by diagnosis
Finnish Registry for Kidney Diseases 2014–2018

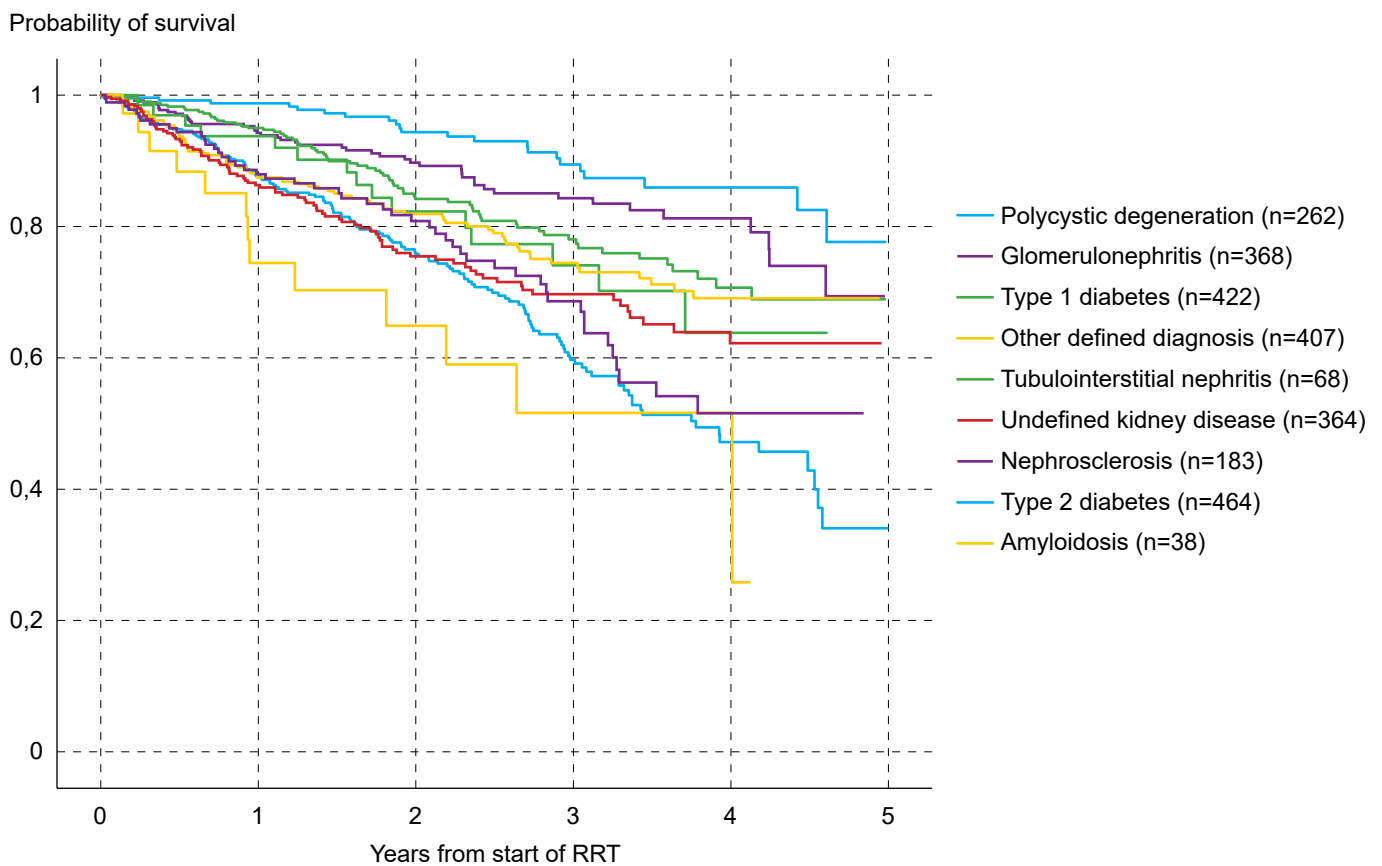


Figure 18 shows the survival probability of patients aged 20 years or older who started RRT in 2014–2018 according to diagnosis of end-stage renal disease. A total of 2576 patients started RRT, 526 of whom died during a median follow-up of 1.9 years. Altogether 568 patients received a kidney transplant. Patients were censored from the analysis if kidney function returned (n=56), if moving abroad (n=6), if they disappeared from follow-up (n=0), or at the latest on 31 December 2018 (n=1987).

The survival probability differed between diagnosis groups (log rank test, $P < 0.001$). After adjustment for age

and sex using Cox regression, diagnosis of end-stage renal disease remained significant ($P < 0.001$). In the analysis, glomerulonephritis was used as the reference group to which other diagnoses were compared. Patients with type 1 diabetes (relative risk of death 2.1, $P < 0.001$), type 2 diabetes (RR 1.9, $P < 0.001$), and amyloidosis (RR 2.5, $P = 0.004$) had a higher risk of death. Patient with polycystic kidney degeneration had the smallest risk of death, but the difference compared with glomerulonephritis patients was not significant (RR 0.62, $P = 0.068$).

Table 12. Number of RRT patients older than 20 years in hospitals
Finnish Registry for Kidney Diseases 2018

Region	Healthcare district	Hospital	RRT patients (≥20 y) on 31/12/2018			
			PD	HD	Tx	Total
South (R1)	Helsinki-Uusimaa (1)		93	543	982	1618
			74	442	818	1334
		Helsinki University Central Hospital	74	342	729	1145
		Nephrology Polyclinic			725	725
		Dialysis unit DHK		88		88
		Dialysis unit DOK	74	96		170
		B. Braun Malmi		70		70
		B. Braun Pitäjänmäki		88		88
		Unit of Transplantation and Liver Surgery			4	4
		Hyvinkää Hospital		43	34	77
		Lohja Hospital		32	36	68
		Länsi-Uusimaa Hospital		25	20	45
		Porvoo Hospital		25	25	50
		Kymenlaakso (8)		14	42	71
Kymenlaakso Central Hospital	14		42	71	127	
Etelä-Karjala (9)		5	59	93	157	
	South Karelia Central Hospital	5	42	93	140	
	Honkajarju Hospital		17		17	
Southwest (R2)		85	313	526	924	
	Varsinais-Suomi (3)		54	137	254	445
		Turku University Central Hospital	54	137	254	445
	Satakunta (4)		25	76	150	251
		Satakunta Central Hospital	25	76	150	251
	Vaasa (16)		6	64	78	148
		Vaasa Central Hospital	6	50	76	132
		Pietarsaari Hospital		14	2	16
	Åland (22)		11	19	30	30
		Åland Central Hospital		11	19	30
	West (R3)		74	355	600	1029
Kanta-Häme (5)			12	61	103	176
		Central Hospital of Tavastia	12	61	103	176
Pirkanmaa (6)			26	166	308	500
		Tampere University Hospital	26	166	308	500
Päijät-Häme (7)			21	57	125	203
		Päijänne Tavastia Central Hospital	21	57	125	203
Etelä-Pohjanmaa (15)			15	71	64	150
		Southern Ostrobothnia Central Hospital	15	71	64	150
East (R4)			51	244	485	780
	Etelä-Savo (10)		7	31	52	90
		Mikkeli Central Hospital	7	31	52	90
	Itä-Savo (11)		1	20	35	56
		Central Hospital of Savonlinna	1	20	35	56
	Pohjois-Karjala (12)		12	57	88	157
		North Karelia Central Hospital	12	57	88	157
	Pohjois-Savo (13)		20	71	180	271
		Kuopio University Hospital	20	43	159	222
		Regional Hospital of Iisalmi		15	14	29
		Regional Hospital of Varkaus		13	7	20
	Keski-Suomi (14)		11	65	130	206
		Central Finland Central Hospital	11	65	130	206
	North (R5)		54	187	375	616
Keski-Pohjanmaa (17)			8	30	46	84
		Central Hospital of Keski-Pohjanmaa	8	30	46	84
Pohjois-Pohjanmaa (18)			23	105	186	314
		Oulu University Hospital	23	105	186	314
Kainuu (19)			6	17	51	74
		Kainuu Central Hospital	6	17	51	74
Länsi-Pohja (20)			4	23	29	56
		Central Hospital of Länsi-Pohja	4	23	29	56
Lappi (21)			13	12	63	88
		Lapland Central Hospital	13	12	63	88
Entire country		357	1642	2969	4968	

At the end of 2018, dialysis and kidney transplantation patients were treated and followed up in 29 hospitals of 21 healthcare districts in five regions (Table 12). In the first part of this report, the healthcare district of the patient is determined according to place of residence. However, in the

analysis of treatment quality on pages 33–43, healthcare district of the patient is determined according to treating unit. In the entire country, 97% of patients lived in the same healthcare district in which they were treated.

