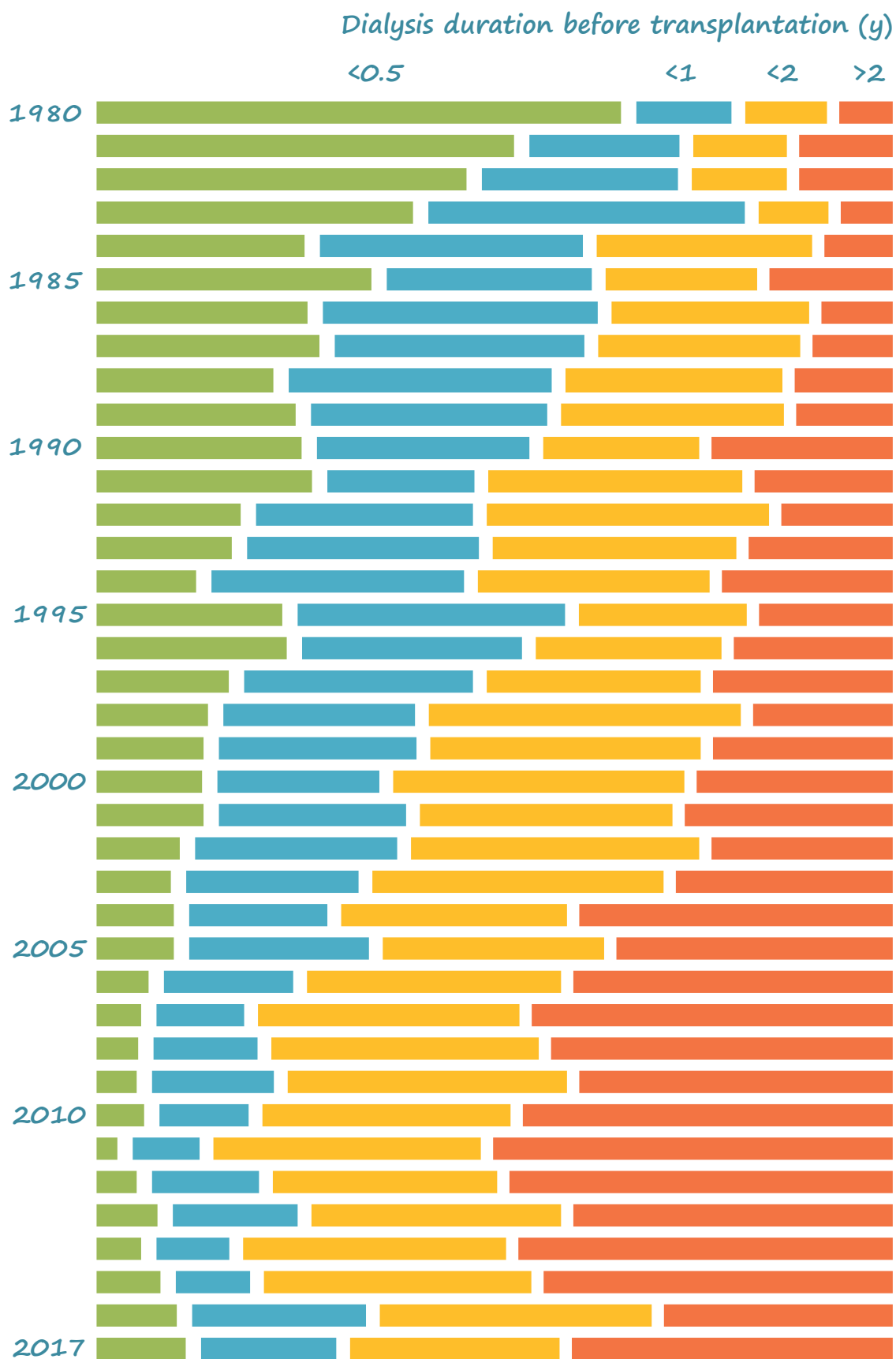


Report 2017

Finnish Registry for Kidney Diseases



Finnish Registry for Kidney Diseases – Report 2017

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Finnish Registry for Kidney Diseases 2017

The Finnish Registry for Kidney Diseases has published annual reports since the beginning of the 1990s. The reports have tracked the development of renal replacement therapy (RRT, i.e. dialysis and kidney transplantation) over the years. Many changes occur slowly, but there are also fast and unexpected turns in the development. It is interesting to see how the criteria for initiating RRT have changed. In the early 1990s, only a few persons aged over 75 years started chronic dialysis. During the same decade an increasing number of elderly patients entered RRT, and in recent years 20% of all new patients are older than 75 years.

Significant changes have occurred in the frequency of various types of primary kidney disease among patients who enter RRT. Before 1990, the most common diagnosis was glomerulonephritis, in the 1990s it was type 1 diabetes, in 2000–2016 type 2 diabetes, and in 2017 a bit unexpectedly again type 1 diabetes. The prevalence of type 1 diabetes in the population is increasing, but we know from a recent Finnish study that type 1 diabetic patients' risk of developing end-stage renal disease has decreased in the last decades.

Developments in recent years give an indication of the future. Report 2017 presents new projections for the number of dialysis and kidney transplantation patients in the coming years. The projections are only as reliable as their underlying assumptions. The previous predictions were published in Report 2014, but the projected number of patients turned out to be too low, as in 2015–2017 the number of new patients entering RRT was suddenly considerably larger than ever before. The new predictions are based on the assumption that the incidence of RRT will remain at the 2015–2017 level. By 2025, the number of dialysis patients is anticipated to increase by 19% and transplantation patients by 17%. In the future, the proportion of elderly dialysis patients is expected to increase. By performing more than 250 kidney transplantations annually, growth in the number of dialysis patients can be reduced.

For the sixth consecutive year, Report 2017 gives an analysis of the quality of care in the healthcare districts. In recent years, 10% of those who have started dialysis were waitlisted for kidney transplantation within 90 days, while the proportion was 6% before 2014. This proportion varies considerably, from 2% to 31%, between hospital districts. This indicates that many units have the potential to waitlist patients faster. In Finland, the

waitlisting of patients for kidney transplantation from deceased donors before initiation of dialysis has not been allowed, but this regulation was removed in September 2018. This will help nephrologists to waitlist patients at an earlier stage.

RRT patients have an increased risk of premature death relative to the general population. It is encouraging that patients' mortality has been steadily declining, and in recent years the mortality differences between regions have disappeared. This indicates that dialysis and transplantation patients' treatment has improved. It is important that this positive development endures; the Finnish Registry for Kidney Diseases will continue to monitor the progress.

Lately, there have been active discussions about quality registers in healthcare in Finland. Quality monitoring is critical for ensuring that patients receive high-quality care throughout Finland. It enables identification of problem areas that need to be addressed. Information from quality registers is especially important as some public health services may be transferred to private producers as patients' freedom of choice increases. We are pleased that new registers are being planned and developed in many fields of healthcare, and we look forward to fruitful collaboration. Notably, the Finnish Registry for Kidney Diseases, despite a history of several decades, still does not have a legal status. This situation will hopefully change if the proposed laws, which are currently under review in the Finnish parliament, are accepted.

The Finnish Registry for Kidney Diseases thanks its main sponsor, the Funding Centre for Social Welfare and Health Organisations (STEA), and also the Finnish Kidney and Liver Association for funding. The Finnish Registry for Kidney Diseases could not function without the excellent cooperation of all of the nephrology units in Finland. We warmly thank all 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 2007–2017. The population has grown in ten healthcare districts, most in Helsinki-Uusimaa, Åland, Pirkanmaa, and Pohjois-Pohjanmaa, and the population has decreased in 11 healthcare districts, most in Itä-Savo and Kainuu. The proportion of inhabitants older than 65 years has increased in all healthcare districts in 2007–2017. In 2017, the proportion of inhabitants under the age of 20 years was the 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 11–20)

In 2017, the incidence of RRT was 99 new patients per million inhabitants. Age- and sex-standardized incidence decreased in 2007–2013, but has increased since 2014. Significant variation has existed in the incidence of RRT between healthcare districts in 2013–2017, ranging from 59 new patients per year per million inhabitants in Lappi to 130 in Kainuu. 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 60–69 years is the largest, but the incidence of RRT is the highest in the age group 70–79 years due to the smaller background population. In men, the incidence increases faster than in women as the age rises and is relatively highest in the group of patients aged over 80 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 compared to Finland.

In 2017, the most common kidney disease diagnosis of patients entering RRT was type 1 diabetes, while the incidence of type 2 diabetes has been slightly decreasing since the early 2000s. From 2014, data on kidney disease diagnoses have also been collected using the new ERA-EDTA diagnosis code. In 2017, the ERA-EDTA diagnosis code provided more detailed information on kidney disease in 54 patients whose ICD-10 diagnosis was undefined. The propor-

tion of kidney biopsies increased from 25% to 28% in 2007–2017. In 2013–2017, three months after the start of RRT, one-third of the patients were on home dialysis (peritoneal dialysis or home hemodialysis), and only 1% had received a kidney transplant.

Prevalence of RRT, number of patients at end of year (pages 21–30)

At the end of 2017, there were 1973 dialysis patients and 3015 kidney transplantation patients in Finland. The prevalence of RRT was 905 per million inhabitants. The prevalence has increased by 21% 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 has ranged from 656 to 1279 patients per million inhabitants in healthcare districts. Of all dialysis patients, 20% were on peritoneal dialysis (PD) and 7% on home hemodialysis (HHD) at the end of 2017. In the healthcare districts, the proportion of home dialysis (PD and HHD) varied from 0% to 47%. The proportion of hemodiafiltration as a treatment modality in in-center dialysis units ranged from 15% to 100%. The most frequent kidney disease diagnosis of peritoneal dialysis patients was type 1 diabetes, of hemodialysis patients type 2 diabetes, and of kidney transplantation patients glomerulonephritis. The number of undefined kidney disease diagnoses in all patients has increased in ten years by 44%.

Changes in type of treatment (page 31)

In 2017, altogether 548 new patients started RRT, 406 patients died, and dialysis was discontinued in 18 patients after kidney function resumed. Treatment was terminated in 62 patients, most of whom had been on hemodialysis (60 patients). During the year 239 patients received a kidney transplant. The number of peritoneal dialysis patients increased by 5%.

RRT patients' mortality (page 32)

In 2017, 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.

Quality of care (pages 33–46)

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 dialysis patients reaching therapeutic goals, the probability of proceeding to the kidney transplantation waitlist, and the time on dialysis before the first kidney transplantation. In addition, information on immunosuppressive treatment of kidney transplantation patients is presented.

At the end of 2017, 83% of dialysis patients reached a hemoglobin concentration ≥ 100 g/l, but the proportion of patients with a hemoglobin concentration < 100 g/l increased in ten years from 11% to 17%. There have been no temporal changes in serum phosphorus concentrations, but significant differences exist between healthcare districts and regions in the treatment of hyperphosphatemia. In 2014–2016, the proportion of catheters for vascular access in new hemodialysis patients decreased annually, but in 2017 the proportion of catheters increased again. In all patients on hemodialysis, the proportion of catheters has increased steadily over the past ten years, reaching 16% at the end of 2017. There was no change in 2006–2017 in proportion of dialysis patients reaching therapeutic goals in hemoglobin, serum phosphorus, and blood pressure management.

In 2014–2017, of the patients entering RRT, 9–10% proceeded to the kidney transplantation waitlist within 90 days after RRT start, and this proportion had increased from the 6% in the previous years. In 2013–2017, the proportion of patients proceeding to waitlist within 90 days varied significantly between

healthcare districts (2–31%). The proportion of patients receiving a kidney transplantation within six months of RRT start decreased continuously over the period 1980–2011, but thereafter the proportion has increased from 4% to 15%. In immunosuppressive treatment of kidney transplantation patients, the use of mycophenolate and tacrolimus has increased, and the use of cyclosporin, steroids, and azathioprine has decreased in 2007–2017.

Projection of RRT patients (pages 47–48)

Since 2015, approximately 550 new patients have started RRT per year, which is considerably more than the previous year's level of 450 new patients per year. Therefore, the projection of incident and prevalent RRT patients in Report 2014 proved to be too small. According to the projection in this year's Report, the number of patients entering RRT will increase by 14% by 2040, when there will be 625 new RRT patients per year. At the same time, the proportion of new RRT patients aged over 75 years is anticipated to increase from 19% to 31%. The number of prevalent dialysis patients will increase by more than 20% over the next ten years and by 36% by 2040, with the number of older patients increasing the most. However, if mortality continues to decrease, and the incidence of RRT, especially in the oldest age group, rises closer to the level of most other European countries, the number of dialysis patients can increase considerably more. The number of renal transplantation patients is growing almost as fast as the number of dialysis patients. If the number of kidney transplantations can be increased from the current 250 per year, growth in the number of dialysis patients can be curtailed.

Table 1. The Finnish population (as thousands of inhabitants) and its distribution in healthcare districts
Finnish Registry for Kidney Diseases 2006–2016

Healthcare district		Year					Change (%) 2007-2017
		2007	2012	2015	2016	2017	
1	Helsinki-Uusimaa	1480	1563	1616	1634	1652	11.6
3	Varsinais-Suomi	463	472	477	479	481	3.9
4	Satakunta	227	225	223	222	220	-3.0
5	Kanta-Häme	171	175	175	174	173	0.7
6	Pirkanmaa	501	518	527	530	532	6.3
7	Päijät-Häme	211	214	212	213	212	0.3
8	Kymenlaakso	176	174	172	171	169	-4.3
9	Etelä-Karjala	134	132	131	131	130	-3.0
10	Etelä-Savo	108	105	103	102	102	-5.8
11	Itä-Savo	47	45	43	43	42	-9.8
12	Pohjois-Karjala	171	169	168	168	166	-2.6
13	Pohjois-Savo	249	248	248	248	247	-0.9
14	Keski-Suomi	245	250	252	253	253	3.4
15	Etelä-Pohjanmaa	199	199	197	197	196	-1.6
16	Vaasa	163	168	170	170	170	4.0
17	Keski-Pohjanmaa	78	78	79	79	78	0.6
18	Pohjois-Pohjanmaa	387	401	407	408	409	5.7
19	Kainuu	80	77	75	75	74	-7.8
20	Länsi-Pohja	66	65	63	63	62	-6.2
21	Lappi	119	118	118	118	117	-0.9
22	Åland	27	29	29	29	29	8.6
Region							
	South	1790	1870	1919	1936	1950	9.0
	Southwest	880	894	900	900	900	2.3
	West	1082	1106	1111	1113	1113	2.8
	East	819	818	815	813	810	-1.1
	North	729	739	742	742	740	1.5
Entire country		5300	5427	5487	5503	5513	4.0

Figure 1. Healthcare districts and regions in Finland
Finnish Registry for Kidney Diseases 2017

On 31 December 2017, the population of Finland was 5.513 million (Table 1, Source: Statistics Finland). During the past ten years the population of the country has increased by 4.0%, 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, Etelä-Savo, and Länsi-Pohja, 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.

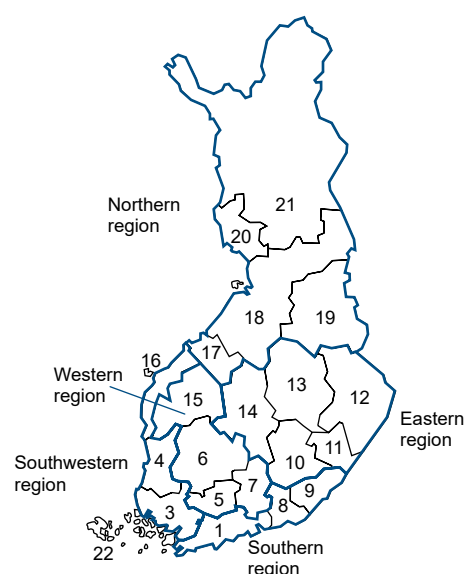


Table 2. The Finnish population (as thousands of inhabitants) according to region, age group, and sex
Finnish Registry for Kidney Diseases 2007–2017

Region	2007					2017				
	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	210 (24)	557 (64)	62 (7)	38 (4)	867 (100)	215 (23)	586 (61)	97 (10)	55 (6)	953 (100)
Women	203 (22)	568 (62)	76 (8)	76 (8)	923 (100)	205 (21)	584 (59)	116 (12)	92 (9)	998 (100)
Total	413 (23)	1125 (63)	138 (8)	114 (6)	1790 (100)	420 (22)	1170 (60)	213 (11)	147 (8)	1950 (100)
Southwest										
Men	101 (24)	263 (61)	38 (9)	28 (6)	430 (100)	96 (22)	256 (57)	57 (13)	36 (8)	444 (100)
Women	96 (21)	259 (58)	44 (10)	51 (11)	450 (100)	91 (20)	247 (54)	61 (13)	56 (12)	456 (100)
Total	197 (22)	522 (59)	82 (9)	79 (9)	880 (100)	188 (21)	503 (56)	118 (13)	92 (10)	900 (100)
West										
Men	126 (24)	326 (62)	46 (9)	32 (6)	530 (100)	122 (22)	315 (57)	69 (13)	42 (8)	548 (100)
Women	121 (22)	316 (57)	54 (10)	61 (11)	552 (100)	116 (21)	304 (54)	77 (14)	68 (12)	564 (100)
Total	247 (23)	643 (59)	100 (9)	93 (9)	1082 (100)	238 (21)	619 (56)	146 (13)	110 (10)	1113 (100)
East										
Men	93 (23)	248 (61)	37 (9)	26 (6)	404 (100)	84 (21)	230 (57)	55 (14)	33 (8)	401 (100)
Women	89 (22)	235 (57)	43 (10)	48 (12)	415 (100)	80 (20)	219 (54)	57 (14)	52 (13)	408 (100)
Total	183 (22)	483 (59)	80 (10)	74 (9)	819 (100)	164 (20)	449 (55)	111 (14)	86 (11)	810 (100)
North										
Men	96 (26)	220 (60)	30 (8)	20 (5)	366 (100)	91 (24)	210 (56)	44 (12)	27 (7)	372 (100)
Women	91 (25)	205 (56)	33 (9)	34 (9)	364 (100)	86 (24)	196 (53)	45 (12)	40 (11)	368 (100)
Total	187 (26)	426 (58)	63 (9)	54 (7)	729 (100)	178 (24)	407 (55)	89 (12)	67 (9)	740 (100)
Entire country										
Men	626 (24)	1615 (62)	213 (8)	143 (6)	2597 (100)	607 (22)	1596 (59)	322 (12)	194 (7)	2719 (100)
Women	600 (22)	1584 (59)	250 (9)	270 (10)	2704 (100)	579 (21)	1551 (56)	356 (13)	308 (11)	2794 (100)
Total	1227 (23)	3199 (60)	463 (9)	413 (8)	5300 (100)	1186 (22)	3147 (57)	678 (12)	502 (9)	5513 (100)

Table 2 shows the age and sex distribution of the Finnish population at the end of 2007 and 2017. 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 12%. The proportion of inhabitants older than 65 years has increased considerably in all regions, and at the end of 2017 it was the smallest in the south-

ern region, 19%, and 21–25% in the other regions. The proportion of inhabitants aged 20–64 years was largest in the southern region, 60%, while it was 55–56% in all other regions. The proportion of 20–64-year-olds countrywide has decreased from 60% to 57%. At the end of 2017, the proportion of inhabitants younger than 20 years was the largest, 24%, in the northern region.

Table 3. Number of new RRT patients and incidence of RRT by healthcare district and region
Finnish Registry for Kidney Diseases 2007–2017

Healthcare district	Number of new RRT patients						Incidence of RRT/million inhabitants						
	2007	2012	2015	2016	2017	2013–2017 on average	2007	2012	2015	2016	2017	2013–2017 on average	
1	Helsinki-Uusimaa	99	114	128	143	148	135	67	73	79	87	90	84
3	Varsinais-Suomi	43	45	46	57	56	49	93	95	96	119	117	103
4	Satakunta	31	23	22	32	28	24	136	102	99	144	127	107
5	Kanta-Häme	15	15	21	22	21	22	87	85	120	127	122	128
6	Pirkanmaa	67	45	52	56	55	54	134	87	99	106	103	103
7	Päijät-Häme	21	13	16	24	25	21	99	61	75	113	118	97
8	Kymenlaakso	28	16	18	15	9	13	159	92	105	88	53	76
9	Etelä-Karjala	16	12	17	21	14	15	119	91	130	161	108	118
10	Etelä-Savo	10	5	16	11	9	10	93	48	155	107	89	95
11	Itä-Savo	3	7	7	4	6	5	64	156	161	93	142	120
12	Pohjois-Karjala	17	7	25	15	23	18	99	41	149	89	138	110
13	Pohjois-Savo	30	34	32	31	17	26	121	137	129	125	69	103
14	Keski-Suomi	21	23	21	27	25	22	86	92	83	107	99	86
15	Etelä-Pohjanmaa	17	21	20	25	24	20	85	106	101	127	123	101
16	Vaasa	17	12	19	18	22	18	104	71	112	106	130	104
17	Keski-Pohjanmaa	4	9	13	8	8	10	52	115	165	102	102	122
18	Pohjois-Pohjanmaa	31	30	26	33	40	34	80	75	64	81	98	83
19	Kainuu	10	6	13	11	6	10	125	77	173	147	81	130
20	Länsi-Pohja	7	2	9	6	6	7	106	31	143	96	97	114
21	Lappi	7	8	7	9	5	7	59	68	59	76	43	59
22	Åland	2	5	5	2	1	2	74	175	173	68	34	76
<hr/>													
Region South		143	142	163	179	171	164	80	76	85	92	88	85
Southwest		93	85	92	109	107	93	106	95	102	121	119	103
West		120	94	109	127	125	117	111	85	98	114	112	106
East		81	76	101	88	80	81	99	93	124	108	99	99
North		59	55	68	67	65	67	81	74	92	90	88	91
<hr/>													
Entire country		496	452	533	570	548	521	94	83	97	104	99	95
Children <15 y		11	8	13	3	11	9	12	9	15	3	12	10

Table 3 shows the number of new RRT (renal replacement therapy, i.e. dialysis and kidney transplantation) patients and the incidence of RRT according to healthcare district and region. In 2013–2017, the average incidence was highest in the western region and lowest in the southern region. In the healthcare districts, the average incidence during the same period was lowest in Lapland (59 new RRT patients per million inhabitants) and highest in Kainuu (130 per million inhabitants).

Table 4. Number of new RRT patients by age group in healthcare districts and regions
Finnish Registry for Kidney Diseases 2013–2017

Healthcare district		Average annual number of new RRT patients in 2013–2017 by age group (y)						Incidence*/million inhabitants in 2013–2017 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	4.0	19.6	49.6	34.4	27.6	135	11	34	119	215	262	84
3	Varsinais-Suomi	1.6	6.8	16.4	15.8	8.4	49	16	46	130	272	185	103
4	Satakunta	0.4	4.0	8.4	7.0	4.0	24	9	66	136	231	162	107
5	Kanta-Häme	0.2	3.0	7.6	5.8	5.8	22	5	62	155	263	337	128
6	Pirkanmaa	2.4	7.4	20.6	14.8	9.2	54	21	43	153	243	194	103
7	Päijät-Häme	0.2	3.2	7.8	6.6	2.8	21	5	55	131	223	131	97
8	Kymenlaakso	0.2	1.8	7.0	2.6	1.4	13	6	40	141	108	74	76
9	Etelä-Karjala	0.4	2.2	5.6	4.4	2.8	15	16	61	149	249	187	117
10	Etelä-Savo	0	1.6	3.8	2.8	1.6	10	0	63	124	185	128	95
11	Itä-Savo	0	0.6	1.6	1.4	1.6	5	0	60	121	208	280	120
12	Pohjois-Karjala	0.4	2.8	7.0	4.8	3.4	18	12	61	144	217	192	109
13	Pohjois-Savo	0.4	4.6	9.8	8.4	2.4	26	8	66	139	273	95	103
14	Keski-Suomi	0.4	2.8	9.4	5.4	3.6	22	7	35	145	185	159	86
15	Etelä-Pohjanmaa	0.8	2.6	7.6	5.4	3.6	20	18	49	142	222	173	101
16	Vaasa	0.8	1.8	5.4	5.0	4.6	18	20	34	130	257	276	104
17	Keski-Pohjanmaa	0.4	1.8	2.4	1.8	3.2	10	20	82	121	191	436	122
18	Pohjois-Pohjanmaa	0.8	5.6	11.0	9.6	6.6	34	7	44	109	240	215	83
19	Kainuu	0	1.0	4.6	3.0	1.2	10	0	54	200	294	140	130
20	Länsi-Pohja	0	1.0	3.4	2.0	0.8	7	0	61	187	246	123	114
21	Lappi	0	1.2	1.8	2.6	1.4	7	0	37	51	180	119	59
22	Åland	0	0.6	1.0	0.6	0	2	0	70	123	172	0	76
Region	South	4.6	23.6	62.2	41.4	31.8	164	11	36	123	205	228	85
	Southwest	2.8	13.2	31.2	28.4	17.0	93	15	49	131	255	190	103
	West	3.6	16.2	43.6	32.6	21.4	117	15	49	147	238	200	106
	East	1.2	12.4	31.6	22.8	12.6	81	7	54	139	219	150	99
	North	1.2	10.6	23.2	19.0	13.2	67	7	49	118	231	203	91
Entire country		13.4	76.0	191.8	144.2	96.0	521	11	45	131	227	198	95

*Average annual incidence of RRT in subgroup

Table 4 presents the average annual number of new RRT patients and the incidence of RRT in 2013–2017 according to healthcare district, region, and age group. The incidence was highest among 65–74-year-olds and varied in this age group in the range of 108–294 in the healthcare districts. In the age group of 75 years and older, the incidence was 198 new RRT patients per million age-related inhabitants and varied in healthcare districts in the range of 0–436 and in regions in the range of 150–228.

Table 5. Number of new RRT patients by age group and sex
Finnish Registry for Kidney Diseases 2007–2017

Age group		Number of new RRT patients					Incidence of RRT/million inhabitants				
		2007	2012	2015	2016	2017	2007	2012	2015	2016	2017
0–19 y	Men	7	7	10	2	9	11	11	16	3	15
	Women	7	2	8	4	6	12	3	14	7	10
	Total	14	9	18	6	15	11	7	15	5	13
20–44 y	Men	46	38	48	61	48	53	44	55	69	54
	Women	23	20	31	31	30	28	24	37	37	36
	Total	69	58	79	92	78	41	34	46	54	45
45–64 y	Men	139	119	128	133	113	184	158	176	184	159
	Women	66	51	68	73	69	87	67	92	100	96
	Total	205	170	196	206	182	135	112	134	142	127
65–74 y	Men	75	86	114	104	111	353	324	375	337	345
	Women	35	30	40	46	58	140	100	118	135	163
	Total	110	116	154	150	169	238	205	240	231	249
≥75 y	Men	64	64	54	77	64	448	385	296	401	330
	Women	34	35	32	39	40	126	122	107	127	130
	Total	98	99	86	116	104	238	219	179	232	207
Total	Men	331	314	354	377	345	127	118	131	139	127
	Women	165	138	179	193	203	61	50	64	69	73
	Total	496	452	533	570	548	94	83	97	104	99

Table 5 shows the number of new RRT patients and the incidence of RRT according to age group and sex in 2007–2017. The number of new patients has increased in recent years especially in the age group of 65 years and older. Of the new RRT patients in 2017, 63% were men. In the age

group of 65–74-year-olds, the incidence of RRT (number of new RRT patient per million age-related population) has remained virtually unchanged during the past ten years. In 2017, the incidence of RRT in men relative to women had decreased slightly compared with previous years.

Figure 2. Number of new RRT patients according to age group and sex
Finnish Registry for Kidney Diseases 2013–2017

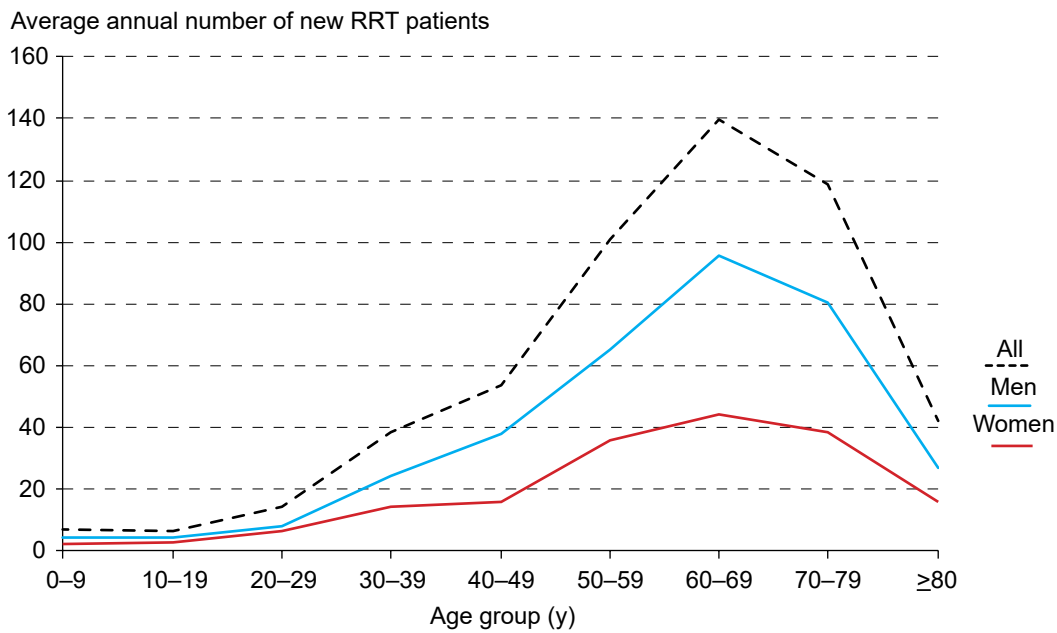


Figure 3. Incidence of RRT according to age group and sex
Finnish Registry for Kidney Diseases 2013–2017

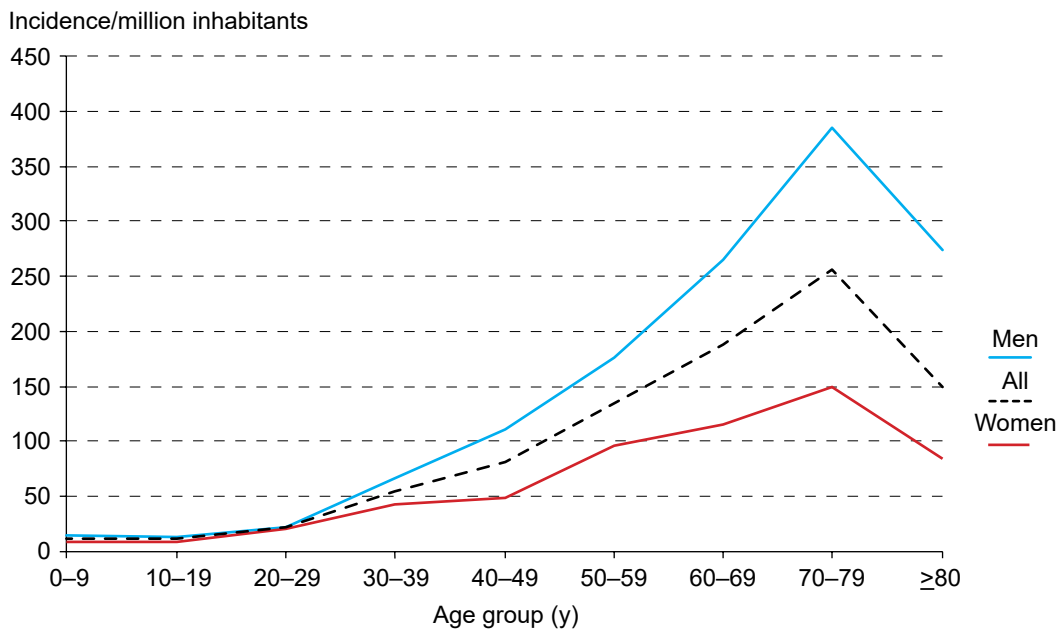


Figure 2 displays the average annual number of RRT patients in 2013–2017 according to age group and sex. The number of new patients is largest in the group of 60–69-year-olds in both sexes. The number of men is twice as large as the number of women in all age groups above 40 years.

Figure 3 presents the annual incidence of RRT in 2013–2017 according to age group and sex. The highest incidence in both sexes occurs in the age group of 70–79-year-olds. The incidence increases faster with age among males than among females, and in the age group over 80 years the incidence of RRT is threefold in men than in women.

Figure 4. Standardized incidence of RRT in regions Finnish Registry for Kidney Diseases 2007–2017

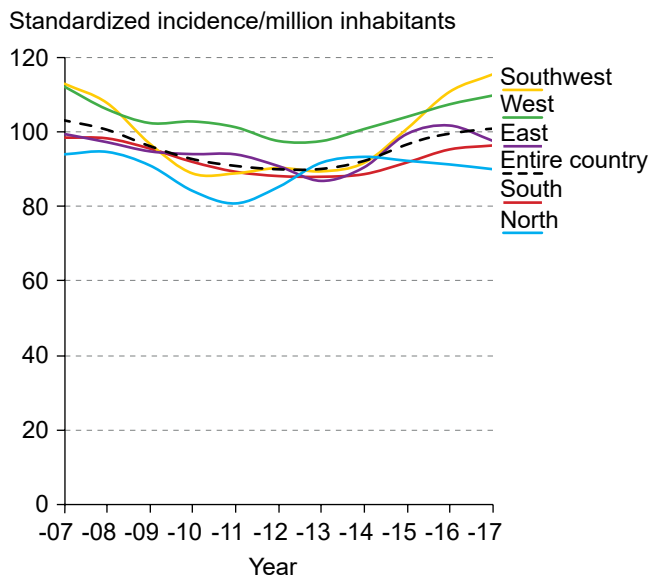


Figure 4 shows the regional incidence of RRT in 2007–2017 as smoothed averages. The incidence rates are age- and sex-standardized using the Finnish general population on 31 December 2017 as the reference. Population changes in 2007–2017 have been taken into consideration. Standardization removes the 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 5. Standardized incidence of RRT in regions 90 days after the start of RRT Finnish Registry for Kidney Diseases 2007–2017

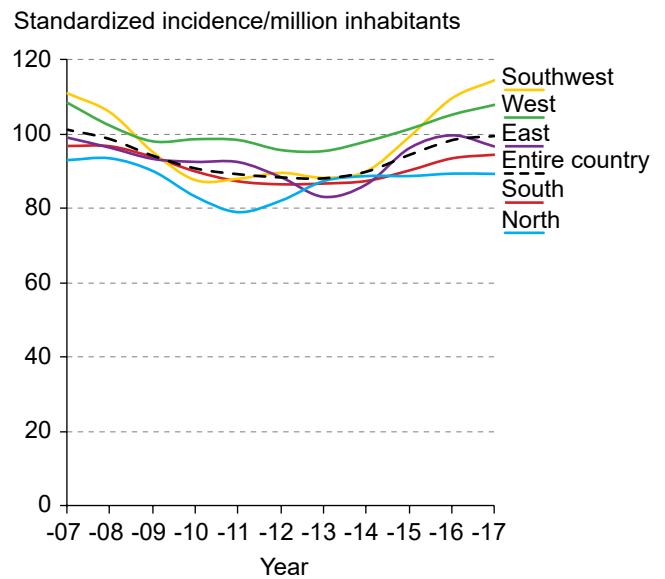
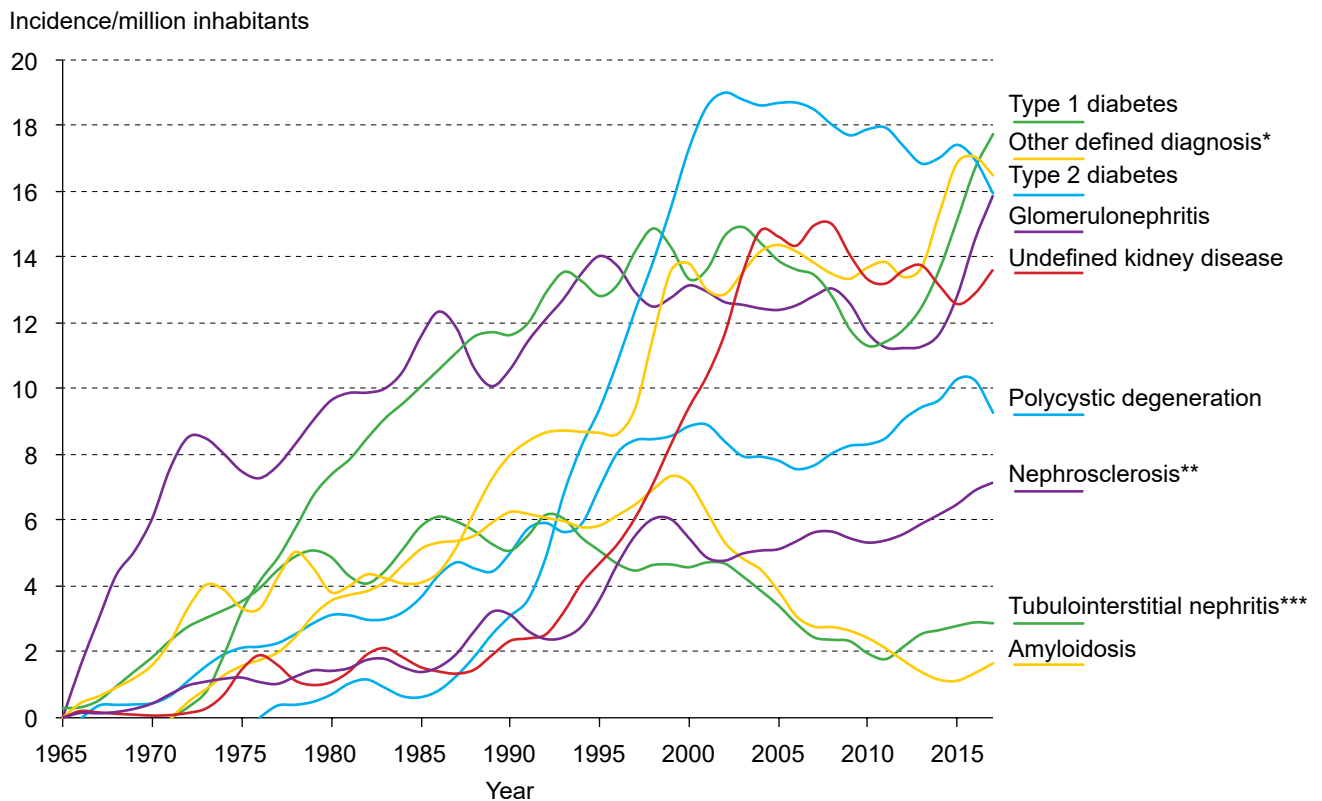


Figure 5 shows the age- and sex-standardized regional incidence of RRT 90 days after the start of RRT. The Finnish Registry for Kidney Diseases does not store data on patients who have regained renal function within 90 days of start of RRT because in that case RRT is not considered chronic. However, 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 5.