Figure 19. Hemoglobin distribution of dialysis patients older than 20 years at end of year
Finnish Registry for Kidney Diseases 2008–2018

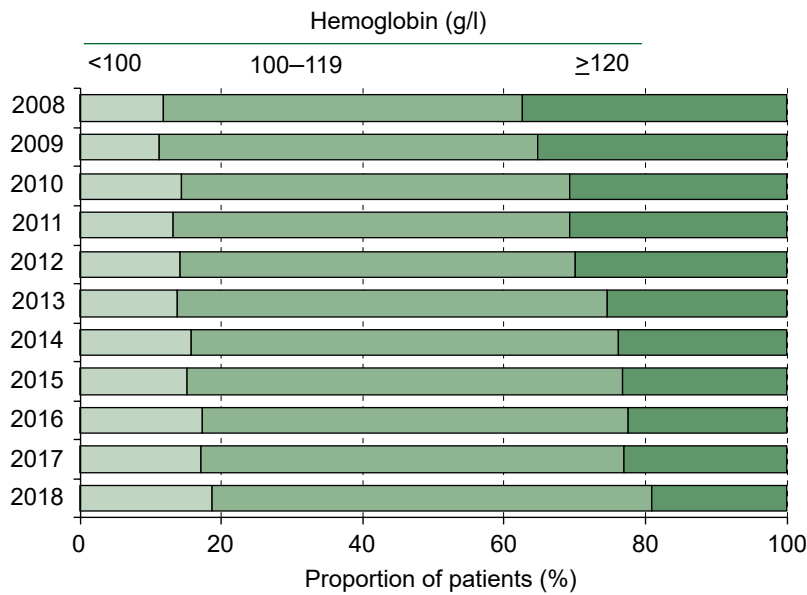
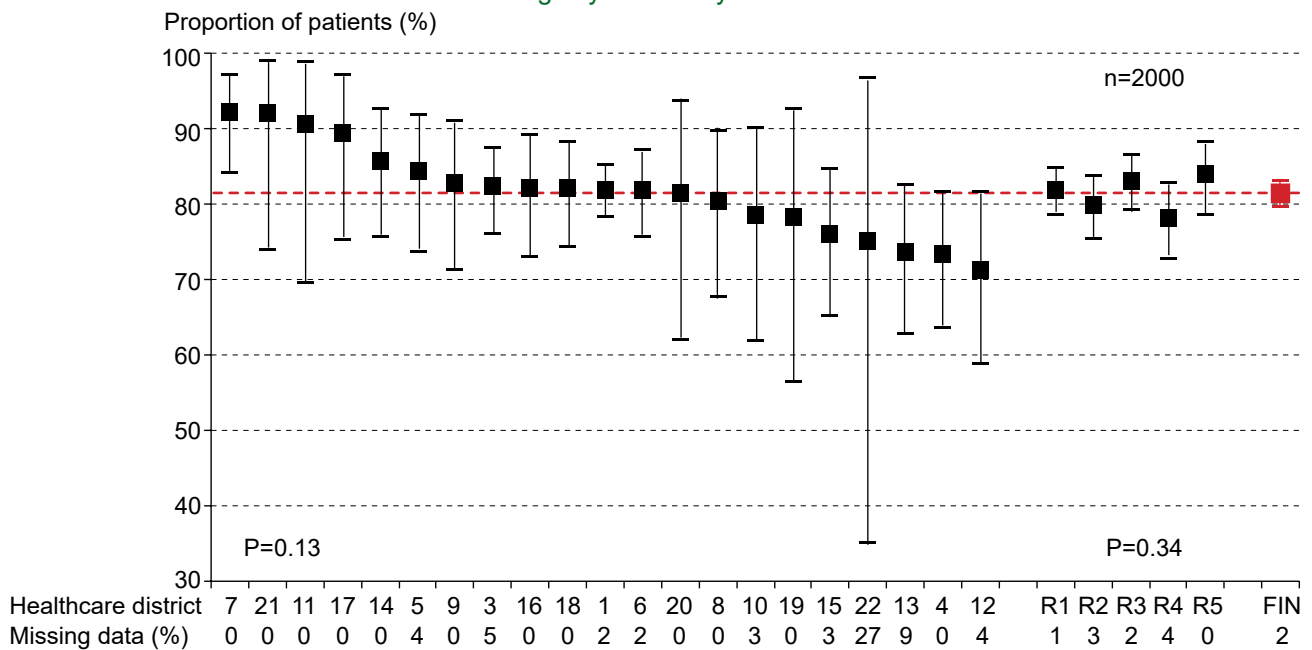


Figure 20. Proportion of dialysis patients older than 20 years with hemoglobin concentration ≥ 100 g/l in healthcare districts and regions
Finnish Registry for Kidney Diseases 2017



Several guidelines exist regarding the target for blood hemoglobin concentration in dialysis patients: European Best Practice Guidelines (EBPG) and the guidelines of the Kidney Disease Outcome Quality Initiative (KDOQI) and the Kidney Disease Global Outcomes (KDIGO). KDIGO published new guidelines on renal anemia in 2012, according to which erythropoiesis-stimulating agents (ESAs) should be used to keep dialysis patients' hemoglobin in the range of 100–115 g/l.

The renal registries in the UK and Sweden have in their reports used target hemoglobin levels of either 100–120 g/l or ≥ 100 g/l. For sake of comparison, we have chosen these same cut-offs.

The distribution of dialysis patients' hemoglobin concen-

tration has changed during 2008–2018 (Figure 19). The proportion of patients with a hemoglobin concentration <100 g/l has increased from 12% to 19%, while the proportion of patients with a hemoglobin concentration ≥ 120 g/l has decreased from 37% to 19%. Figures 23 and 24 include all hemodialysis patients, also those who did not use ESAs.

In Figure 20, the hemoglobin target is ≥ 100 g/l. At the end of 2018, the proportion of dialysis patients reaching this target was 81%, varying from 71% to 92% in the healthcare districts ($P=0.13$) and from 78% to 84% in the regions ($P=0.34$). No significant difference was present in the proportions of men and women with a hemoglobin concentration ≥ 100 g/l.

Figure 21. Distribution of serum phosphorus among dialysis patients older than 20 years at end of year Finnish Registry for Kidney Diseases 2008–2018

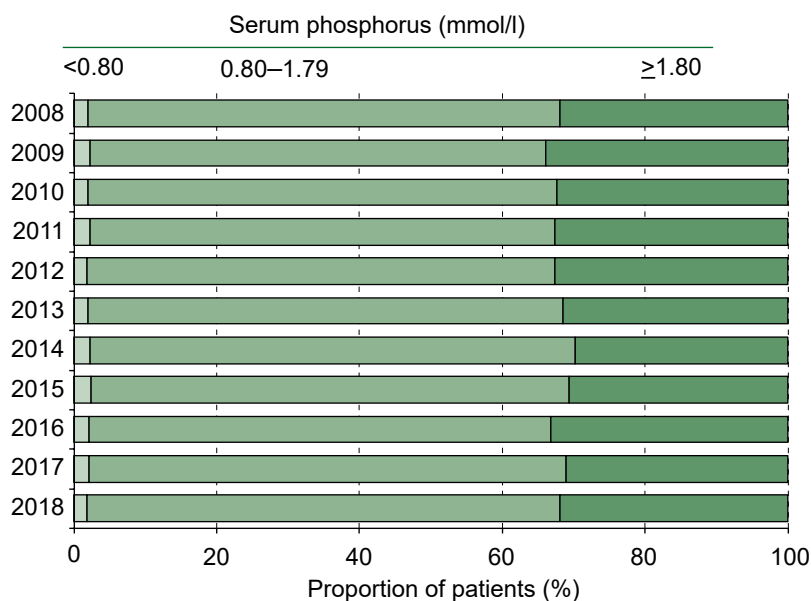
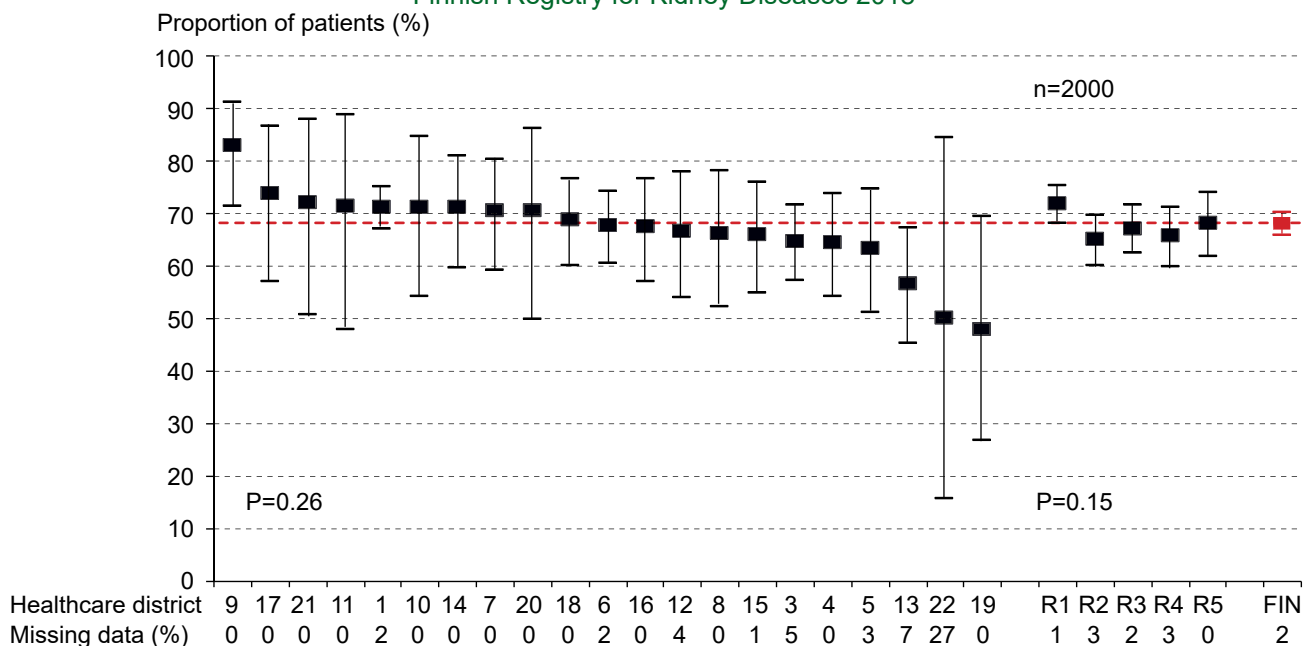


Figure 22. Proportion of dialysis patients older than 20 years with serum phosphorus <1.8 mmol/l in healthcare districts and regions Finnish Registry for Kidney Diseases 2018



Hyperphosphatemia among patients with kidney disease is associated with vascular calcification and increased mortality. The guideline of the Kidney Disease Global Outcomes (KDIGO) suggests that elevated serum phosphorus of dialysis patients should be lowered towards the normal range with diet, intensified dialysis treatment, and phosphate binders if needed.

At the end of 2018, 68% of hemodialysis and peritoneal dialysis patients had concentrations of serum phosphorus <1.8 mmol/l; this proportion has remained virtually un-

changed in the last decade (Figure 21). Only 2% of dialysis patients had an excessively low concentration of serum phosphorus (<0.8 mmol/l).

The proportion of patients with serum phosphorus <1.8 mmol/l varied between 48% and 83% in the healthcare districts (P=0.26) and between 65% and 72% in the regions (P=0.15) (Figure 22). Serum phosphorus was <1.8 mmol/l more often among female than male dialysis patients (P=0.02).

Figure 23. Vascular access of new hemodialysis patients older than 20 years at end of year
Finnish Registry for Kidney Diseases 2014–2018

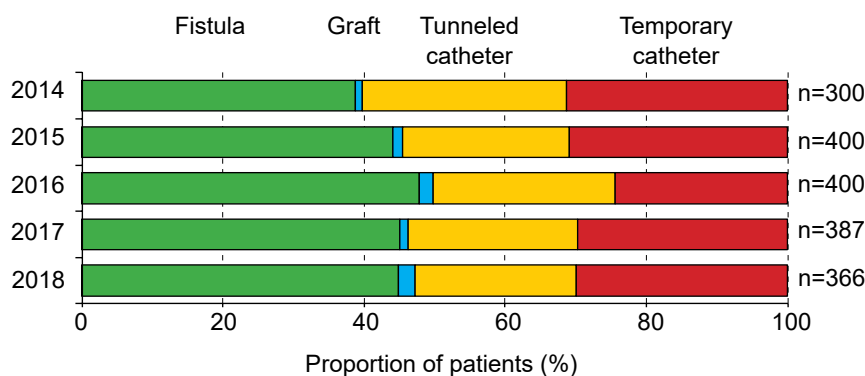
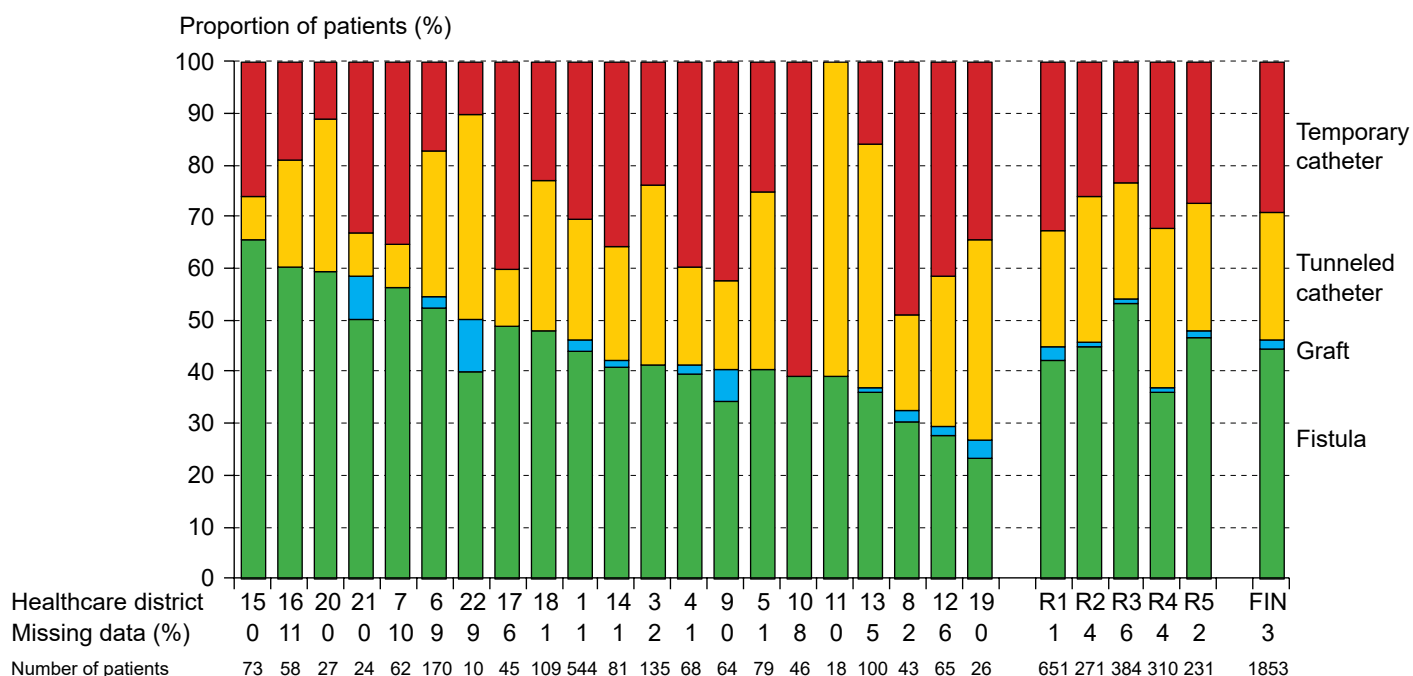


Figure 24. Vascular access of new hemodialysis patients older than 20 years in healthcare districts
Finnish Registry for Kidney Diseases 2014–2018



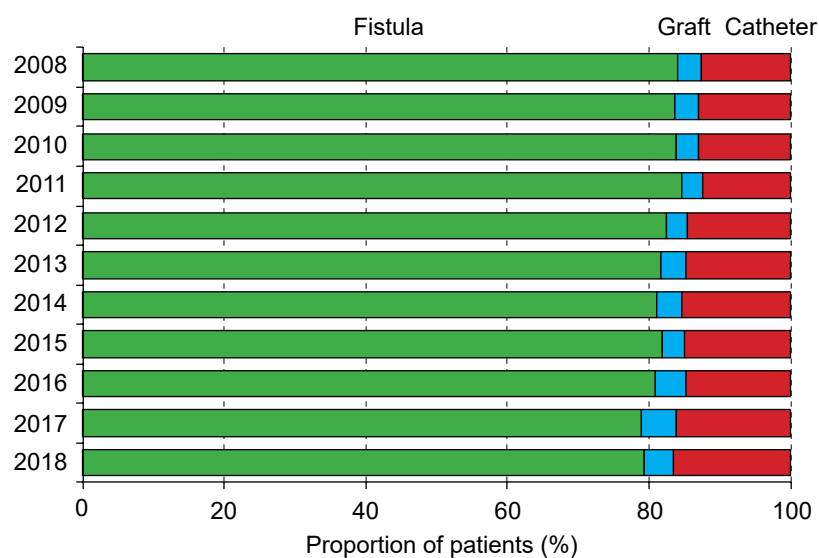
The Finnish Registry for Kidney Diseases has since 2014 collected data on vascular access of patients entering hemodialysis as the first type of RRT. The recommended type of vascular access is an arteriovenous fistula or graft. A tunneled central venous catheter is a better alternative than a temporary (non-cuffed) central venous catheter, which is recommended only when dialysis is started acutely and other types of vascular access are not possible.