Figure 6. Incidence of RRT according to diagnosis
Finnish Registry for Kidney Diseases 1965–2017



*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 6. 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.

Type 2 diabetes has been the leading cause of end-stage renal disease since 1999, but in 2017 type 1 diabetes was more frequent. Glomerulonephritis ranks as the third most common cause of end-stage renal disease. The number of amyloidosis patients entering RRT decreased continuously until 2015.

In earlier reports, pyelonephritis was presented as a group of its own, and it included tubulointerstitial nephritis. Since Report 2016, this group has been replaced with the

group tubulointerstitial nephritis containing the subgroup pyelonephritis (ICD-10 codes N11.0 and N11.1), which forms a minor part (5% in 2007–2017) of the tubulointerstitial nephritis group.

The group of other defined diagnoses has grown considerably, being larger than type 2 diabetes in 2017. In 2017, altogether 87 new RRT patients had been assigned “other defined diagnosis”. The most common diagnoses were urinary tract obstruction (n=15), vasculitis (n=8), myeloma (n=8), Goodpasture’s syndrome (n=7), kidney cancer (n=5), congenital malformations (n=4), congenital nephrosis of Finnish type (n=3), and hemolytic-uremic syndrome (n=2). Of the 87 patients, 21 had an ICD-10 code of N18.8, indicating other defined kidney disease, but does not give further specification. Among these 21 patients, the new ERA-EDTA diagnosis code specified the diagnosis for 18, whereas for 3 patients the kidney disease remained unknown.

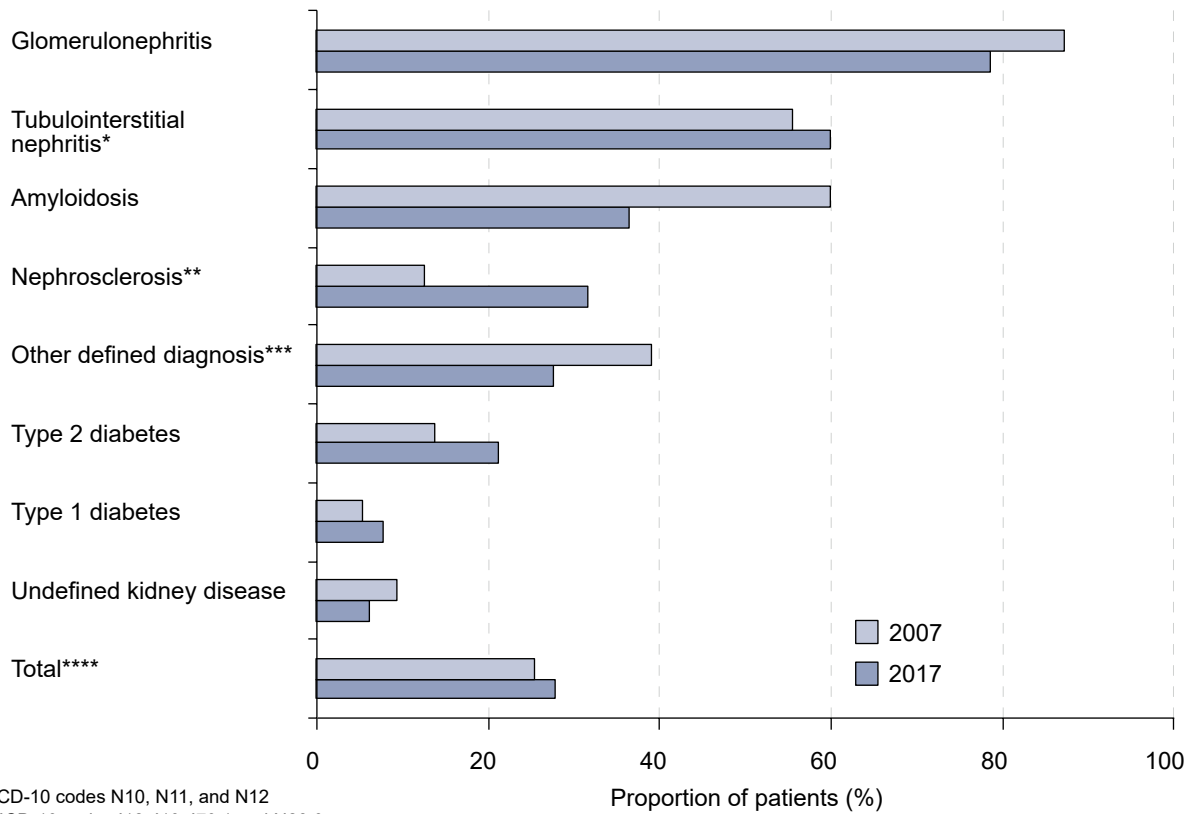
Table 6. New RRT patients' primary renal disease according to the ERA-EDTA coding system
Finnish Registry for Kidney Diseases 2017

ERA-EDTA diagnosis		Number of patients	ICD-10 code	
Code	Description		Defined	Undefined
2316	Diabetic nephropathy in type I diabetes - no histology	97	95	2
2337	Diabetic nephropathy in type II diabetes - no histology	68	63	5
2718	Autosomal dominant polycystic kidney disease	40	40	0
3555	Chronic kidney disease / chronic renal failure - aetiology uncertain / unknown - no histology	38	3	35
1128	IgA nephropathy - histologically proven	36	36	0
2359	Chronic hypertensive nephropathy - no histology	27	21	6
2344	Diabetic nephropathy in type II diabetes - histologically proven	16	16	0
3708	Chronic renal failure	15	0	15
1267	Primary focal segmental glomerulosclerosis (FSGS)	10	10	0
2363	Chronic hypertensive nephropathy - histologically proven	10	10	0
2328	Diabetic nephropathy in type I diabetes - histologically proven	9	9	0
2407	Ischaemic nephropathy - no histology	9	3	6
1897	Tubulointerstitial nephritis - histologically proven	8	8	0
2578	Myeloma kidney - no histology	8	8	0
3749	Glomerulonephritis - no histology	8	6	2
1752	Acquired obstructive uropathy / nephropathy	7	7	0
1377	Glomerulonephritis - histologically indeterminate	6	6	0
2509	Renal amyloidosis	6	5	1
1003	Adult nephrotic syndrome - no histology	5	3	2
1185	Membranous nephropathy - idiopathic	5	5	0
1464	Anti-glomerular basement membrane disease / Goodpasture's syndrome - no histology	5	5	0
1687	Posterior urethral valves	5	2	3
3474	Renal cell carcinoma - histologically proven	5	5	0
1320	Focal segmental glomerulosclerosis (FSGS) secondary to obesity - histologically proven	4	4	0
1349	Mesangial proliferative glomerulonephritis	4	4	0
1417	Granulomatosis with polyangiitis - histologically proven	4	4	0
1429	Microscopic polyangiitis - histologically proven	4	4	0
1625	Congenital dysplasia / hypoplasia	4	4	0
1775	Obstructive nephropathy due to prostatic hypertrophy	4	3	1
2513	AA amyloid secondary to chronic inflammation	4	4	0
1035	Congenital nephrotic syndrome (CNS) - Finnish type - no histology	3	3	0
1472	Anti-glomerular basement membrane disease/Goodpasture's syndrome - histol. proven	3	3	0
1799	Obstructive nephropathy due to bladder cancer	3	2	1
1884	Tubulointerstitial nephritis - no histology	3	2	1
2482	Cardiorenal syndrome	3	0	3
3529	Chronic kidney disease (CKD) / chronic renal failure (CRF) caused by tumour nephrectomy	3	1	2
1100	Minimal change nephropathy - histologically proven	2	2	0
1116	IgA nephropathy - no histology	2	2	0
1222	Mesangiocapillary glomerulonephritis type 1	2	2	0
1246	Mesangiocapillary glomerulonephritis type 3	2	2	0
1354	Focal and segmental proliferative glomerulonephritis	2	2	0
1493	Systemic lupus erythematosus / nephritis - histologically proven	2	1	1
1639	Multicystic dysplastic kidneys	2	2	0
2385	Malignant hypertensive nephropathy / accelerated hypertension nephropathy - histol. proven	2	2	0
2392	Ageing kidney - no histology	2	0	2
2521	AL amyloid secondary to plasma cell dyscrasia	2	2	0
3564	Chronic kidney disease / chronic renal failure - aetiology uncertain / unknown - histology	2	0	2
3643	Chronic renal failure due to systemic infection	2	0	2
3720	Isolated proteinuria - no histology	2	1	1
1057	Congenital nephrotic syndrome (CNS) - diffuse mesangial sclerosis	1	1	0
1171	IgM - associated nephropathy	1	0	1
1192	Membranous nephropathy - malignancy associated	1	1	0
1365	Glomerulonephritis - secondary to other systemic disease	1	1	0
1602	Primary reflux nephropathy - sporadic	1	1	0
1723	Megacystis-megaureter	1	1	0
1768	Acquired obstructive nephropathy due to neurogenic bladder	1	0	1
1832	Calculus nephropathy / urolithiasis	1	1	0
1930	Tubulointerstitial nephritis associated with autoimmune disease - histologically proven	1	1	0
1976	Renal sarcoidosis - histologically proven	1	1	0
2005	Drug-induced tubulointerstitial nephritis - no histology	1	1	0
2014	Drug-induced tubulointerstitial nephritis - histologically proven	1	1	0
2274	Nephropathy related to HIV - no histology	1	0	1
2371	Malignant hypertensive nephropathy / accelerated hypertension nephropathy - no histology	1	0	1
2424	Renal artery stenosis	1	1	0
2430	Atheroembolic renal disease - no histology	1	0	1
2495	Hepatorenal syndrome	1	0	1
2597	Light chain deposition disease	1	1	0
2623	Atypical haemolytic uraemic syndrome (HUS) - diarrhoea negative	1	1	0
2725	Autosomal dominant (AD) polycystic kidney disease type I	1	1	0
2739	Autosomal dominant (AD) polycystic kidney disease type II	1	0	1
2760	Alport syndrome - histologically proven	1	1	0
2815	Medullary cystic kidney disease type II	1	1	0
3207	Primary hyperoxaluria type I	1	1	0
3380	Acute kidney injury	1	0	1
3403	Acute kidney injury due to circulatory failure	1	0	1
3426	Acute kidney injury due to rhabdomyolysis	1	1	0
3572	Haematuria and proteinuria - no histology	1	0	1
3636	Chronic urate nephropathy - no histology	1	1	0
3691	Renal failure	1	0	1
	ERA-EDTA diagnosis not reported	3	3	0
Total		548	444	104

Table 6 shows diagnoses according to the ERA-EDTA coding system for primary renal disease of patients who entered RRT in 2017. Altogether, 73 different codes were used. Type 1 and type 2 diabetes were the most frequent di-

agnoses. According to the ICD-10 code, 104 patients (19%) had an undefined diagnosis, and in 54 of these cases the ERA-EDTA code gave more specific information about the kidney disease.

Figure 7. Proportion of new RRT patients with biopsy-confirmed diagnosis
Finnish Registry for Kidney Diseases 2007–2017



*ICD-10 codes N10, N11, and N12

**ICD-10 codes I12, I13, I70.1 and N28.0

***For example, other systemic diseases, urinary tract obstruction, congenital diseases, and malignancies

****Patients with polycystic kidney degeneration were excluded

Figure 7 presents the proportion of patients who started RRT in 2007 and 2017 who had had a kidney biopsy as the basis for diagnosis of kidney disease. The proportion of patients with kidney biopsy was highest among those with glomerulonephritis, but it had decreased from 87% in 2007

to 78% in 2017. Biopsy had been used to diagnose about half of the cases with tubulointerstitial nephritis or amyloidosis. In all diagnostic groups, kidney biopsy had been used in 25% and 28% of new RRT patients in 2007 and 2017, respectively.

Table 7. Number of RRT patients at 90 days from start of RRT according to type of treatment in healthcare districts and regions
Finnish Registry for Kidney Diseases 2013–2017

Healthcare district		Number of patients (%) at 90 days from start of RRT in 2013–2017						Total
		Tx	CAPD	APD	Home HD	In-center HD	HDF	
1	Helsinki-Uusimaa	13 (2)	54 (8)	87 (13)	65 (10)	416 (64)	17 (3)	652 (100)
3	Varsinais-Suomi	2 (1)	75 (32)	36 (15)	1 (0)	108 (46)	13 (6)	235 (100)
4	Satakunta	0 (0)	34 (29)	12 (10)	1 (1)	69 (59)	1 (1)	117 (100)
5	Kanta-Häme	2 (2)	4 (4)	24 (22)	0 (0)	64 (59)	15 (14)	109 (100)
6	Pirkanmaa	6 (2)	36 (14)	34 (13)	2 (1)	182 (70)	0 (0)	260 (100)
7	Päijät-Häme	0 (0)	22 (22)	9 (9)	5 (5)	64 (63)	1 (1)	101 (100)
8	Kymenlaakso	0 (0)	2 (3)	22 (34)	3 (5)	36 (56)	1 (2)	64 (100)
9	Etelä-Karjala	2 (3)	4 (5)	10 (13)	0 (0)	45 (60)	14 (19)	75 (100)
10	Etelä-Savo	0 (0)	1 (2)	2 (4)	2 (4)	39 (80)	5 (10)	49 (100)
11	Itä-Savo	0 (0)	0 (0)	1 (4)	0 (0)	5 (19)	20 (77)	26 (100)
12	Pohjois-Karjala	0 (0)	11 (12)	17 (19)	2 (2)	46 (52)	13 (15)	89 (100)
13	Pohjois-Savo	1 (1)	3 (2)	27 (21)	23 (18)	70 (56)	2 (2)	126 (100)
14	Keski-Suomi	0 (0)	13 (12)	16 (15)	1 (1)	74 (70)	2 (2)	106 (100)
15	Etelä-Pohjanmaa	0 (0)	17 (18)	10 (10)	0 (0)	37 (39)	32 (33)	96 (100)
16	Vaasa	0 (0)	7 (8)	3 (4)	0 (0)	64 (76)	10 (12)	84 (100)
17	Keski-Pohjanmaa	1 (2)	2 (5)	2 (5)	0 (0)	23 (52)	16 (36)	44 (100)
18	Pohjois-Pohjanmaa	2 (1)	9 (6)	39 (24)	1 (1)	104 (64)	8 (5)	163 (100)
19	Kainuu	1 (2)	13 (27)	11 (22)	1 (2)	22 (45)	1 (2)	49 (100)
20	Länsi-Pohja	0 (0)	5 (14)	7 (19)	1 (3)	6 (17)	17 (47)	36 (100)
21	Lappi	1 (3)	12 (35)	5 (15)	0 (0)	15 (44)	1 (3)	34 (100)
22	Åland	0 (0)	0 (0)	0 (0)	0 (0)	8 (73)	3 (27)	11 (100)
Region South		15 (2)	60 (8)	119 (15)	68 (9)	497 (63)	32 (4)	791 (100)
Southwest		2 (0)	116 (26)	51 (11)	2 (0)	249 (56)	27 (6)	447 (100)
West		8 (1)	79 (14)	77 (14)	7 (1)	347 (61)	48 (8)	566 (100)
East		1 (0)	28 (7)	63 (16)	28 (7)	234 (59)	42 (11)	396 (100)
North		5 (2)	41 (13)	64 (20)	3 (1)	170 (52)	43 (13)	326 (100)
Entire country		31 (1)	324 (13)	374 (15)	108 (4)	1497 (59)	192 (8)	2526 (100)

Table 7 presents the number of RRT patients at 90 days from start of RRT in 2013–2017 according to type of treatment in healthcare districts and regions. Of the 2526 patients aged 20 years or older, only 31 (1.2%) had received a kidney graft (Tx), 28% were on continuous ambulatory or automated peritoneal dialysis (CAPD or APD), 4% were on home hemodialysis (home HD), and 67% were on either in-center hemodialysis (in-center HD) or hemodiafiltration (HDF).