In 2018, 47% of patients older than 20 years who entered hemodialysis had an arteriovenous fistula or graft, and the

proportion has been stable during the last years (Figure 23). Of new hemodialysis patients in 2018, 30% started with a temporary catheter.

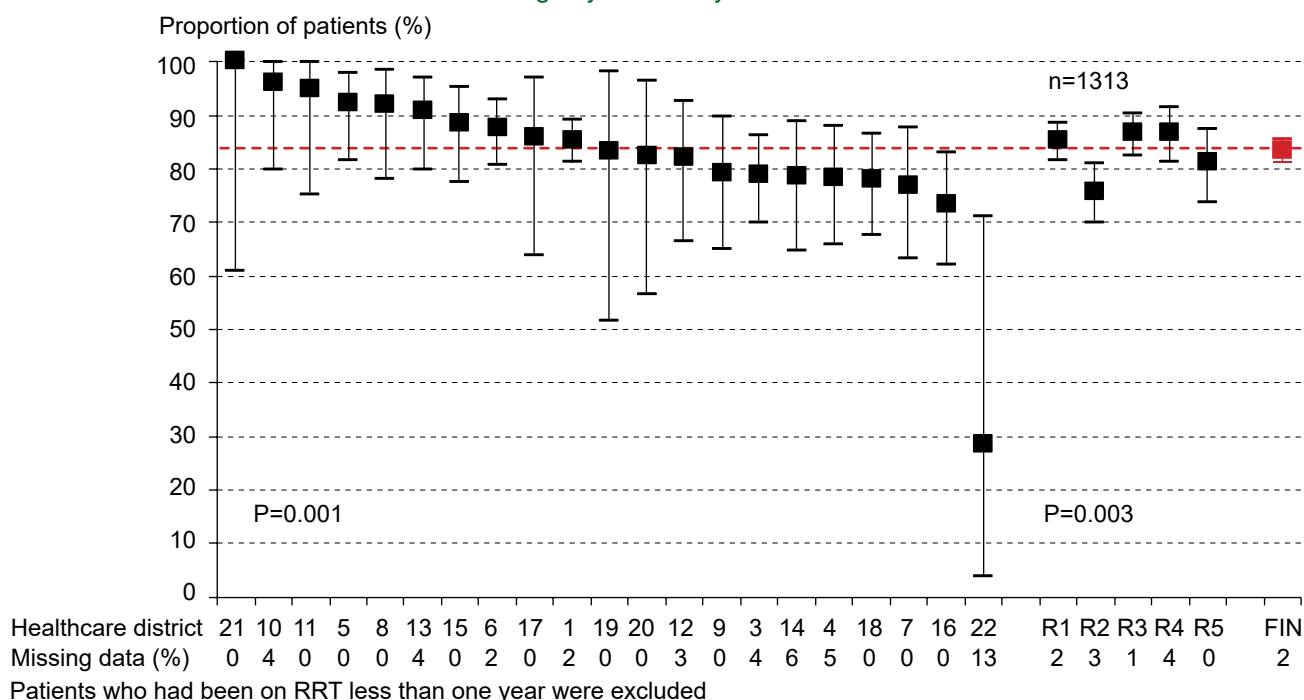
Figure 24 presents the distribution of types of first vascular access among patients who entered hemodialysis in 2014–2018. In the entire country, 47% of patients had a fistula or graft, but the proportion varied between 28% and 66% in healthcare districts ($P < 0.001$) and between 37% and 55% in regions ($P < 0.001$). The proportion of patients with a fistula or graft did not differ between the sexes.

Figure 25. Vascular access of hemodialysis patients older than 20 years at end of year
Finnish Registry for Kidney Diseases 2008–2018



Patients who had been on RRT less than one year were excluded

Figure 26. Proportion of hemodialysis patients older than 20 years with a fistula or graft
in healthcare districts and regions
Finnish Registry for Kidney Diseases 2018

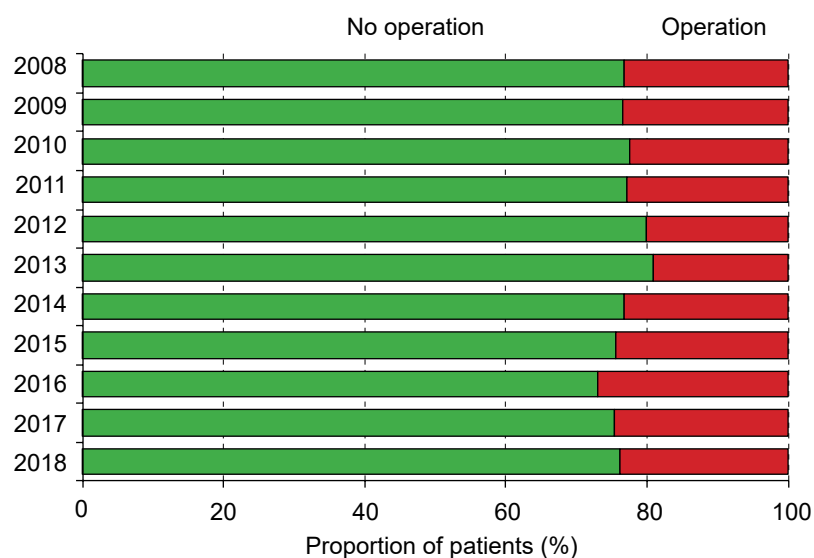


Patients who had been on RRT less than one year were excluded

Vascular access is one of the most important quality measures of hemodialysis. Use of a central venous catheter is associated with complications, and the goal is that hemodialysis patients have an arteriovenous fistula or graft. Of hemodialysis patients aged 20 years or older who had been on RRT for at least one year, the proportion with a fistula or graft had decreased from 87% in 2008 to 83% in 2018 (Figure 25).

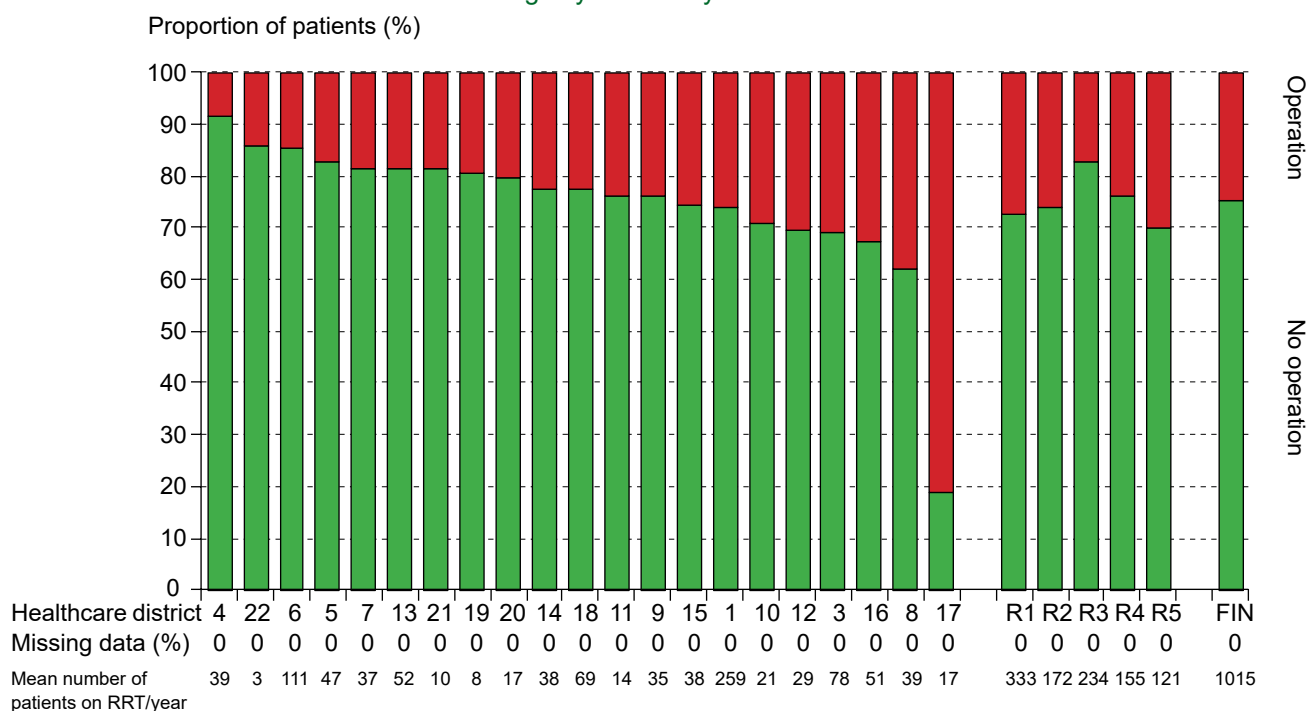
At the end of 2018, the proportion of patients with a fistula or graft varied between 29% and 100% in healthcare districts ($P=0.001$) and between 76% and 87% in regions ($P=0.003$) (Figure 26). At the end of 2018, female hemodialysis patients less frequently than male patients had a fistula or graft (79% vs. 86%, $P=0.002$). A fistula or graft was as common in patients over 75 years as in younger patients.

Figure 27. Need for operation on vascular access in hemodialysis patients older than 20 years
Finnish Registry for Kidney Diseases 2008–2018



Patients who had been on RRT less than one year were excluded

Figure 28. Need for operation on vascular access in hemodialysis patients older than 20 years
in healthcare districts and regions
Finnish Registry for Kidney Diseases 2018

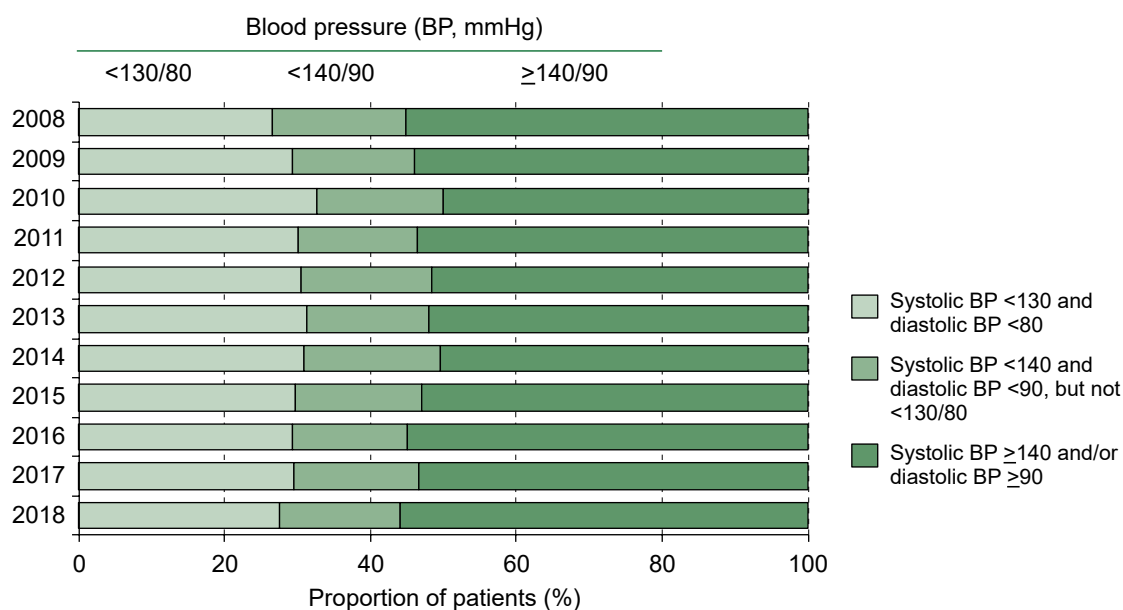


Patients who had been on RRT less than one year were excluded

An arteriovenous fistula or graft requires vascular operation if there is a functional problem. Figure 27 shows the proportion of hemodialysis patients aged 20 years or over with a fistula or graft who underwent vascular operation during the past year. The proportion of fistulae or grafts requiring an operation was approximately 23% between 2008 and 2018.

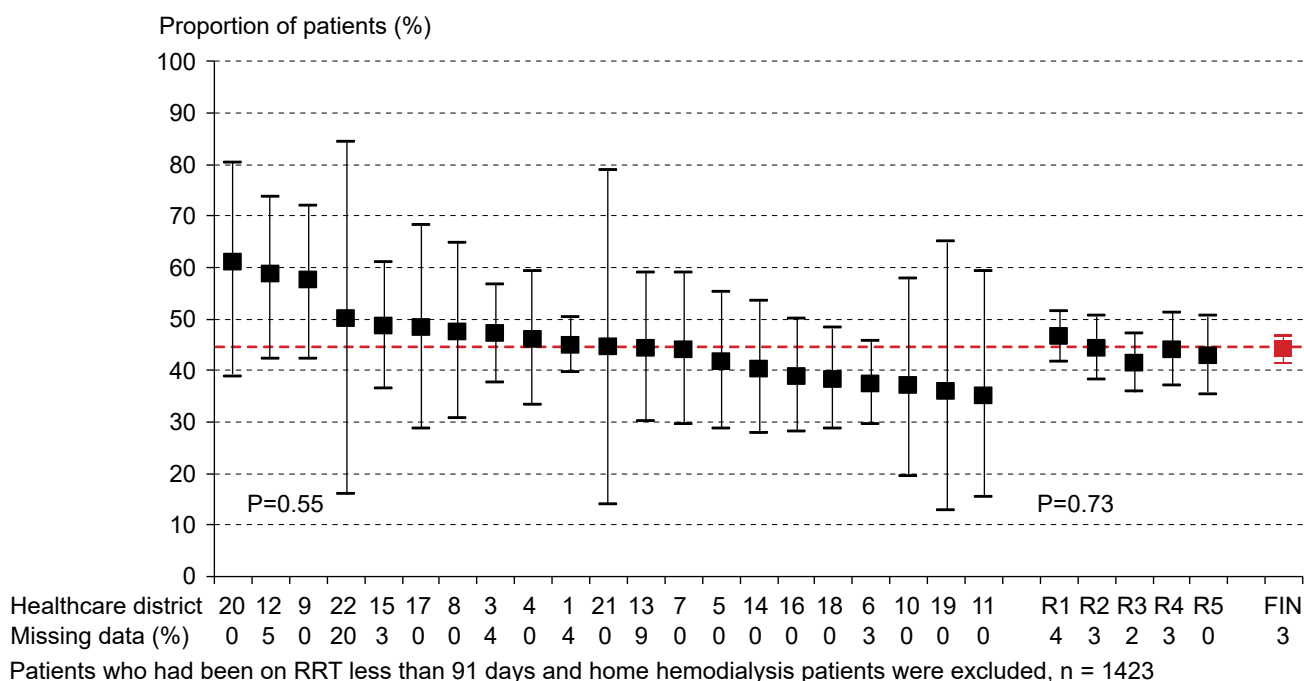
Between 2014 and 2018, an average of 8–81% of patients by hospital district ($P < 0.001$) and 17–30% of patients by region ($P < 0.001$) underwent vascular operation for a fistula or graft (Figure 28). More operations were performed on female patients (27% vs. 24%, $P = 0.03$) and on patients aged over 75 years (22% vs. 26%, $P = 0.002$).

Figure 29. Distribution of predialytic blood pressure among hemodialysis patients older than 20 years
Finnish Registry for Kidney Diseases 2008–2018



Patients who had been on RRT less than 91 days and home hemodialysis patients were excluded

Figure 30. Proportion of hemodialysis patients older than 20 years with predialytic blood pressure <140/90 mmHg in healthcare districts and regions
Finnish Registry for Kidney Diseases 2018



According to the guidelines of the Kidney Disease Outcome Quality Initiative (KDOQI), hemodialysis patients' target predialytic blood pressure is <140/90 mmHg. At the end of 2018, 45% of hemodialysis patients reached this target (Figure 29). The proportion of patients attaining the

target varied between 35% and 61% in healthcare districts (P=0.55) and between 41% and 46% in regions (P=0.73) (Figure 30). No significant difference was observed between the sexes.