Figure 8. International comparison of incidence of RRT in 2016
Finnish Registry for Kidney Diseases 2016

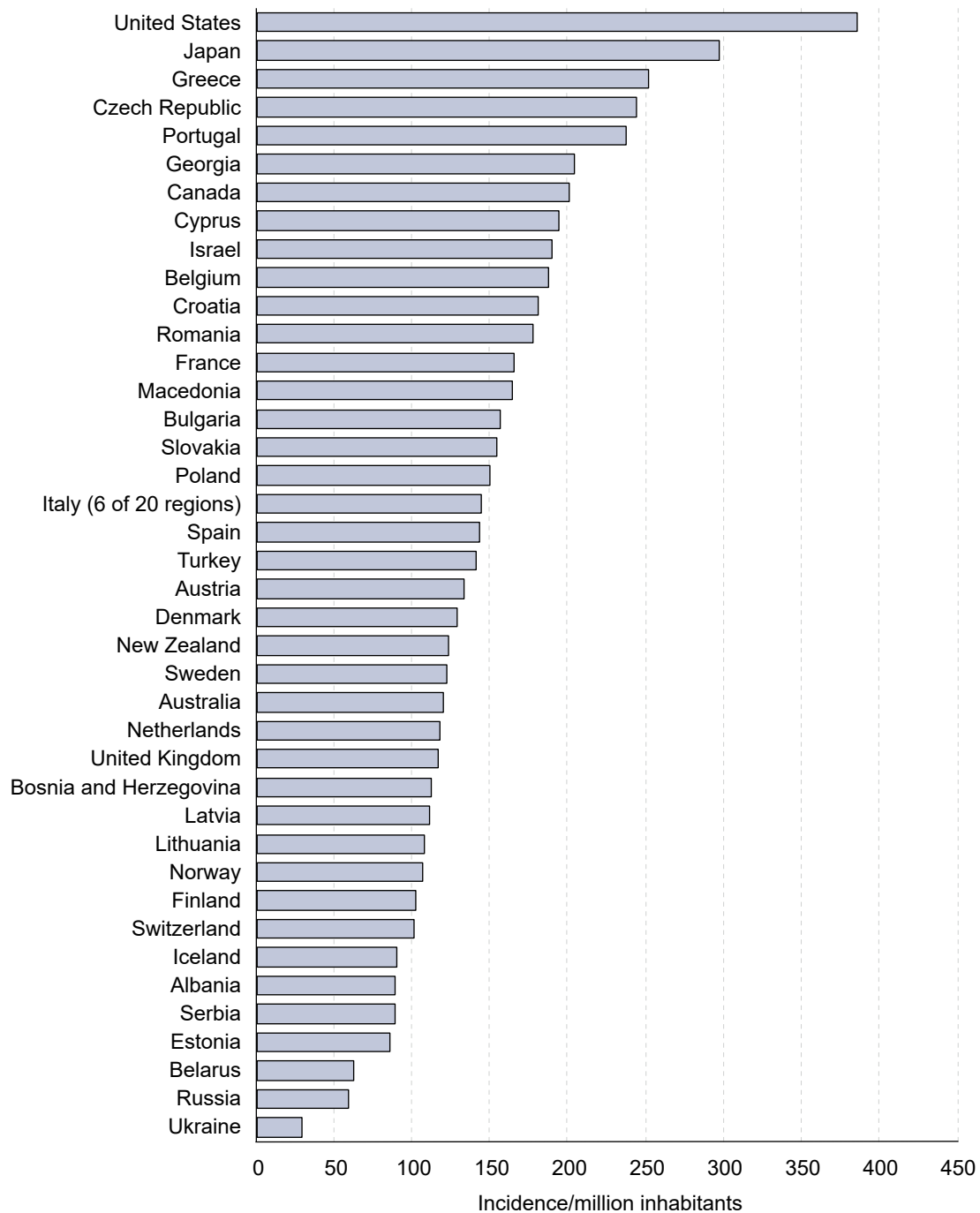


Figure 8 shows the incidence of RRT in 2016 in countries reporting to the ERA-EDTA Registry (Annual Report 2016, <http://www.era-edta-reg.org>) and in the United States, Canada, Australia, New Zealand, and Japan (The 2018 USRDS Annual Data Report Atlas, <http://www.usrds.org>). In 2016, the incidence of RRT in Finland was the second lowest among the Nordic countries. Relative to Finland, the incidence in Norway was 4% higher, in Sweden 18% higher, in Denmark 25% higher, and in Iceland 13% lower. In Greece, the incidence was 2.5-fold and in the United States 4-fold that in Finland.

Table 8. Patients on RRT at end of year according to healthcare district and region
Finnish Registry for Kidney Diseases 2007–2017

Healthcare district		Number of RRT patients					Prevalence of RRT/million inhabitants				
		2007	2012	2015	2016	2017	2007	2012	2015	2016	2017
1	Helsinki-Uusimaa	1035	1193	1300	1335	1368	699	763	804	817	828
3	Varsinais-Suomi	366	411	427	442	455	791	871	894	924	947
4	Satakunta	221	227	219	237	247	973	1009	982	1069	1121
5	Kanta-Häme	115	145	160	170	175	671	826	916	978	1013
6	Pirkanmaa	407	444	474	488	506	813	857	900	921	951
7	Päijät-Häme	164	175	183	194	203	776	820	861	913	958
8	Kymenlaakso	133	141	141	139	132	754	808	821	814	782
9	Etelä-Karjala	134	150	150	164	166	1001	1133	1144	1257	1278
10	Etelä-Savo	81	87	101	99	95	752	830	978	966	936
11	Itä-Savo	42	50	51	51	54	898	1114	1174	1186	1279
12	Pohjois-Karjala	136	132	145	150	159	796	779	861	895	955
13	Pohjois-Savo	221	245	263	273	268	888	987	1060	1102	1087
14	Keski-Suomi	141	169	183	197	206	576	675	726	780	815
15	Etelä-Pohjanmaa	113	138	132	138	158	568	694	669	702	808
16	Vaasa	102	119	142	151	155	625	708	834	888	913
17	Keski-Pohjanmaa	51	60	69	71	74	657	767	878	904	947
18	Pohjois-Pohjanmaa	265	286	308	323	337	685	713	756	791	824
19	Kainuu	73	60	70	75	72	910	775	929	1003	974
20	Länsi-Pohja	58	54	54	55	54	881	835	856	880	874
21	Lappi	77	82	79	84	77	649	694	671	714	656
22	Åland	16	30	25	27	27	589	1053	863	924	916
Region											
	South	1302	1484	1591	1638	1666	727	794	829	846	854
	Southwest	705	787	813	857	884	801	881	904	953	982
	West	799	902	949	990	1042	738	815	854	890	937
	East	621	683	743	770	782	758	835	912	947	966
	North	524	542	580	608	614	719	733	782	820	829
Entire country		3951	4398	4676	4863	4988	745	810	852	884	905

Table 8 presents the number of RRT patients and the prevalence of RRT on 31 December 2007–2017. In the entire country, the prevalence at the end of 2017 was 905 RRT patients per million inhabitants. On 31 December 2017, the prevalence was the highest in the southwestern and eastern regions and the lowest in the northern region. In the healthcare districts, the prevalence varied between 656 and 1279 patients per million inhabitants.

In the entire country, the prevalence has increased by 21% since 2007 and by 12% since 2012. Since 2012, the prevalence has increased in all regions, the least in the southern region (8%) and the most in the eastern region (16%). In the healthcare districts, the prevalence has increased the most during the past five years in Vaasa (29%). In three healthcare districts (Kymenlaakso, Lappi, and Åland), the prevalence has decreased.

Table 9. Patients on RRT according to age group and sex
Finnish Registry for Kidney Diseases 2007–2017

Age group		Number of RRT patients					Prevalence of RRT/million inhabitants				
		2007	2012	2015	2016	2017	2007	2012	2015	2016	2017
0–19 y	Men	77	65	70	71	72	123	105	114	116	119
	Women	58	52	52	51	54	97	88	89	88	93
	Total	135	117	122	122	126	110	97	102	102	106
20–44 y	Men	443	413	448	466	480	515	479	513	530	543
	Women	285	245	244	260	274	346	299	294	313	328
	Total	728	658	692	726	754	432	391	406	424	439
45–64 y	Men	1162	1225	1244	1253	1240	1539	1626	1706	1736	1740
	Women	702	721	737	756	766	923	949	1002	1039	1068
	Total	1864	1946	1981	2009	2006	1230	1286	1353	1386	1403
65–74 y	Men	443	693	803	829	877	2084	2610	2638	2687	2727
	Women	283	373	433	441	475	1132	1244	1281	1291	1335
	Total	726	1066	1236	1270	1352	1569	1886	1924	1953	1996
≥75 y	Men	300	387	425	475	477	2099	2328	2332	2472	2457
	Women	198	224	220	261	273	734	781	737	848	887
	Total	498	611	645	736	750	1207	1349	1342	1472	1495
Total	Men	2425	2783	2990	3094	3146	934	1044	1107	1141	1157
	Women	1526	1615	1686	1769	1842	564	585	605	634	659
	Total	3951	4398	4676	4863	4988	745	810	852	884	905

Figure 9. Standardized prevalence of RRT in regions
Finnish Registry for Kidney Diseases 2007–2017

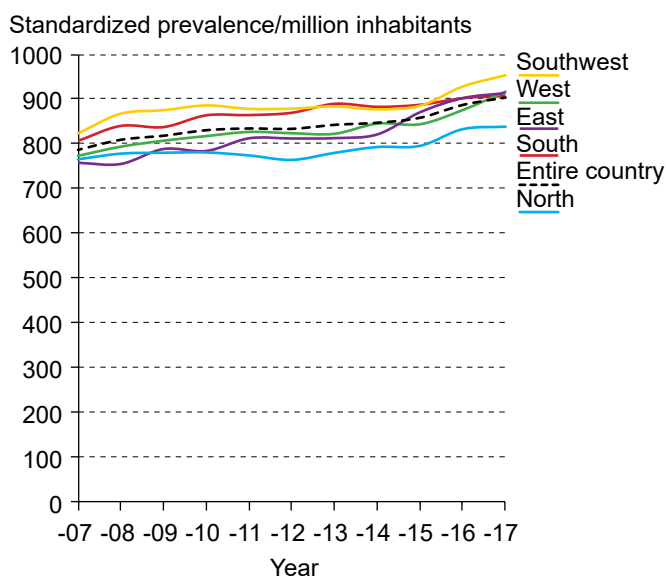


Table 9 shows the number of RRT patients and the prevalence of RRT on 31 December 2007–2017 according to age group and sex. The prevalence of RRT has increased by 21% since 2007. The prevalence has increased by 24% in the age group 75 years and older, by 27% in 65–74-year-olds, and by 14% in 45–64-year-olds. In the younger age groups, the prevalence of RRT has been stable during the past ten years. The highest prevalence, observed among men aged 65–74 years at the end of 2017, was 2727 cases per million age-related inhabitants. At the end of 2017, 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 almost threefold in men than in women.

Figure 9 shows the age- and sex-standardized prevalence rates for 2007–2017 using the Finnish general population on 31 December 2017 as the reference. The standardized prevalence rates have increased slowly in recent years, and the differences between regions are small.

Figure 10. Number of patients on RRT according to age group and sex
Finnish Registry for Kidney Diseases 2017

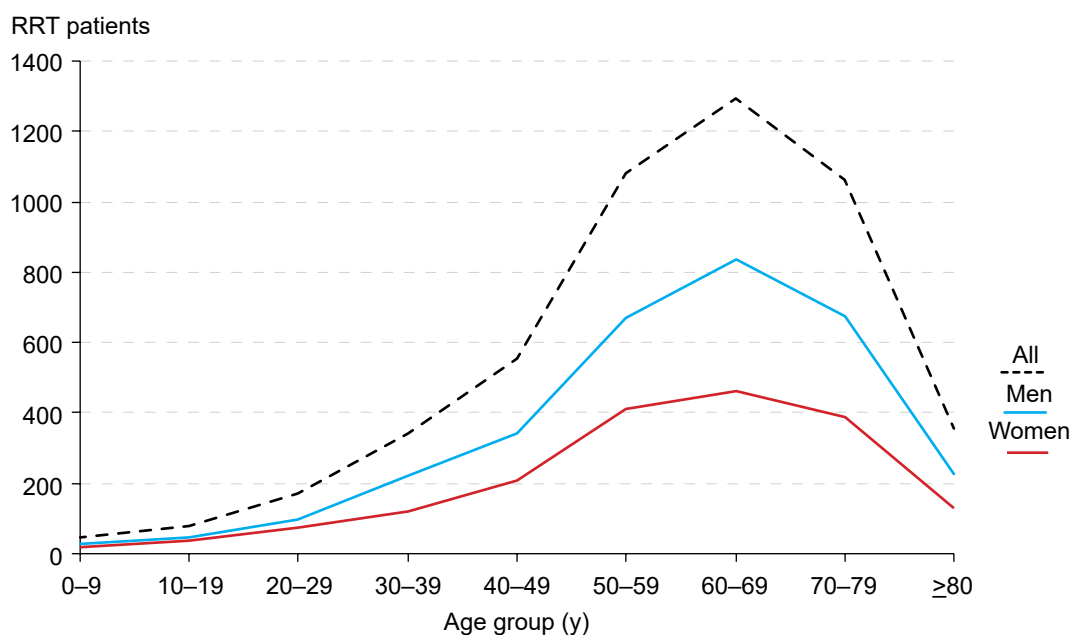


Figure 11. Prevalence of RRT according to age group and sex
Finnish Registry for Kidney Diseases 2017

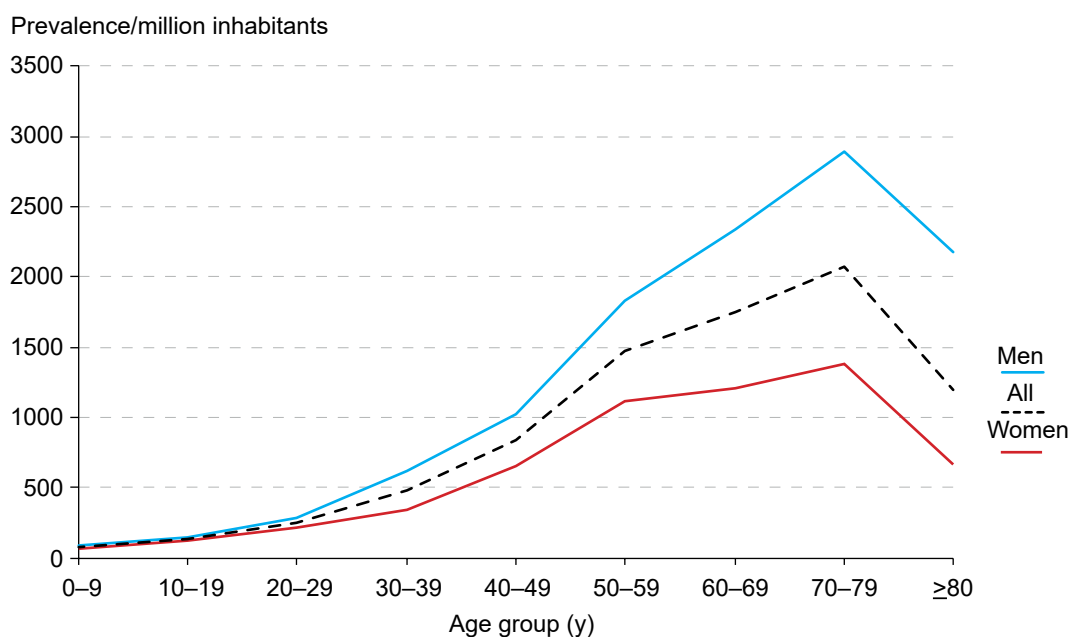


Figure 10 shows the number of RRT patients in 2017 according to age group and sex. The number of RRT patients is highest in 60–69-year-olds in both sexes. The numbers of men are more than 1.5 times the numbers of women in all age groups over 30 years.

In Figure 11, the prevalence of RRT in 2017 is shown

per million inhabitants according to age group and sex. The peak prevalence in both sexes is in the age group 70–79 years. Compared with women, in men the prevalence increases faster with age, being more than threefold in men older than 80 years.

Figure 12. Prevalence of RRT on 31 December 2017
Finnish Registry for Kidney Diseases 2017



The healthcare districts shown on the map are grouped according to the prevalence of RRT at the end of 2017 (Figure 12). The prevalence per million inhabitants was <850 in six districts, 850–950 in six districts, and >950 in nine districts. The borders of the regions are indicated with thick lines.