Figure 31. Distribution of blood pressure in kidney transplantation patients older than 20 years
Finnish Registry for Kidney Diseases 2008–2018

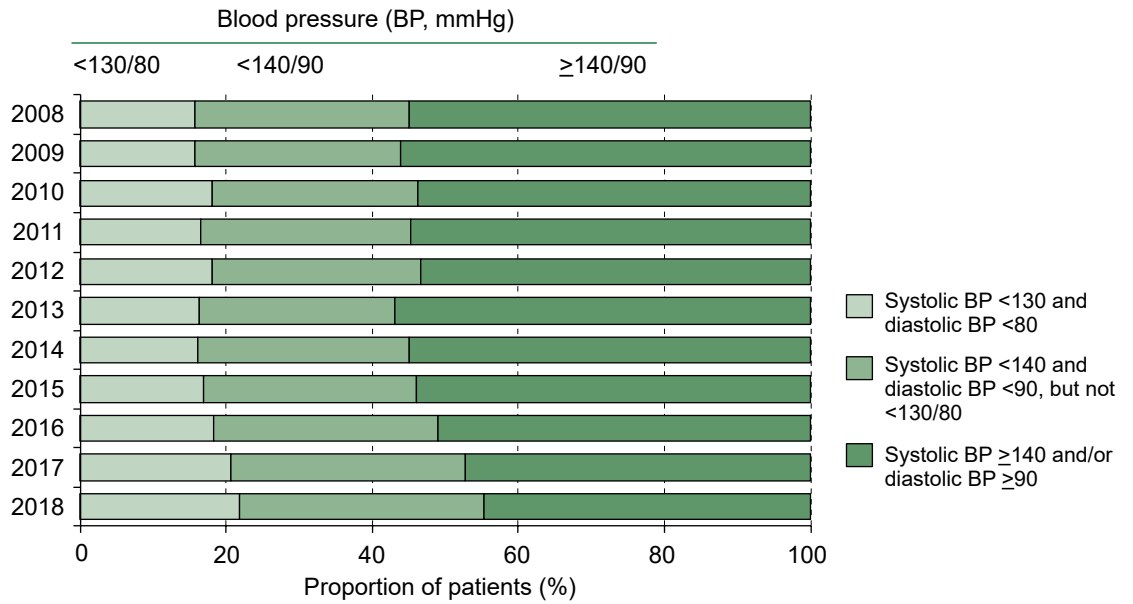
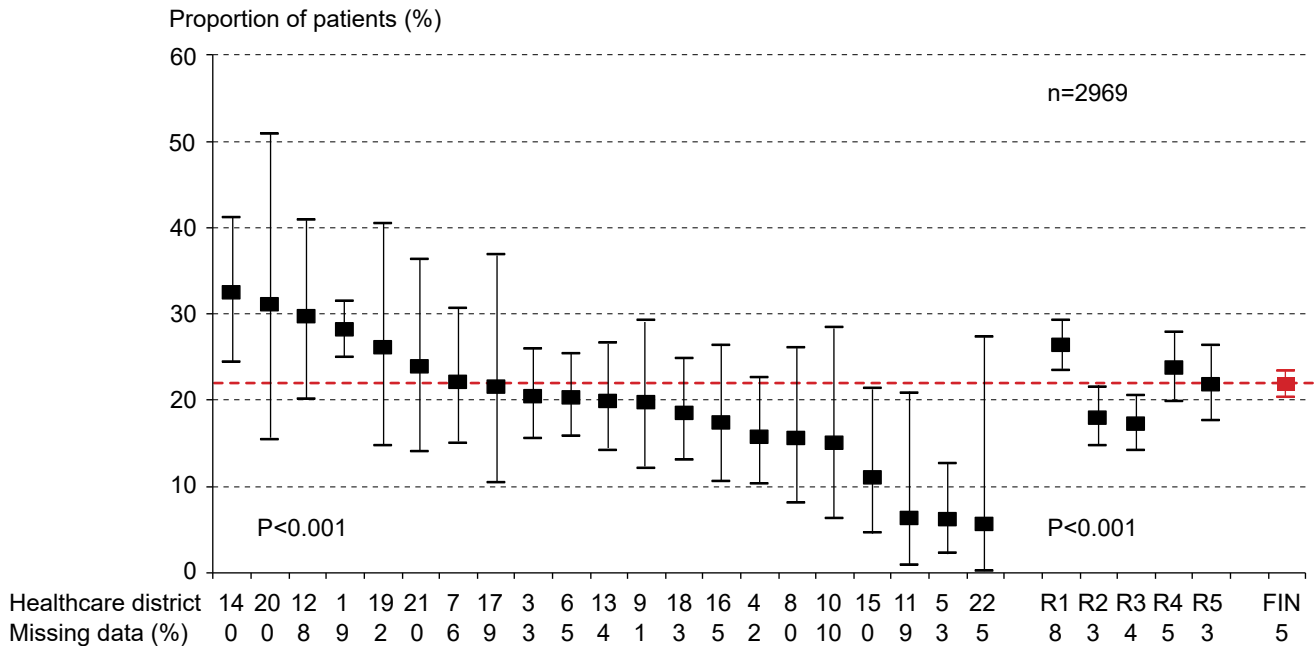


Figure 32. Proportion of kidney transplantation patients older than 20 years with blood pressure <130/80 mmHg in healthcare districts and regions
Finnish Registry for Kidney Diseases 2018



The KDIGO guidelines suggest that the blood pressure target of kidney transplantation patients be <130 mmHg for systolic blood pressure and <80 mmHg for diastolic blood pressure. Figure 31 shows the blood pressure distribution of kidney transplantation patients at the end of the years 2008–2018. The proportion of patients reaching the target (<130/80 mmHg) was 15% in 2008 and 22% in 2018.

At the end of 2018, the proportion of kidney transplantation patients attaining the blood pressure target varied between 6% and 32% in healthcare districts ($P<0.001$) and between 17% and 26% in regions ($P<0.001$) (Figure 32). Female patients reached the target more often than male patients (25% vs. 20%, $P=0.001$).

Figure 33. Distribution of serum LDL cholesterol among kidney transplantation patients older than 20 years Finnish Registry for Kidney Diseases 2008–2018

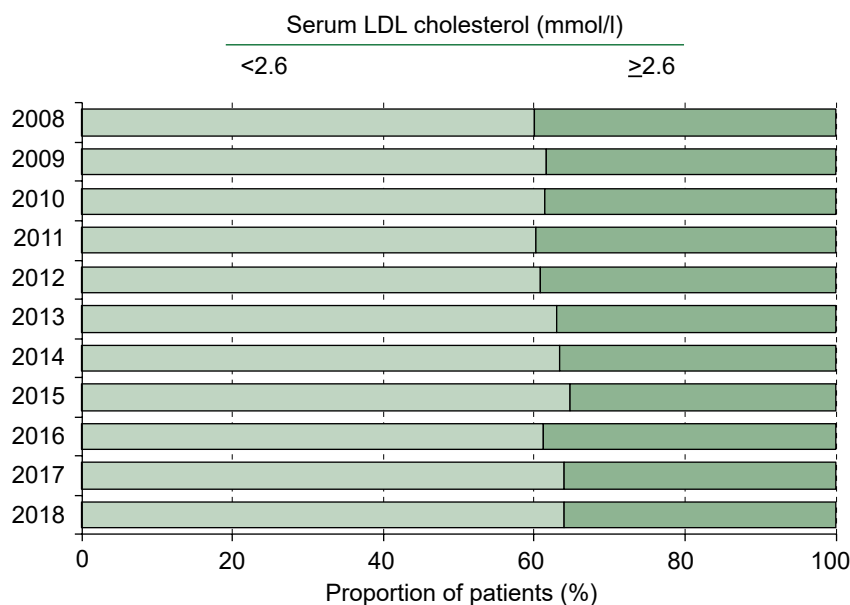
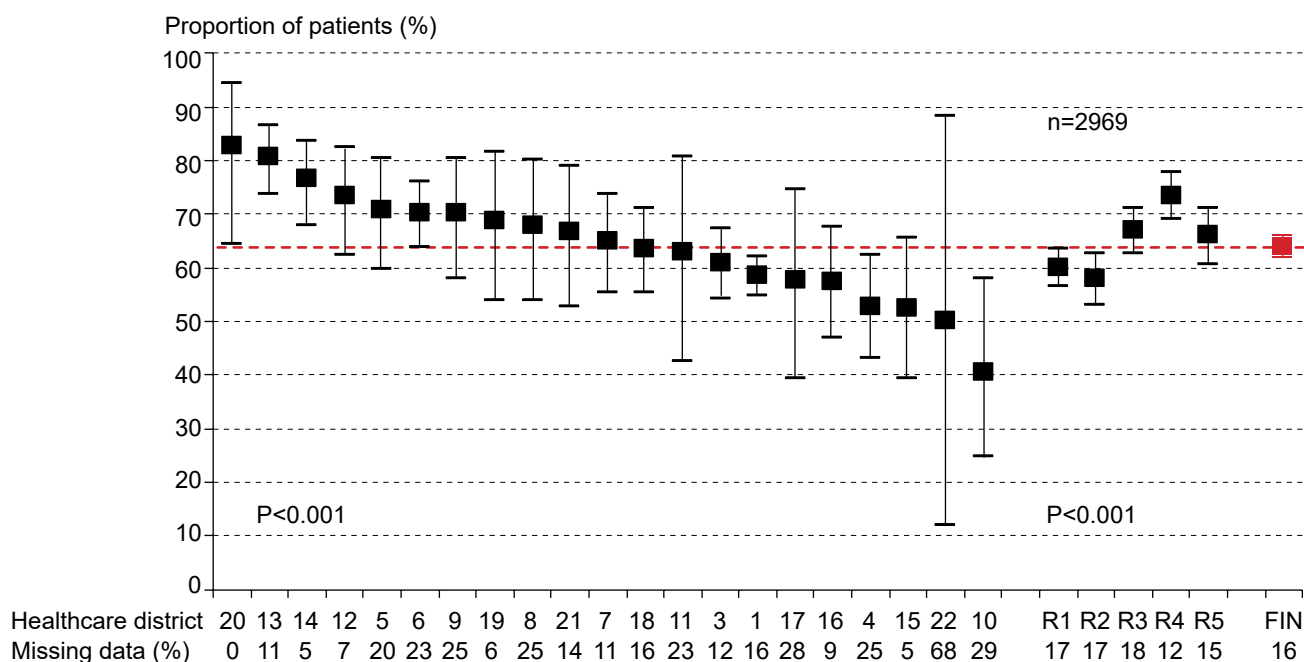


Figure 34. Proportion of kidney transplantation patients older than 20 years with serum LDL cholesterol <2.6 mmol/l in healthcare districts and regions Finnish Registry for Kidney Diseases 2018



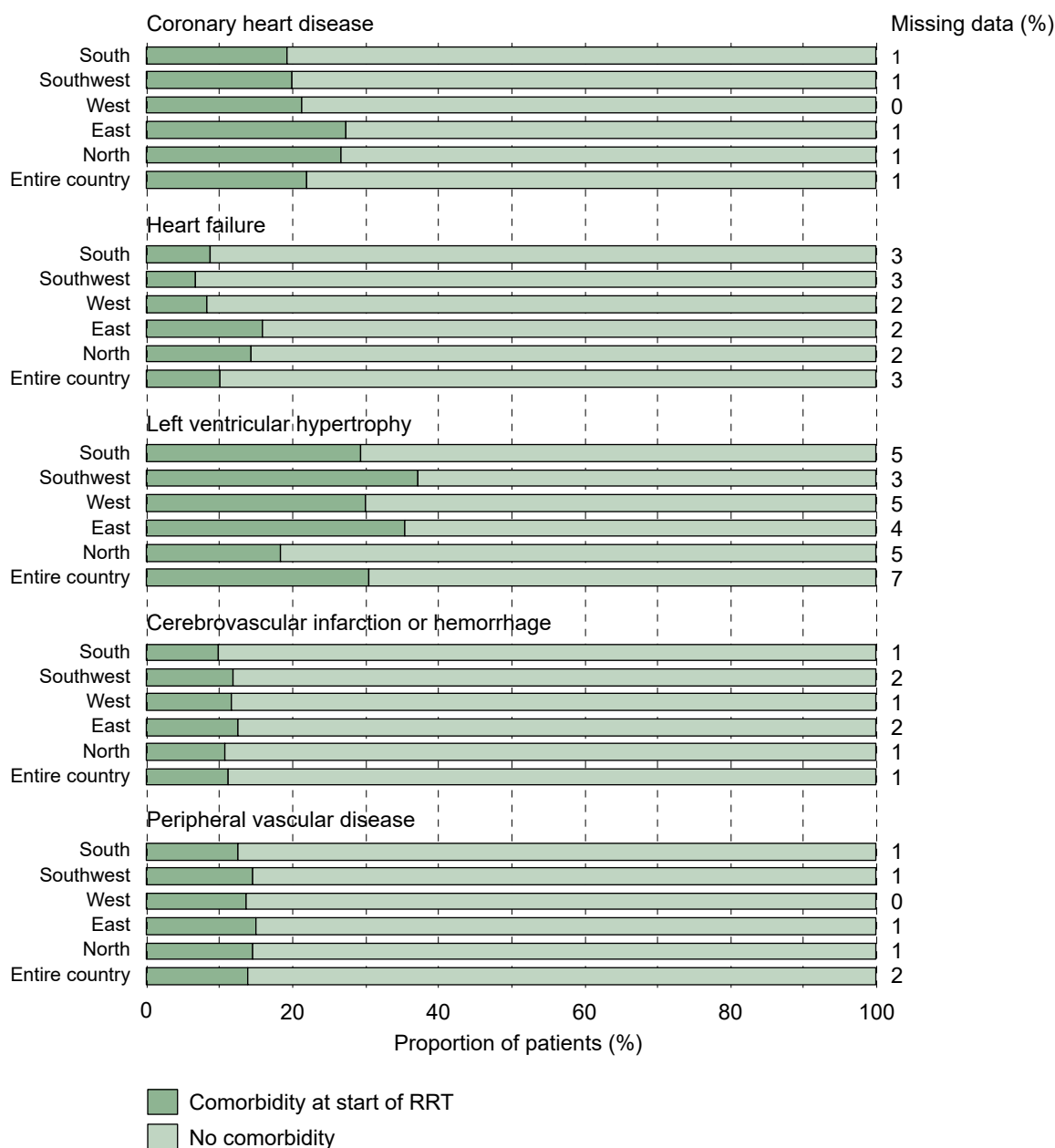
According to the KDIGO and KDOQI guidelines, kidney transplantation patients' concentration of serum low-density lipoprotein (LDL) cholesterol should be <2.6 mmol/l. In 2018, 64% of kidney transplantation patients reached this target (Figure 33).

The proportion of kidney transplantation patients reaching the treatment target for LDL cholesterol varied between 41% and 83% in healthcare districts ($P<0.001$) and between 60% and 73% in regions ($P<0.001$) (Figure 34).

Male patients reached the treatment target more often than female patients (67% vs. 60%, $p<0.001$).

The concentration of LDL cholesterol was calculated using the Friedewald formula based on serum concentrations of total cholesterol, high-density lipoprotein (HDL) cholesterol, and triglycerides. Because of restrictions of the Friedewald formula, patients with a triglyceride concentration >4.5 mmol/l were excluded.