Figure 13. Prevalence of RRT at end of year according to type of treatment
Finnish Registry for Kidney Diseases 1965–2017

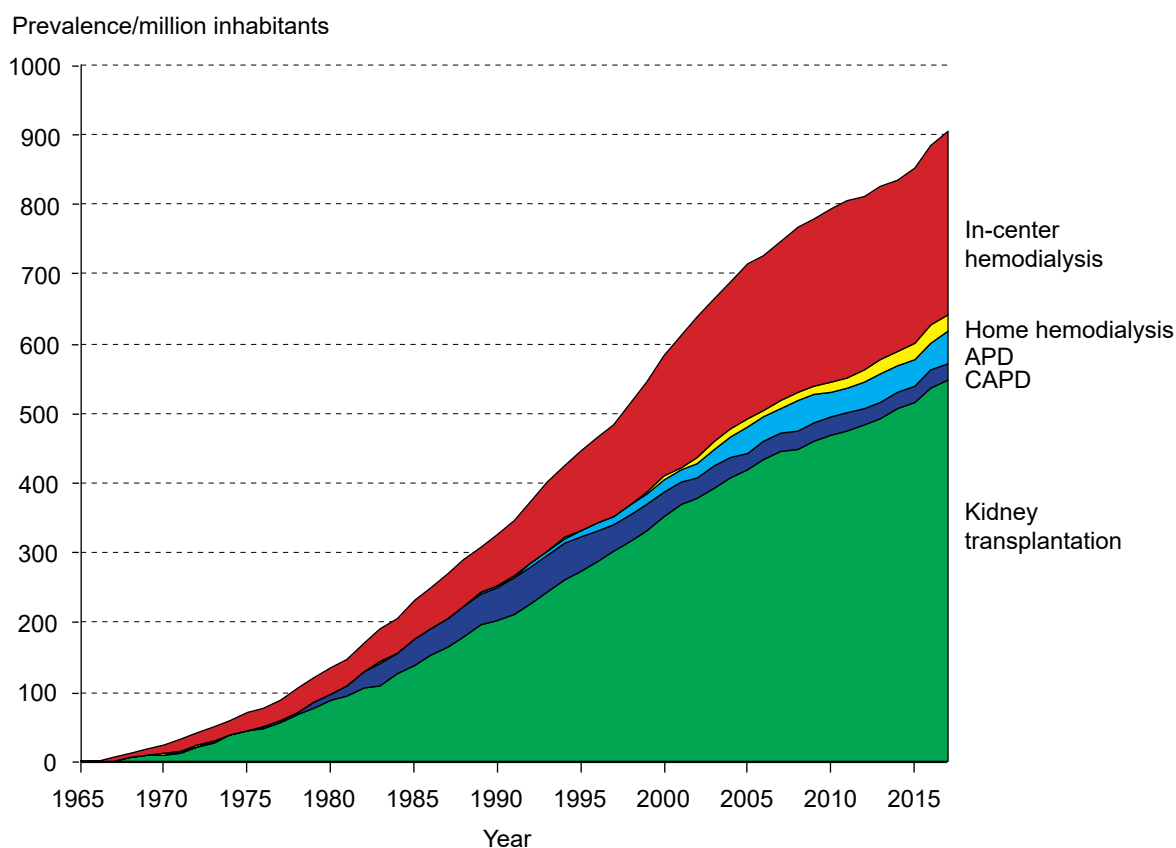


Figure 13 displays the prevalence of RRT according to treatment type. The prevalence of kidney transplantation has grown steadily, increasing by 23% during 2007–2017. The number of in-center hemodialysis patients decreased during 2012–2014, but increased by 5% in 2015–2017. The number of patients on peritoneal dialysis has remained virtually unchanged for decades, ranging from 253 in 2002 to

386 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 60%. The number of home hemodialysis patients has increased twofold from 2010 to 2017, with 139 patients on home hemodialysis at the end of 2017.

Table 10. Prevalence of dialysis and kidney transplantation in healthcare districts and regions
Finnish Registry for Kidney Diseases 2007–2017

Healthcare district		Number of dialysis patients/ million inhabitants					Number of kidney transplantation patients/ million inhabitants				
		2007	2012	2015	2016	2017	2007	2012	2015	2016	2017
1	Helsinki-Uusimaa	257	281	300	310	321	442	482	504	507	507
3	Varsinais-Suomi	316	356	375	389	404	476	515	520	535	543
4	Satakunta	414	387	368	424	436	559	622	614	645	685
5	Kanta-Häme	367	399	418	455	446	303	427	498	524	567
6	Pirkanmaa	360	353	362	353	355	453	504	537	568	596
7	Päijät-Häme	312	318	348	358	392	464	501	513	555	566
8	Kymenlaakso	346	424	425	381	338	408	384	396	433	445
9	Etelä-Karjala	441	491	435	513	524	560	642	709	743	755
10	Etelä-Savo	251	324	387	361	335	501	506	591	605	601
11	Itä-Savo	427	423	460	442	521	470	691	713	744	758
12	Pohjois-Karjala	328	283	398	394	409	468	496	463	501	547
13	Pohjois-Savo	301	403	363	351	316	587	584	697	751	770
14	Keski-Suomi	229	304	278	301	332	348	371	449	479	482
15	Etelä-Pohjanmaa	216	347	329	371	435	352	347	339	331	373
16	Vaasa	270	268	311	364	407	355	440	523	523	507
17	Keski-Pohjanmaa	283	345	369	382	371	373	422	509	522	576
18	Pohjois-Pohjanmaa	279	264	282	306	342	406	449	474	485	482
19	Kainuu	449	245	266	307	257	461	529	664	695	717
20	Länsi-Pohja	410	418	444	416	421	471	418	412	464	453
21	Lappi	211	279	229	212	145	439	415	441	501	511
22	Åland	184	526	276	308	237	405	526	587	616	678
Region	South	280	309	320	330	336	448	485	509	516	518
	Southwest	328	352	358	390	407	473	528	546	562	575
	West	325	353	363	373	390	413	463	491	517	547
	East	286	339	352	350	353	473	496	559	596	613
	North	299	287	295	309	312	420	446	487	511	517
Entire country		301	327	336	349	358	445	484	516	535	547

Table 10 presents the prevalence of dialysis and kidney transplantation per million inhabitants in healthcare districts and regions in 2007–2017. The prevalence of dialysis has increased by 19% and that of kidney transplantation by 23% during the past ten years. During the past five years the prevalence of dialysis has increased by 10%. At the end of 2017, the prevalence of dialysis varied in healthcare districts between 145 and 524 per million inhabitants and that of kidney transplantation between 373 and 770 per million inhabitants. In regions, the prevalence of dialysis varied between 312 and 407 per million inhabitants and that of kidney transplantation between 517 and 613 per million inhabitants.

Table 11. Number of RRT patients at end of year according to type of treatment in healthcare districts and regions
Finnish Registry for Kidney Diseases 2017

Healthcare district		Number of patients on 31 December 2017 (%)						
		CAPD	APD	Home HD	In-center HD	HDF	Tx	Total
1	Helsinki-Uusimaa	31 (2)	63 (5)	67 (5)	274 (20)	96 (7)	837 (61)	1368 (100)
3	Varsinais-Suomi	28 (6)	43 (9)	5 (1)	47 (10)	71 (16)	261 (57)	455 (100)
4	Satakunta	16 (6)	10 (4)	4 (2)	56 (23)	10 (4)	151 (61)	247 (100)
5	Kanta-Häme	3 (2)	11 (6)	1 (1)	32 (18)	30 (17)	98 (56)	175 (100)
6	Pirkanmaa	14 (3)	14 (3)	7 (1)	124 (25)	30 (6)	317 (63)	506 (100)
7	Päijät-Häme	10 (5)	10 (5)	11 (5)	42 (21)	10 (5)	120 (59)	203 (100)
8	Kymenlaakso	2 (2)	10 (8)	6 (5)	31 (23)	8 (6)	75 (57)	132 (100)
9	Etelä-Karjala	0 (0)	7 (4)	5 (3)	15 (9)	41 (25)	98 (59)	166 (100)
10	Etelä-Savo	1 (1)	3 (3)	0 (0)	13 (14)	17 (18)	61 (64)	95 (100)
11	Itä-Savo	0 (0)	0 (0)	0 (0)	0 (0)	22 (41)	32 (59)	54 (100)
12	Pohjois-Karjala	9 (6)	7 (4)	5 (3)	20 (13)	27 (17)	91 (57)	159 (100)
13	Pohjois-Savo	1 (0)	12 (4)	15 (6)	34 (13)	16 (6)	190 (71)	268 (100)
14	Keski-Suomi	5 (2)	10 (5)	6 (3)	41 (20)	22 (11)	122 (59)	206 (100)
15	Etelä-Pohjanmaa	4 (3)	11 (7)	0 (0)	9 (6)	61 (39)	73 (46)	158 (100)
16	Vaasa	4 (3)	1 (1)	4 (3)	20 (13)	40 (26)	86 (55)	155 (100)
17	Keski-Pohjanmaa	0 (0)	2 (3)	0 (0)	4 (5)	23 (31)	45 (61)	74 (100)
18	Pohjois-Pohjanmaa	2 (1)	25 (7)	1 (0)	56 (17)	56 (17)	197 (58)	337 (100)
19	Kainuu	3 (4)	3 (4)	1 (1)	5 (7)	7 (10)	53 (74)	72 (100)
20	Länsi-Pohja	0 (0)	3 (6)	1 (2)	1 (2)	21 (39)	28 (52)	54 (100)
21	Lappi	3 (4)	5 (6)	0 (0)	3 (4)	6 (8)	60 (78)	77 (100)
22	Åland	0 (0)	0 (0)	0 (0)	1 (4)	6 (22)	20 (74)	27 (100)
Region South		33 (2)	80 (5)	78 (5)	320 (19)	145 (9)	1010 (61)	1666 (100)
Southwest		48 (5)	54 (6)	13 (1)	124 (14)	127 (14)	518 (59)	884 (100)
West		31 (3)	46 (4)	19 (2)	207 (20)	131 (13)	608 (58)	1042 (100)
East		16 (2)	32 (4)	26 (3)	108 (14)	104 (13)	496 (63)	782 (100)
North		8 (1)	38 (6)	3 (0)	69 (11)	113 (18)	383 (62)	614 (100)
Entire country		136 (3)	250 (5)	139 (3)	828 (17)	620 (12)	3015 (60)	4988 (100)

Table 11 presents the number of RRT patients according to type of treatment in healthcare districts and regions at the end of 2017. The proportion of peritoneal dialysis patients was the greatest in the healthcare district of Varsinais-Suomi, 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, 6%, in the healthcare district of Pohjois-Savo. In six healthcare districts, there were no home HD patients.

The proportion of kidney transplantation patients varied

between 46% and 78% in the healthcare districts ($p < 0.001$ in age- and gender-adjusted analysis using binary logistic regression). The difference between regions was not significant ($p = 0.20$).

Of all RRT patients, 27% were on home dialysis (CAPD, APD, or home HD) at the end of 2017. The proportion of home dialysis was highest (47%) in the healthcare district of Lappi and higher than 35% also in four other healthcare districts (Kainuu, Pohjois-Savo, Päijät-Häme, and Varsinais-Suomi) and lower than 15% in five healthcare districts.

Figure 14. International comparison of prevalence of RRT on 31 December 2016
Finnish Registry for Kidney Diseases 2016

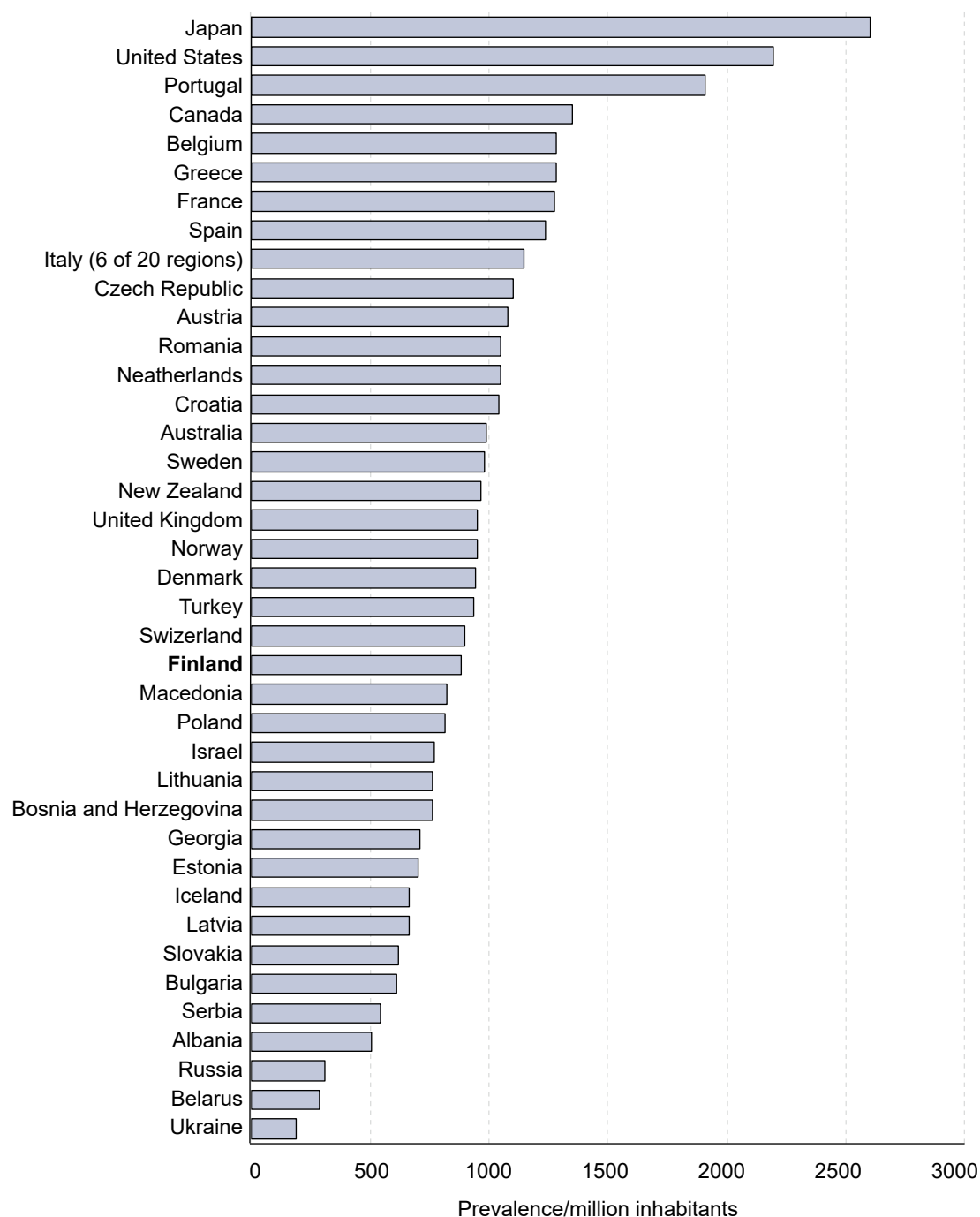


Figure 14 displays the prevalence of RRT on 31 December 2016 in countries reporting to the ERA-EDTA Registry (Annual Report 2016, <http://www.era-edta-reg.org>) and in the United States, Canada, Australia, New Zealand, and Japan (The 2018 USRDS Annual Data Report Atlas, <http://www.usrds.org>). The prevalence rate in Finland was the second lowest of the Nordic countries. Relative to Finland, the prevalence in Denmark was 6% higher, in Norway 7% higher, and in Sweden 11% higher, and in Portugal, the United States, and Japan the prevalence was more than twofold. Figure 8 shows the international incidence rates.

Table 12. Number of patient-years of all RRT patients according to diagnosis and type of treatment
Finnish Registry for Kidney Diseases 2007–2017

Diagnosis	Number of patient-years in 2007 (%)				Number of patient-years in 2017 (%)			
	Peritoneal dialysis	Hemo-dialysis	Trans-plantation	Total	Peritoneal dialysis	Hemo-dialysis	Trans-plantation	Total
Glomerulonephritis	48 (15.3)	196 (15.7)	643 (27.7)	886 (22.8)	71 (18.8)	235 (14.7)	773 (25.9)	1079 (21.8)
Type 1 diabetes	82 (26.3)	137 (10.9)	447 (19.2)	665 (17.1)	88 (23.5)	217 (13.6)	494 (16.6)	799 (16.1)
Polycystic degeneration	12 (3.9)	108 (8.6)	373 (16.1)	493 (12.7)	33 (8.8)	154 (9.7)	551 (18.5)	738 (14.9)
Undefined kidney disease	38 (12.3)	190 (15.2)	90 (3.9)	318 (8.2)	43 (11.4)	232 (14.5)	183 (6.2)	458 (9.2)
Type 2 diabetes	50 (16.0)	252 (20.2)	54 (2.3)	357 (9.2)	42 (11.2)	298 (18.7)	111 (3.7)	451 (9.1)
Tubulointerstitial nephritis	15 (4.8)	56 (4.5)	198 (8.5)	269 (6.9)	13 (3.3)	54 (3.4)	173 (5.8)	240 (4.8)
Nephrosclerosis	19 (6.2)	71 (5.7)	53 (2.3)	144 (3.7)	25 (6.7)	109 (6.8)	88 (3.0)	223 (4.5)
Other systemic diseases	15 (4.9)	59 (4.7)	74 (3.2)	149 (3.8)	17 (4.4)	72 (4.5)	114 (3.8)	202 (4.1)
Urinary tract obstruction	5 (1.6)	35 (2.8)	95 (4.1)	135 (3.5)	16 (4.4)	52 (3.3)	125 (4.2)	194 (3.9)
Other kidney diseases	5 (1.7)	38 (3.0)	58 (2.5)	102 (2.6)	9 (2.4)	84 (5.3)	84 (2.8)	178 (3.6)
Congenital diseases	4 (1.2)	15 (1.2)	99 (4.2)	118 (3.0)	9 (2.3)	19 (1.2)	126 (4.2)	153 (3.1)
Congenital nephrosis, Finnish type	5 (1.6)	3 (0.3)	61 (2.6)	69 (1.8)	5 (1.4)	5 (0.3)	91 (3.1)	102 (2.1)
Amyloidosis	2 (0.5)	46 (3.7)	39 (1.7)	87 (2.2)	3 (0.7)	21 (1.3)	29 (1.0)	53 (1.1)
Malignancies	5 (1.5)	28 (2.2)	7 (0.3)	39 (1.0)	3 (0.7)	30 (1.9)	12 (0.4)	44 (0.9)
Pyelonephritis	5 (1.5)	9 (0.7)	20 (0.9)	33 (0.9)	0 (0.0)	7 (0.4)	14 (0.5)	20 (0.4)
Metabolic diseases	2 (0.7)	5 (0.4)	12 (0.5)	19 (0.5)	0 (0.0)	5 (0.3)	12 (0.4)	17 (0.3)
Total	312 (100)	1249 (100)	2322 (100)	3883 (100)	376 (100)	1595 (100)	2980 (100)	4951 (100)

Table 12 presents the number of patient-years according to diagnosis of kidney disease and type of treatment in 2007 and 2017. The number of patient-years indicates time spent by patients in RRT during the year. Overall, the number of patient-years has increased by 28% since 2007. The number of patient-years has increased by 28% in hemodialysis, by 20% in peritoneal dialysis, and by 28% 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 glomerulonephritis was 22% in 2017. 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 patients with polycystic degeneration has increased by 50% during the last ten years. Polycystic degeneration is the second most common diagnosis of kidney transplantation patients. Type 2 diabetes is the fourth most common kidney disease diagnosis of all RRT patients and the most common kidney disease diagnosis of hemodialysis patients. The proportion of undefined kidney disease has increased 44% during the past decade, reaching 9.2% in 2017.