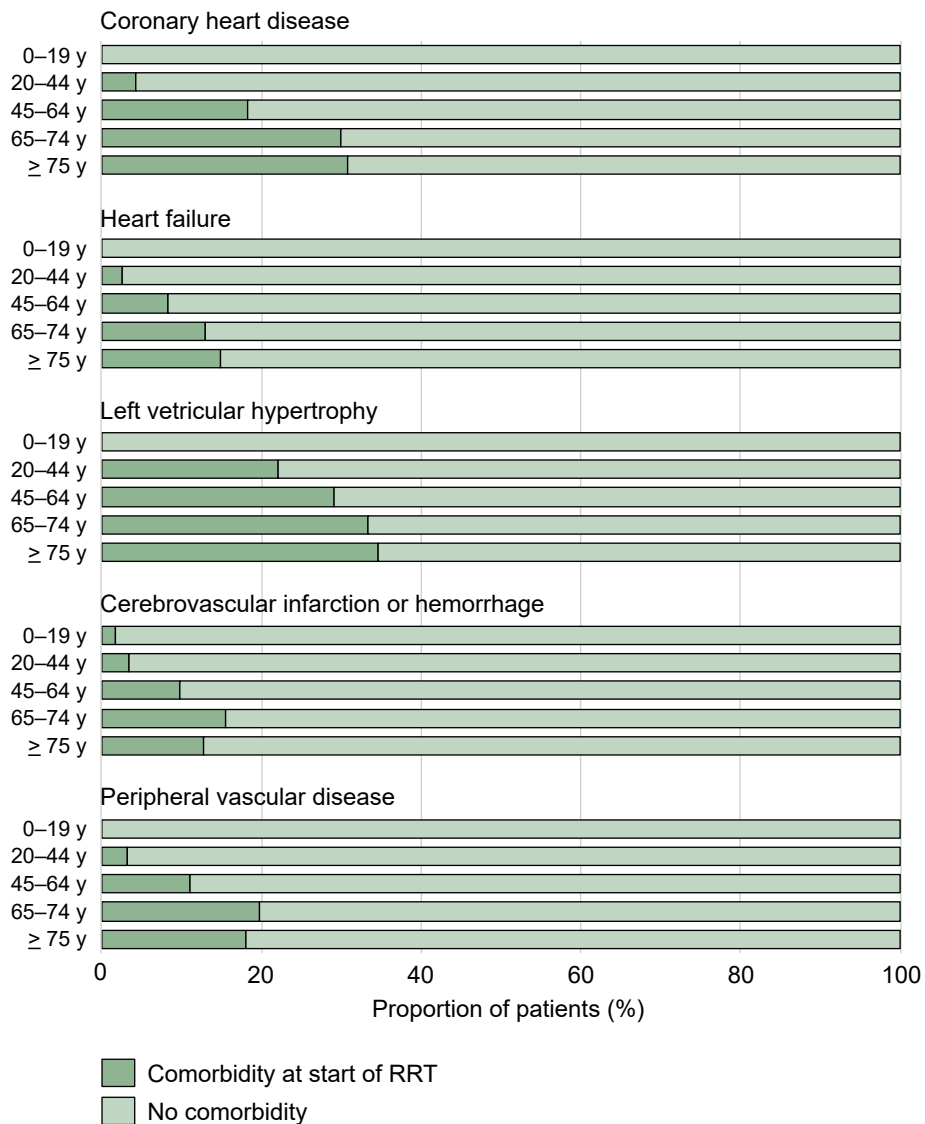
Figure 35. Comorbidities at start of RRT in patients older than 20 years by region
Finnish Registry for Kidney Diseases 2014–2018



In 2014–2018, 2576 patients aged 20 years or over entered RRT: 826 in the southern, 449 in the southwestern, 556 in the western, 413 in the eastern, and 332 in the northern region. Figure 35 shows by region the proportion of these patients having a history of coronary heart disease, heart failure, left ventricular hypertrophy, cerebrovascular infarction or hemorrhage, or peripheral vascular disease.

Coronary heart disease and heart failure were more common among patients in the eastern and northern regions (age- and sex-adjusted $P < 0.001$). The proportion of patients with left ventricular hypertrophy also differed between regions ($P < 0.001$). The frequency of cerebrovascular events and peripheral vascular disease did not differ significantly by region.

Figure 36. Comorbidities at start of RRT in patients older than 20 years by age group
Finnish Registry for Kidney Diseases 2014–2018

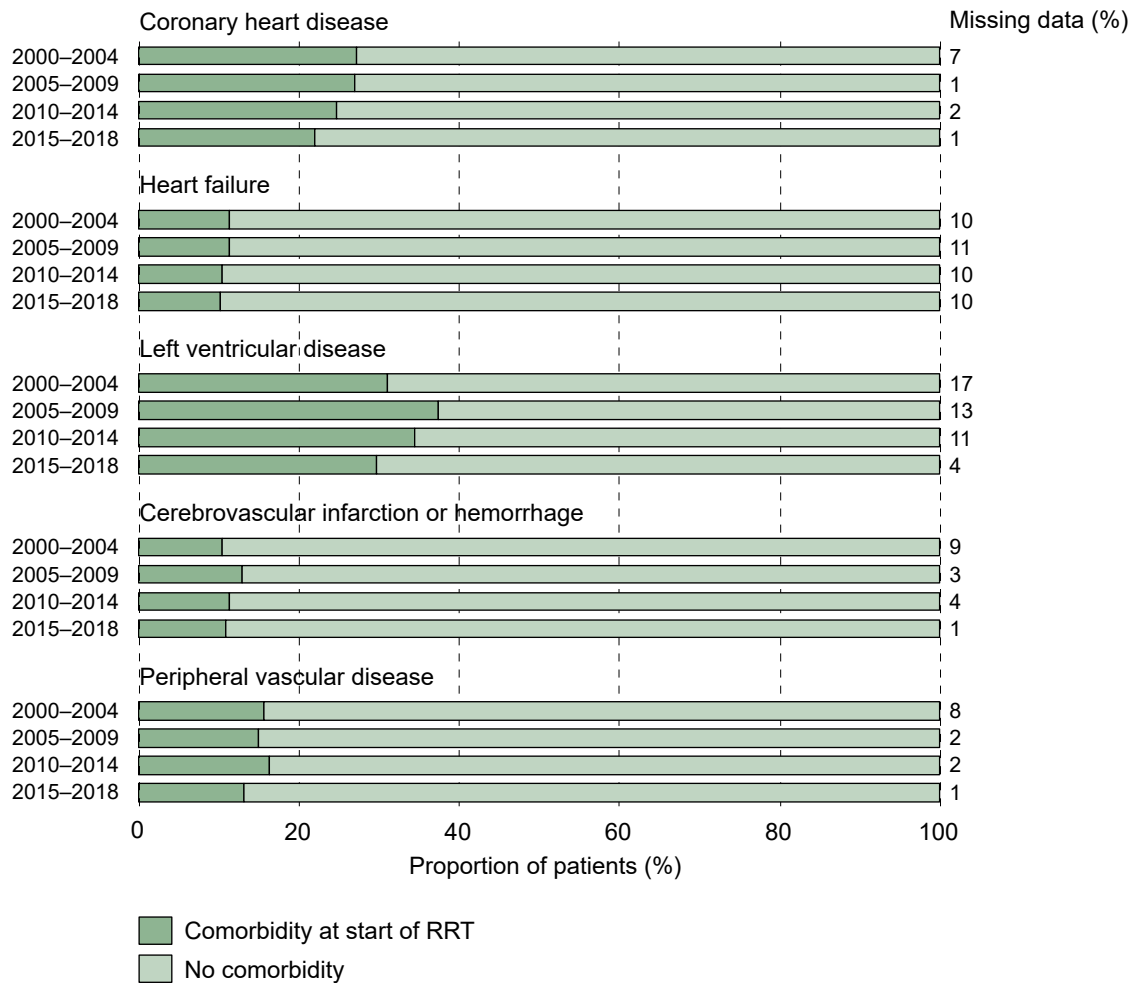


In 2014–2018, 2640 patients commenced RRT; 64 were younger than 20 years, 380 were 20–44 years, 968 were 45–64 years, 740 were 65–74 years, and 488 were 75 years or older. Figure 36 shows by age group the proportion of patients having a history of coronary heart disease,

heart failure, left ventricular hypertrophy, cerebrovascular infarction or hemorrhage, or peripheral vascular disease.

All comorbidities were more common among patients who started RRT at the age 65 years or over.

Figure 37. Comorbidities at start of RRT in patients older than 20 years by time period
Finnish Registry for Kidney Diseases 2014–2018



In 2000–2018, 9147 patients started RRT at the age of 20 years or older. Of these, 2391 started in 2000–2004, 2366 in 2005–2009, 2266 in 2010–2014, and 2124 in 2015–2018. Compared with 2000–2004, patients who started RRT in 2015–2018 had less frequently a history of coronary heart disease (age- and sex-adjusted $P < 0.001$), heart failure

($P = 0.048$), or peripheral vascular disease ($P = 0.001$). The frequency of left ventricular hypertrophy and cerebrovascular events has not changed.

The proportion of patients with missing data on comorbidities has decreased continuously.

- Age
 at end of year 2013:16, 2014:17, 2017:22–23, 2018:13
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- Alport's syndrome 2011:25,27
- Amyloidosis 2014:12,13,23, 2016:14,27, 2017:16–18,29–30, 2018:15,31
- APD (automated peritoneal dialysis) 2010:12,18, 2011:11,17,18,25,27, 2012:23,25, 2013:18,27, 2014:14,19,21, 2015:13,14,19,21, 2016:15,18,23,25, 2017:19,25,27,29–30, 2018:16,21,23
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- Goodpasture's syndrome 2016:14, 2017:17–18
- Graft survival
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Finnish Registry for Kidney Diseases

Report 2018



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