Figure 15. Prevalence of peritoneal dialysis according to diagnosis
Finnish Registry for Kidney Diseases 1965–2017

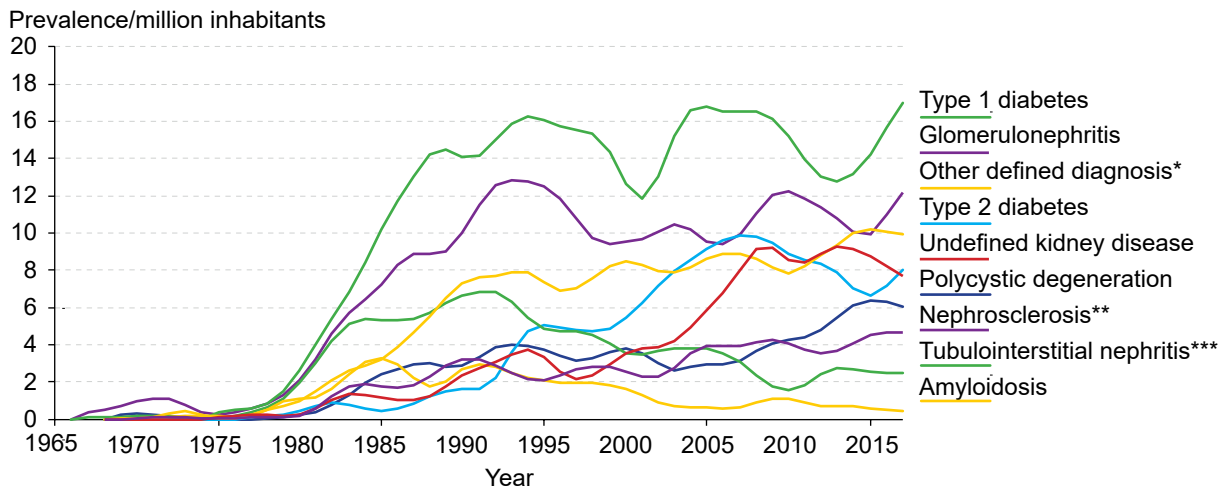


Figure 16. Prevalence of hemodialysis according to diagnosis
Finnish Registry for Kidney Diseases 1965–2017

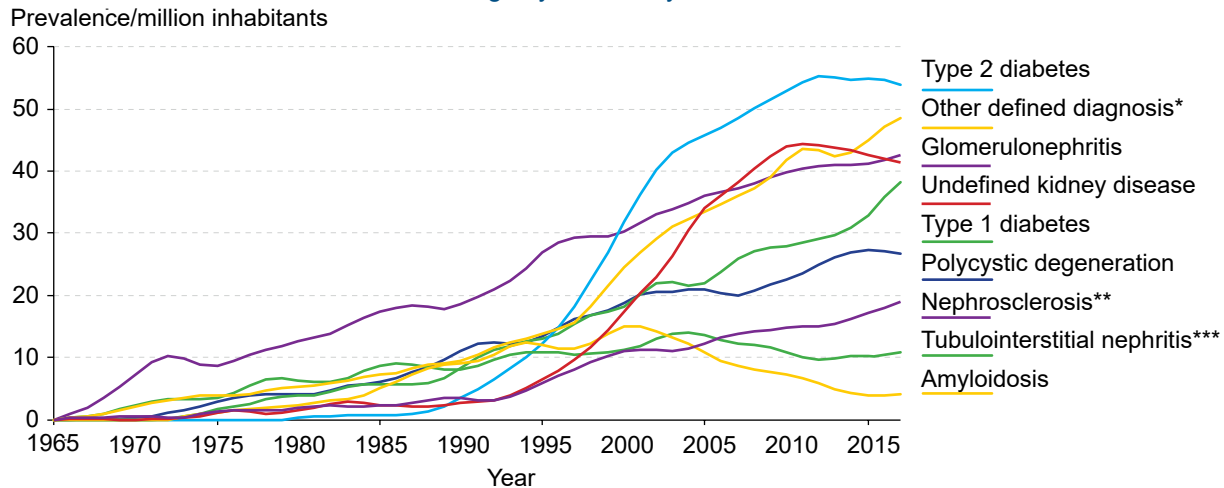
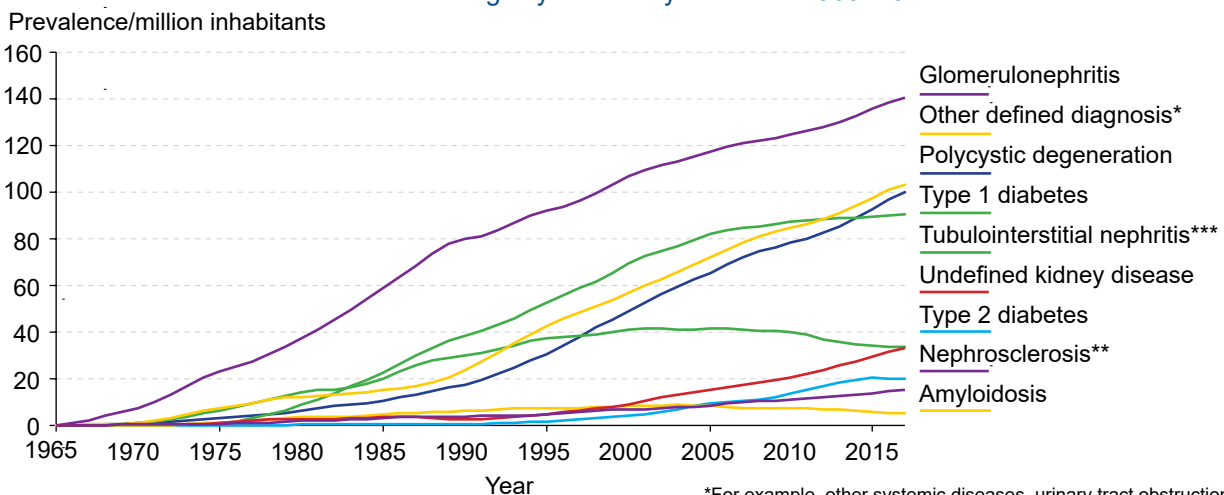


Figure 17. Prevalence of kidney transplantation according to diagnosis
Finnish Registry for Kidney Diseases 1965–2017



*For example, other systemic diseases, urinary tract obstruction, congenital diseases, and malignancies

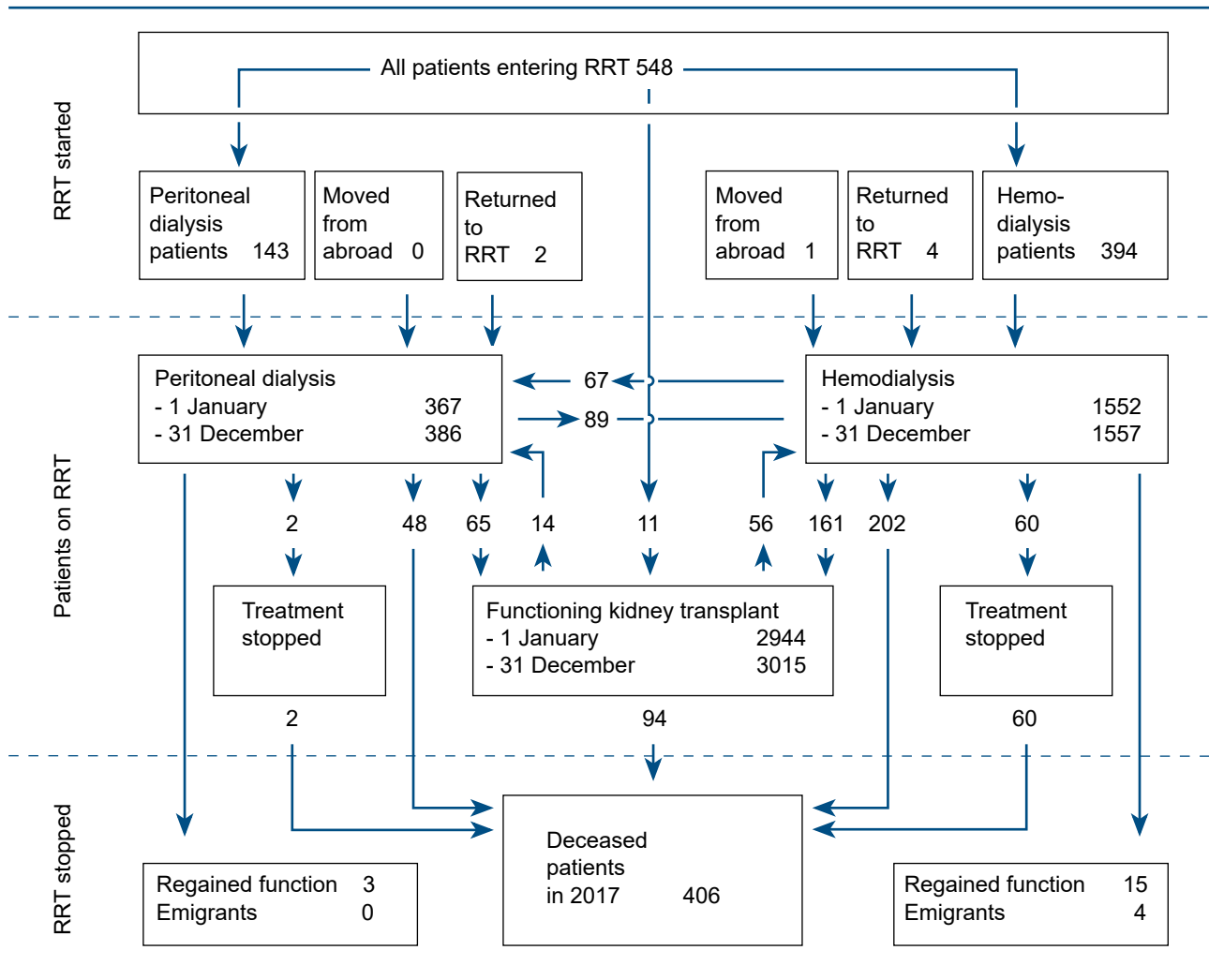
**ICD-10 codes I12, I13, I70.1, and N28.0

***ICD-10 codes N10, N11, and N12

Figures 15 to 17 show the prevalence of treatment modalities as smoothed averages according to diagnosis group between 1965 and 2017. In patients with peritoneal dialysis, type 1 diabetes has consistently been the most significant

cause of end-stage renal disease, whereas in hemodialysis patients the most common diagnosis is type 2 diabetes and in kidney transplantation patients glomerulonephritis.

Figure 18. Net changes in type of treatment
Finnish Registry for Kidney Diseases 2017



During 2017 altogether 548 new patients entered RRT (Figure 18), six patients returned to RRT, and one moved from abroad. In all, 4863 patients were receiving RRT at the beginning of the year. Altogether 406 patients died and dialysis was discontinued for 18 patients because the patient's own kidney function resumed. Of those who died, 94 had a functioning kidney transplant, 48 were receiving peritoneal dialysis, and 202 were on hemodialysis. During 2017 RRT was discontinued for 62 uremic patients. At the end of 2017, the number of peritoneal dialysis patients was 5% larger

and the number of kidney transplantation patients 2% larger than at the beginning of the year. The number of hemodialysis patients did not change markedly.

A total of 239 patients received a kidney transplant. Of these patients, 21 received a combined pancreas and kidney transplantation, and two a combined liver and kidney transplantation (source: Kidney Transplantation Unit, Helsinki University Central Hospital). Twenty-nine kidney transplants were received from living donors.

Table 13. Mortality of RRT patients by region
Finnish Registry for Kidney Diseases 2007–2017

Region	Deaths/1000 patient-years						Deaths/1000 patient-years ¹⁾					
	2007	2012	2015	2016	2017	2013–2017	2007	2012	2015	2016	2017	2013–2017
South	92	78	78	75	81	76	88	76	76	73	79	75
Southwest	77	91	92	73	93	87	77	91	90	73	92	86
West	96	91	101	86	74	90	89	91	98	83	72	87
East	92	103	74	79	84	81	92	101	72	77	83	78
North	118	100	105	70	81	87	118	96	98	68	81	84
Entire country	94	90	88	77	82	83	91	88	85	75	81	81

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

Figure 19. Standardized mortality of RRT patients by region
Finnish Registry for Kidney Diseases 2007–2017

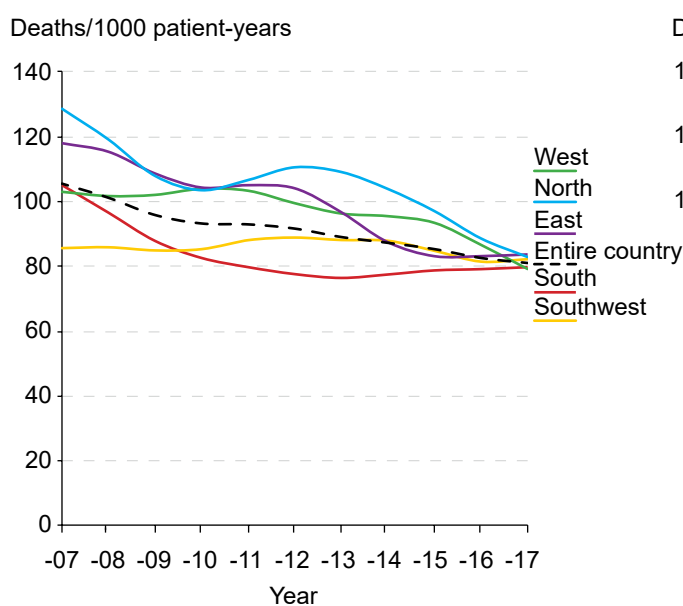


Figure 20. Standardized mortality of RRT patients by region (patients who died within 90 days of start of RRT excluded)
Finnish Registry for Kidney Diseases 2007–2017

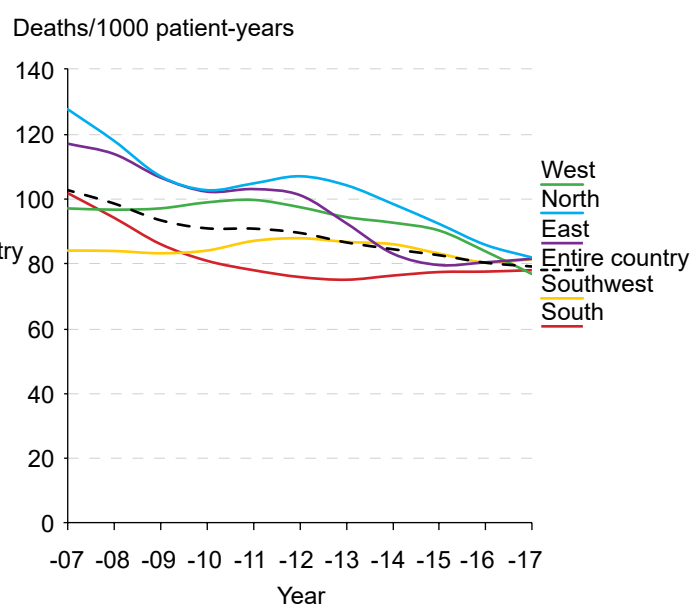


Table 13 shows RRT patients' mortality in 2007–2017 according to region. The mortality of patients who had been on RRT for at least 90 days is presented separately. The average mortality in 2013–2017 was lower in the southern region than elsewhere.

Figures 19 and 20 show regional mortality as smoothed averages. The regional mortality rates for 2007–2017 have

been age- and sex-standardized using all patient-years in 2017 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 20. During 2007–2017 the standardized mortality rate has declined in all regions and the differences between regions have become markedly smaller.

Table 14. Number of RRT patients older than 20 years in hospitals
Finnish Registry for Kidney Diseases 2017

Region	Healthcare district	Hospital	No. of RRT patients (≥20 y) on 31/12/2017			
			PD	HD	Tx	Total
South (R1)						
	Helsinki-Uusimaa (1)		112	513	947	1572
		Helsinki University Central Hospital	93	434	810	1337
		Nephrology Polyclinic			699	699
		Dialysis unit DHK		79		79
		Dialysis unit DOK	93	100		193
		B. Braun Malmi		69		69
		B. Braun Pitäjänmäki		69		69
		Unit of Transplantation and Liver Surgery			3	3
		Hyvinkää Hospital		41	32	73
		Lohja Hospital		27	33	60
		Länsi-Uusimaa Hospital		22	20	42
		Porvoo Hospital		27	23	50
	Kymenlaakso (8)		12	46	68	126
		Kymenlaakso Central Hospital	12	46	68	126
	Etelä-Karjala (9)		7	60	92	159
		South Karelia Central Hospital	7	44	92	143
		Honkajarju Hospital		16		16
Southwest (R2)						
	Varsinais-Suomi (3)		103	264	493	860
		Turku University Central Hospital	69	123	254	446
	Satakunta (4)		27	69	146	242
		Satakunta Central Hospital	27	69	146	242
	Vaasa (16)		7	65	73	145
		Vaasa Central Hospital	7	48	72	127
		Pietarsaari Hospital		17	1	18
	Åland (22)			7	20	27
		Åland Central Hospital		7	20	27
West (R3)						
	Kanta-Häme (5)		73	355	574	1002
		Central Hospital of Tavastia	14	67	95	176
	Pirkanmaa (6)		14	67	95	176
		Tampere University Hospital	26	156	293	475
		Valkeakoski Regional Hospital	26	137	292	455
				19	1	20
	Päijät-Häme (7)		20	63	121	204
		Päijänne Tavastia Central Hospital	20	63	121	204
	Etelä-Pohjanmaa (15)		13	69	65	147
		Southern Ostrobothnia Central Hospital	13	69	65	147
East (R4)						
	Etelä-Savo (10)		49	239	492	780
		Mikkeli Central Hospital	4	30	55	89
	Itä-Savo (11)		4	30	55	89
		Central Hospital of Savonlinna	1	23	36	60
	Pohjois-Karjala (12)		15	52	87	154
		North Karelia Central Hospital	15	52	87	154
	Pohjois-Savo (13)		13	66	187	266
		Kuopio University Hospital	13	42	166	221
		Regional Hospital of Iisalmi		13	14	27
		Regional Hospital of Varkaus		11	7	18
	Keski-Suomi (14)		16	68	127	211
		Central Finland Central Hospital	16	68	127	211
North (R5)						
	Keski-Pohjanmaa (17)		45	184	369	598
		Central Hospital of Keski-Pohjanmaa	3	27	47	77
	Pohjois-Pohjanmaa (18)		3	27	47	77
		Oulu University Hospital	25	111	185	321
	Kainuu (19)		25	111	185	321
		Kainuu Central Hospital	6	14	52	72
	Länsi-Pohja (20)		6	14	52	72
		Central Hospital of Länsi-Pohja	3	22	27	52
	Lappi (21)		8	10	58	76
		Lapland Central Hospital	8	10	58	76
Entire country			382	1582	2898	4862

At the end of 2017, dialysis and kidney transplantation patients were treated and followed up in 30 hospitals of 21 healthcare districts in five regions (Table 14). 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 33–45, healthcare district of the patient is determined according to treating unit. In the entire country, 98% of patients lived in the same healthcare district in which they were treated.

Figure 21. Hemoglobin distribution of dialysis patients older than 20 years at end of year
Finnish Registry for Kidney Diseases 2007–2017

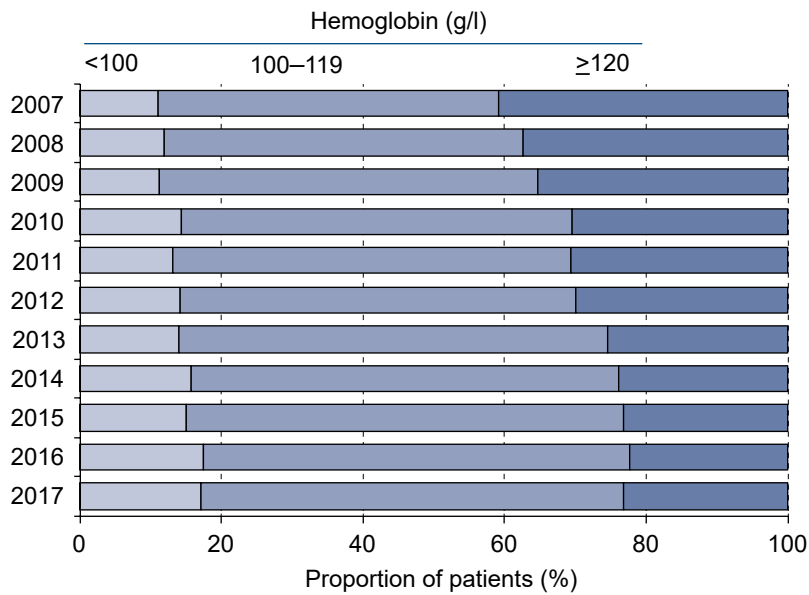
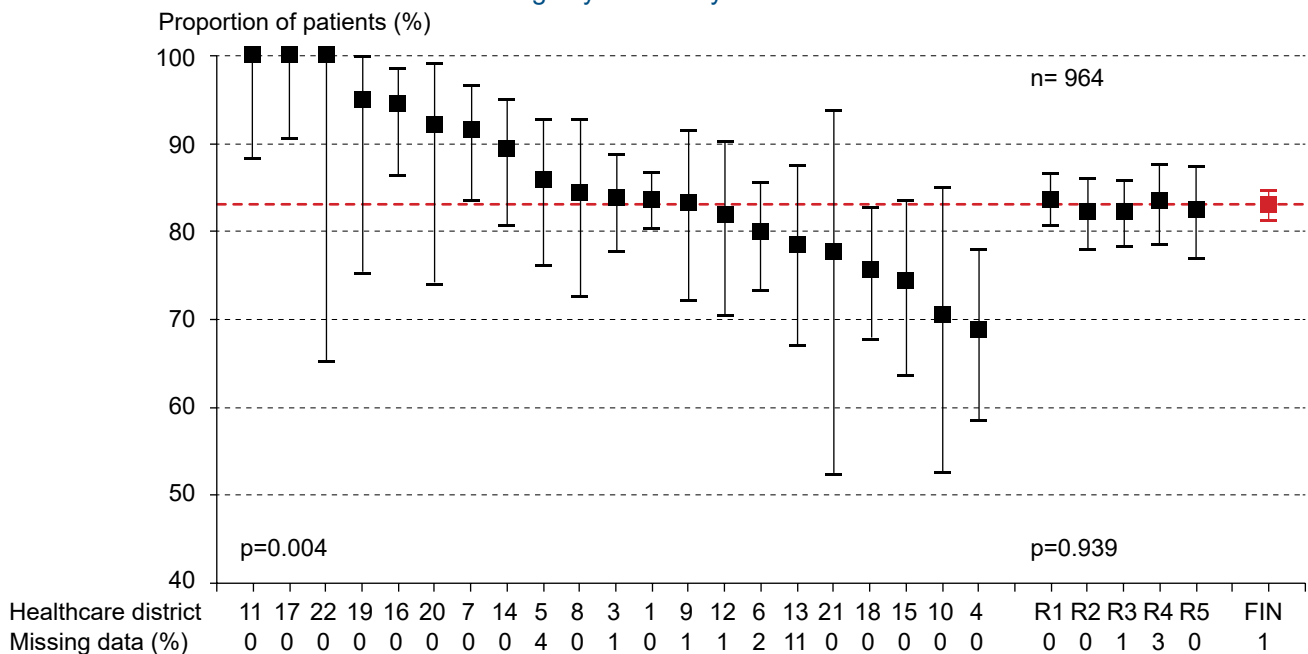


Figure 22. Proportion of dialysis patients older than 20 years with hemoglobin concentration ≥ 100 g/l in healthcare districts and regions
Finnish Registry for Kidney Diseases 2017



Several guidelines exist regarding the target for blood hemoglobin concentration in dialysis patients: European Best Practice Guidelines (EPBG) 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 the same cut-offs.

The distribution of dialysis patients' hemoglobin concen-

tration has changed during 2007–2017 (Figure 21). The proportion of patients with a hemoglobin concentration lower than 100 g/l has increased from 11% to 17%, while the proportion of patients with a hemoglobin concentration of 120 g/l or higher has decreased from 41% to 23%. Figures 21 and 22 include all hemodialysis patients, also those who did not use ESAs.

In Figure 22, the hemoglobin target is 100 g/l or higher. At the end of 2017, the proportion of dialysis patients reaching this target was 83%, varying from 69% to 100% in the healthcare districts ($p=0.004$) and from 82% to 84% in the regions ($p=0.939$). No significant difference was present in the proportions of men and women with a hemoglobin concentration of 100 g/l or higher.

Figure 23. Distribution of serum phosphorus among dialysis patients older than 20 years at end of year Finnish Registry for Kidney Diseases 2007–2017

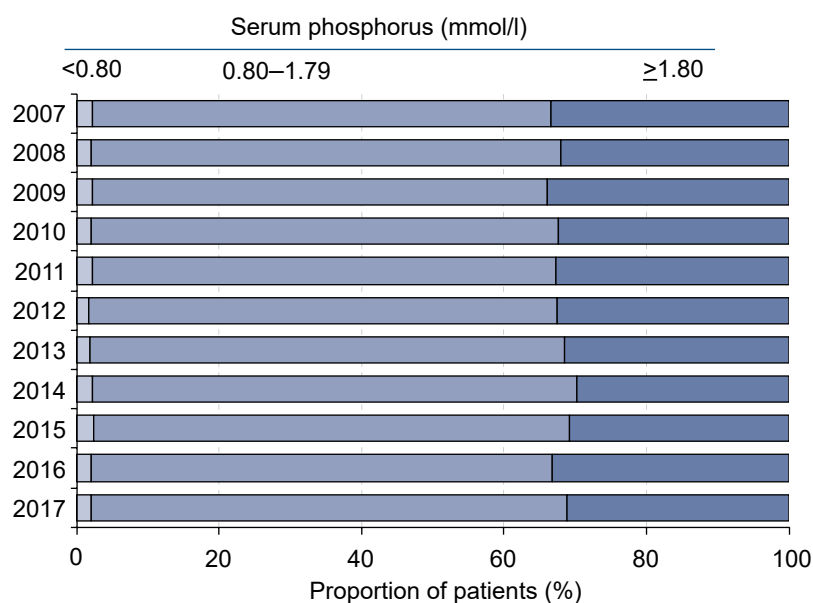
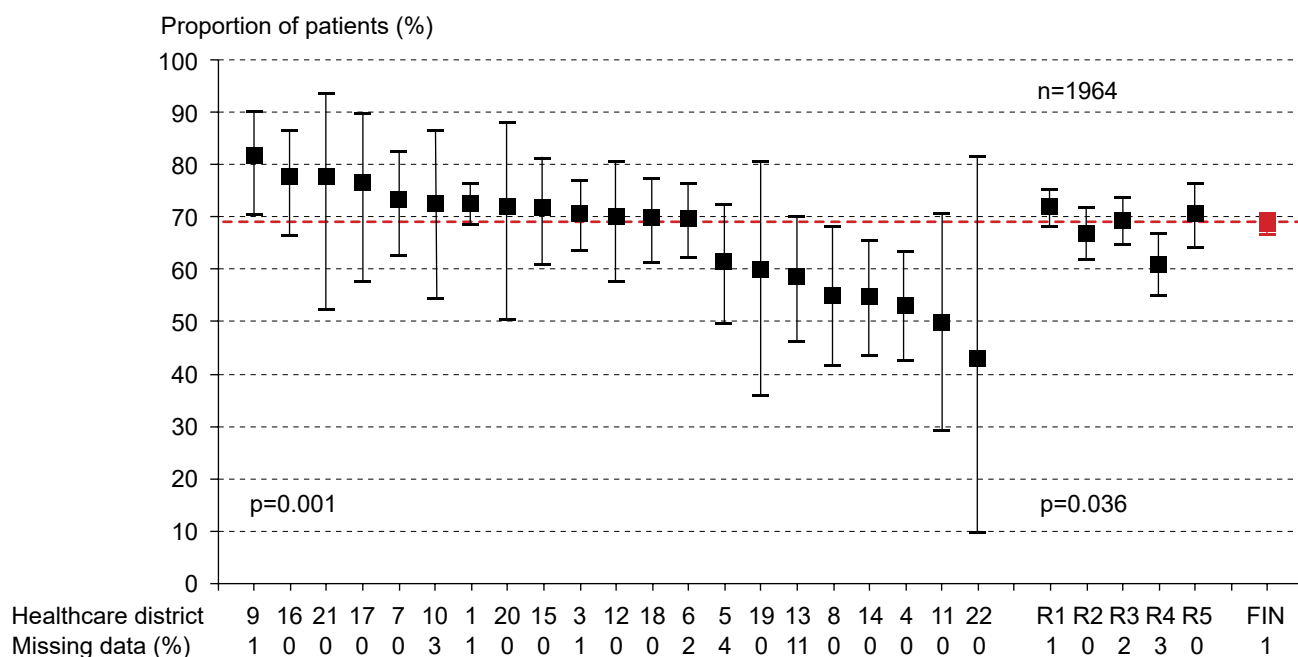


Figure 24. Proportion of dialysis patients older than 20 years with serum phosphorus <1.8 mmol/l in healthcare districts and regions Finnish Registry for Kidney Diseases 2017



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 2017, 68% of hemodialysis and peritoneal dialysis patients had concentrations of serum phosphorus

lower than 1.8 mmol/l; this proportion has remained virtually unchanged in the last decade (Figure 23). Only 2% of dialysis patients had an excessively low concentration of serum phosphorus (<0.8 mmol/l).

The proportion of patients with serum phosphorus under 1.8 mmol/l varied between 43% and 82% in the healthcare districts ($p=0.001$) and between 61% and 72% in the regions ($p=0.036$) (Figure 24). No significant difference was present between the sexes.

Figure 25. Vascular access of new hemodialysis patients older than 20 years at end of year
Finnish Registry for Kidney Diseases 2014–2017

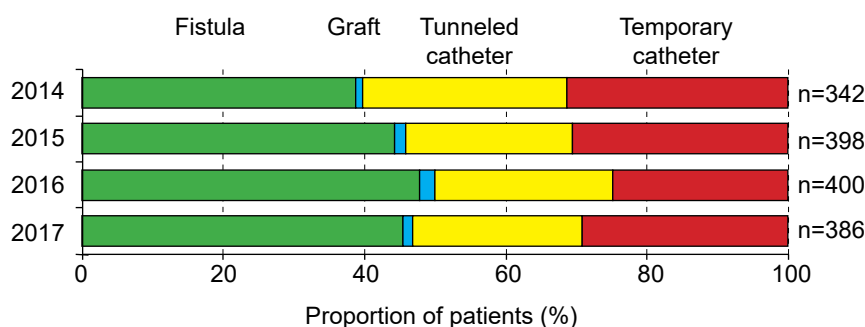
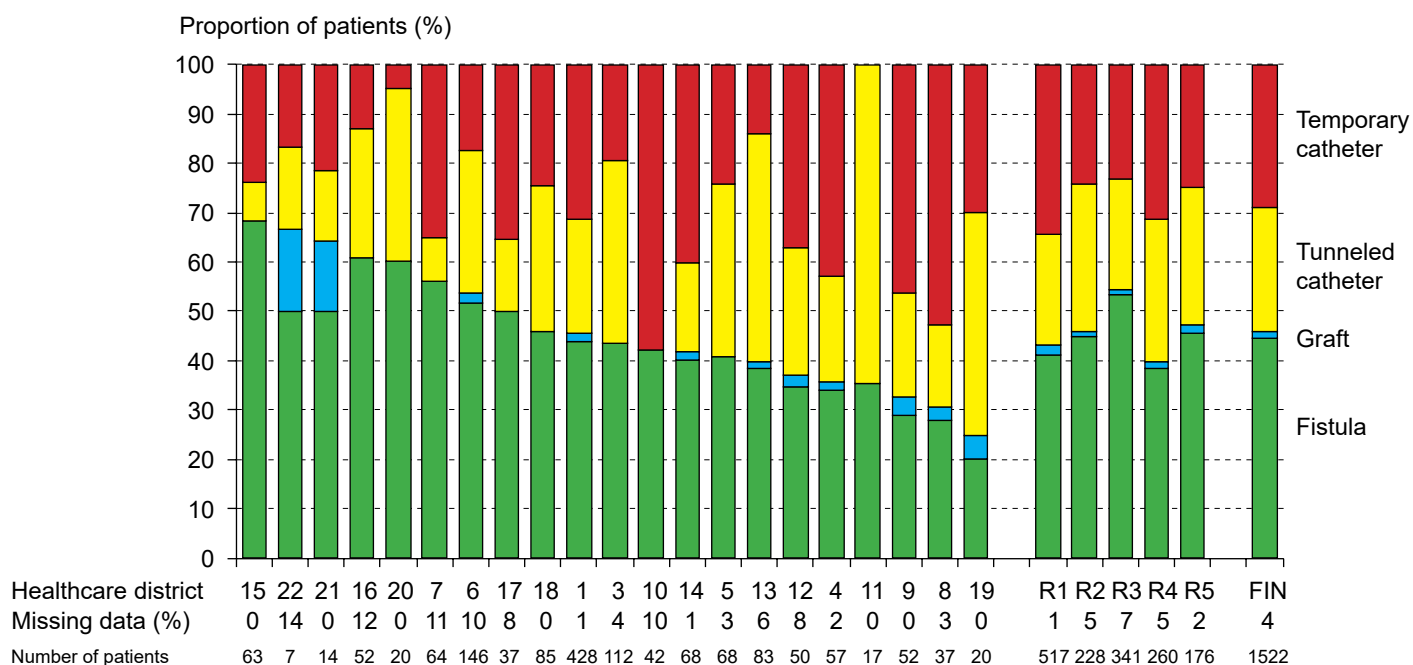


Figure 26. Vascular access of new hemodialysis patients older than 20 years
in healthcare districts and regions
Finnish Registry for Kidney Diseases 2014–2017



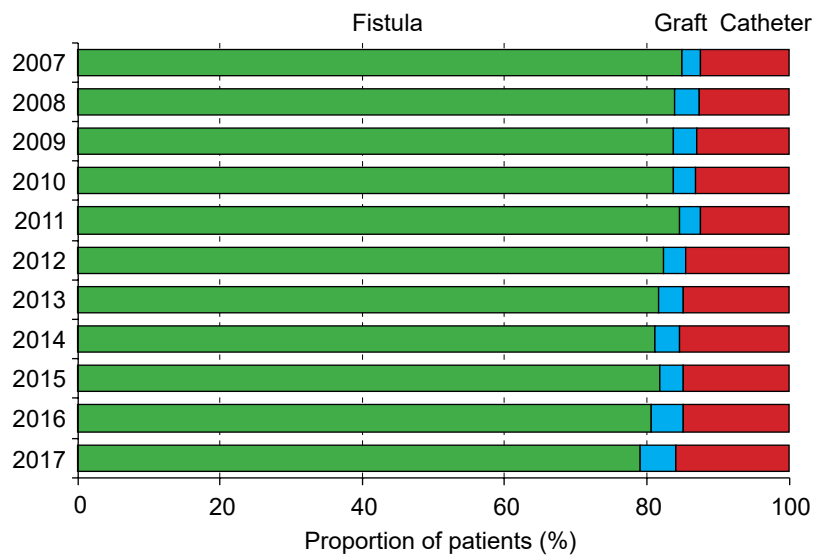
The Finnish Registry for Kidney Diseases has since 2014 collected data on vascular access of patients entering hemodialysis as the first type of RRT. The recommended type of vascular access is an arteriovenous fistula or graft. A tunneled central venous catheter is a better alternative than a temporary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

In 2017, 46% of patients older than 20 years who entered hemodialysis had an arteriovenous fistula or graft, and the proportion had slightly decreased from 2016 (Figure 25).

In 2017, 28% of new hemodialysis patients started with a temporary catheter, showing an increase from the previous year.

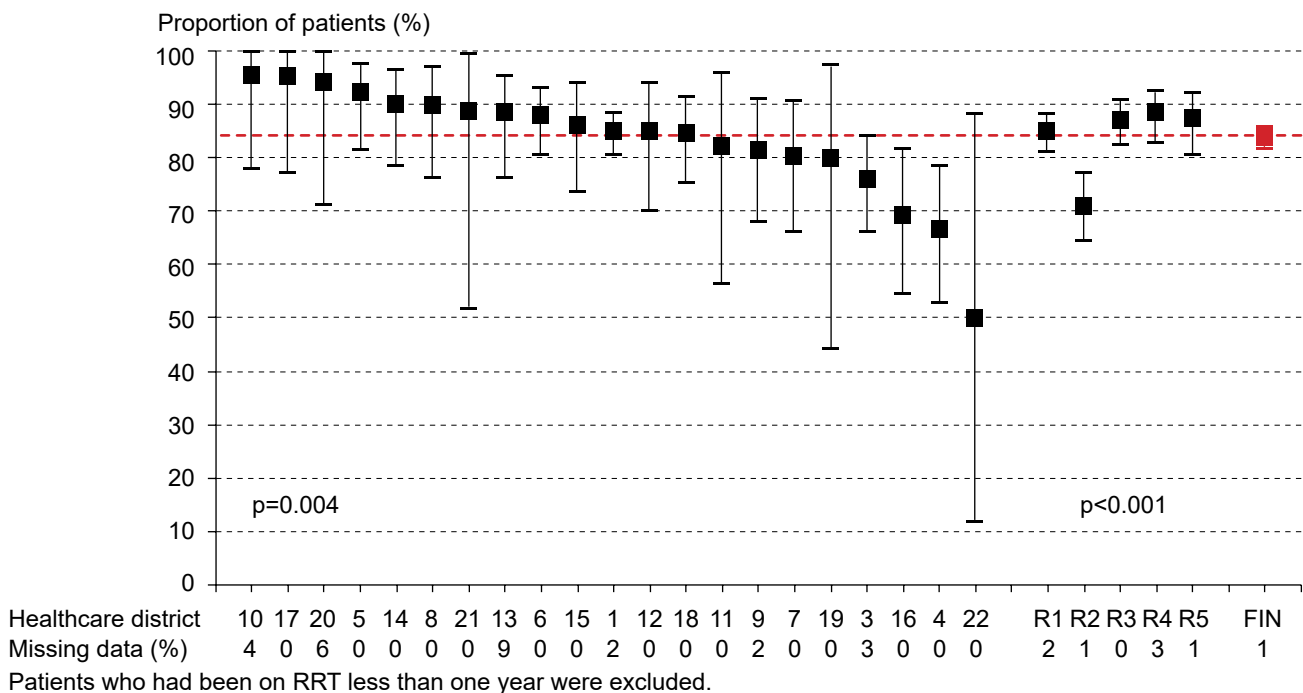
Figure 26 presents the distribution of types of first vascular access among patients who entered hemodialysis in 2014–2017. In the entire country, 46% of patients had a fistula or graft, but the proportion varied between 25% and 68% in healthcare districts ($p=0.002$) and between 40% and 54% in regions ($p=0.006$). The proportion of patients with a fistula or graft did not differ between the sexes.

Figure 27. Vascular access of hemodialysis patients older than 20 years at end of year
Finnish Registry for Kidney Diseases 2007–2017



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

Figure 28. Proportion of hemodialysis patients older than 20 years with a fistula or graft
in healthcare districts and regions
Finnish Registry for Kidney Diseases 2017

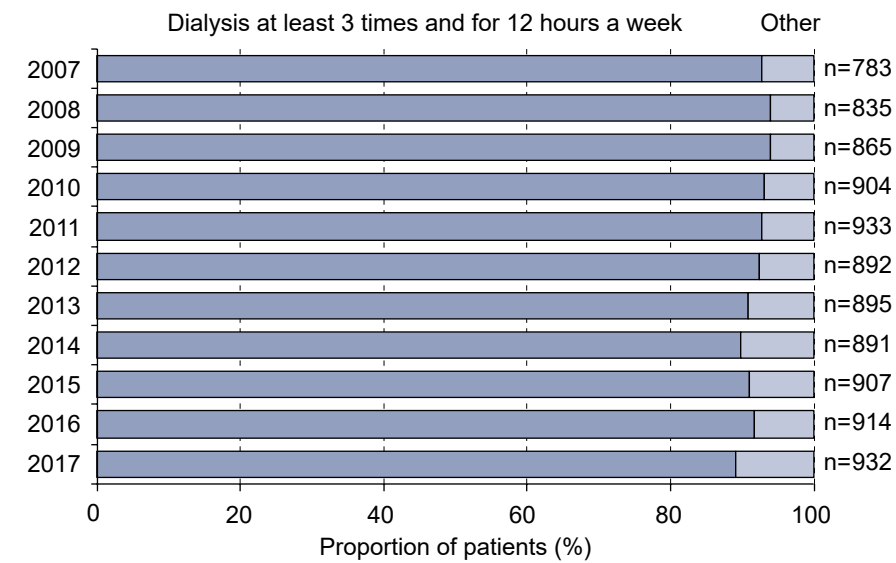


Patients who had been on RRT less than one year were excluded.

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 2007 to 84% in 2017 (Figure 27).

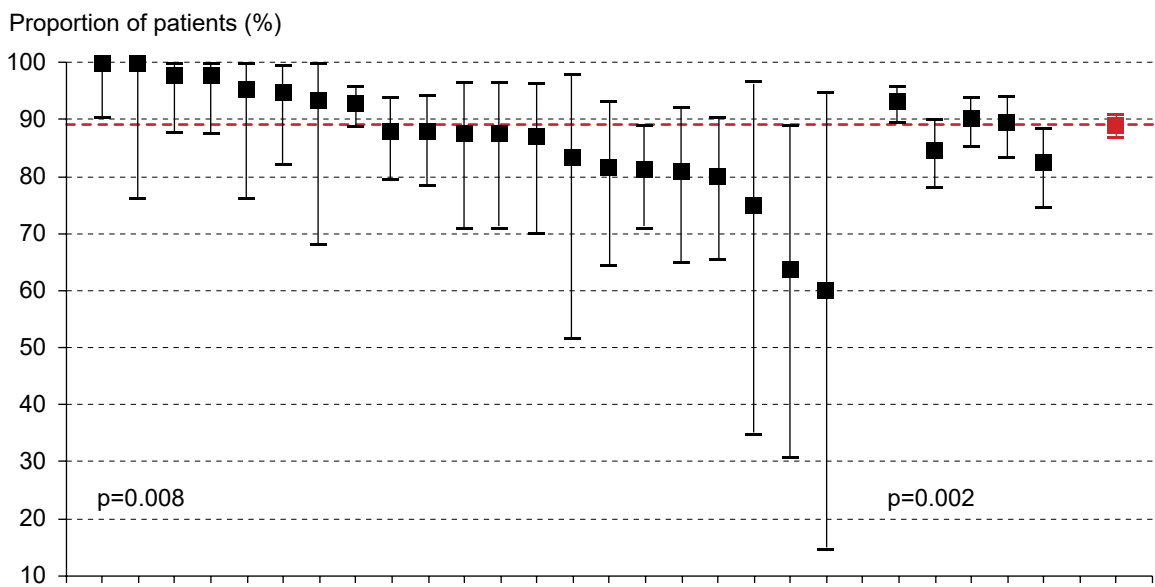
At the end of 2017, the proportion of patients with a fistula or graft varied between 50% and 96% in healthcare districts ($p=0.004$) and between 71% and 89% in regions ($p<0.001$) (Figure 28). At the end of 2017, female hemodialysis patients less frequently than male patients had a fistula or graft (79% vs. 87%, $p<0.001$). A fistula or graft was as common in patients over 75 years as in younger patients (84% in both groups).

Figure 29. Sufficiency of dialysis time among hemodialysis patients aged 20–74 years
Finnish Registry for Kidney Diseases 2007–2017



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

Figure 30. Proportion of hemodialysis patients aged 20–74 years with sufficient dialysis time in healthcare districts and regions
Finnish Registry for Kidney Diseases 2017



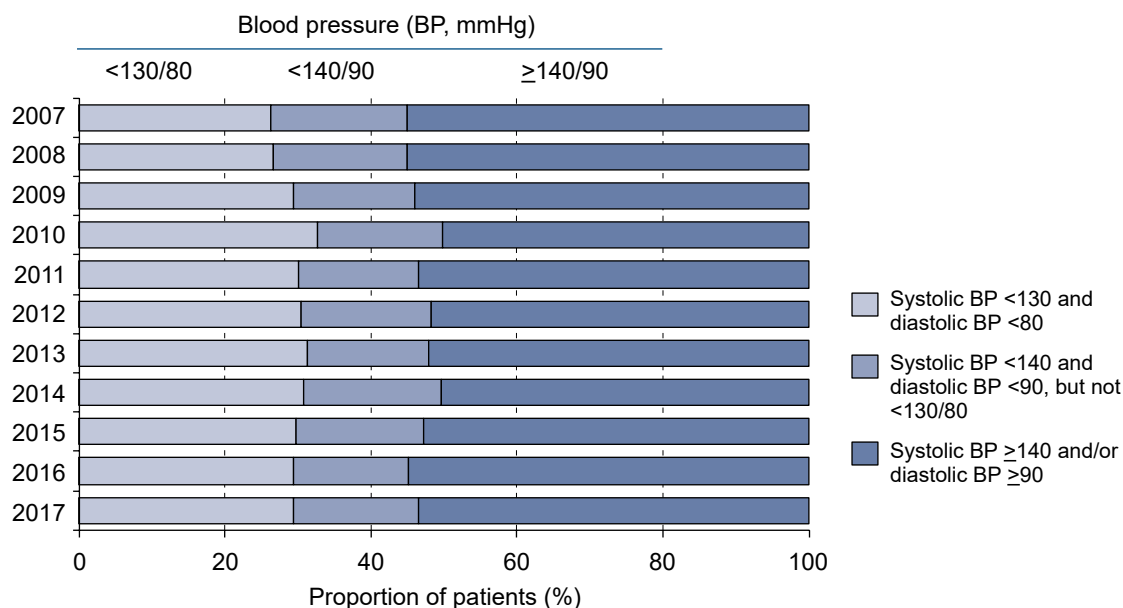
Healthcare district	9	20	15	14	10	5	17	1	6	3	12	16	8	11	7	18	13	4	21	19	22	R1	R2	R3	R4	R5	FIN
Missing data (%)	0	0	0	0	0	0	0	1	2	4	0	0	0	0	0	0	16	0	0	0	0	1	2	1	5	0	2

Patients who had been on RRT less than 91 days and home hemodialysis patients were excluded (n = 932).

According to the European Best Practice Guidelines (EBPG), hemodialysis should be performed at least three times and for at least 12 hours a week if there is no significant residual kidney function. Based on this definition, 89% of 20–74-year-old in-center hemodialysis patients received sufficient hemodialysis time at the end of 2017 (Figure 29).

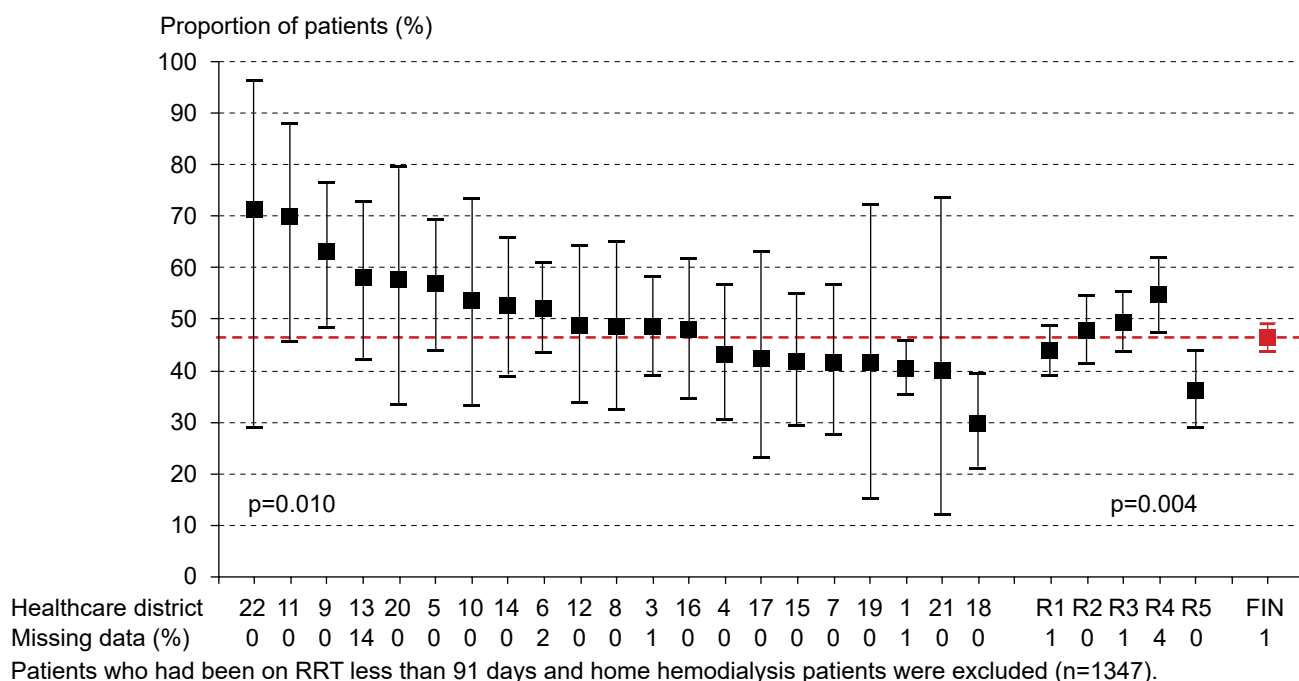
At the end of 2017, the proportion varied between 60% and 100% in healthcare districts (p=0.008) and between 82% and 93% in regions (p=0.002) (Figure 30). Male patients had sufficient dialysis time more often than women (91% vs. 85%, p=0.002).

Figure 31. Distribution of predialytic blood pressure among hemodialysis patients older than 20 years
Finnish Registry for Kidney Diseases 2007–2017



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

Figure 32. 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 2017



According to the guidelines of the Kidney Disease Outcome Quality Initiative (KDOQI), hemodialysis patients' target predialytic blood pressure is under 140/90 mmHg. At the end of 2017, 46% of hemodialysis patients reached this target (Figure 31). The proportion of patients attaining the

target varied between 30% and 71% in healthcare districts (p=0.010) and between 36% and 55% in regions (p=0.004) (Figure 32). No significant difference was observed between the sexes.

Figure 33. Reached therapeutic goals among dialysis patients older than 20 years
Finnish Registry for Kidney Diseases 2006–2017

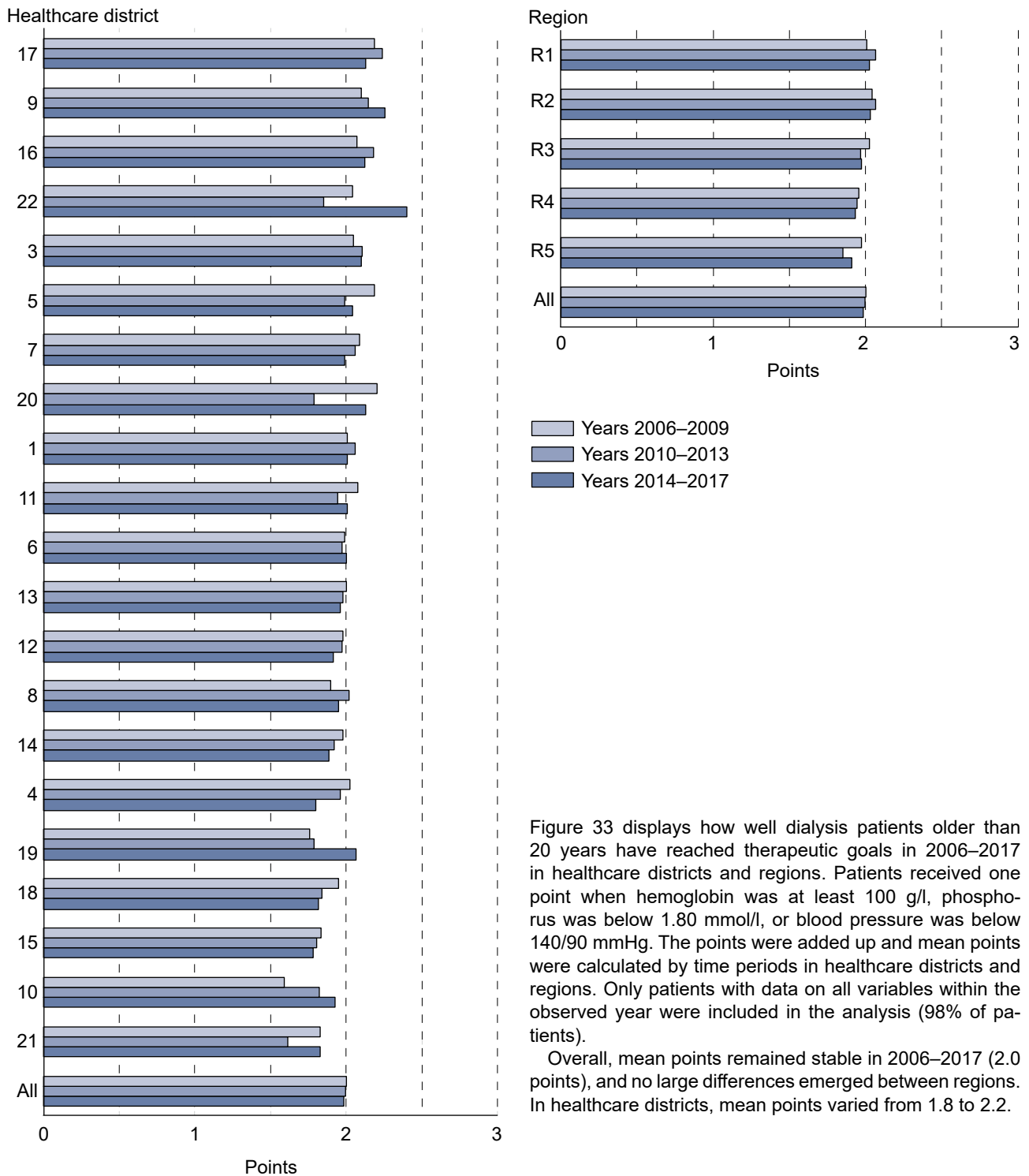


Figure 33 displays how well dialysis patients older than 20 years have reached therapeutic goals in 2006–2017 in healthcare districts and regions. Patients received one point when hemoglobin was at least 100 g/l, phosphorus was below 1.80 mmol/l, or blood pressure was below 140/90 mmHg. The points were added up and mean points were calculated by time periods in healthcare districts and regions. Only patients with data on all variables within the observed year were included in the analysis (98% of patients).

Overall, mean points remained stable in 2006–2017 (2.0 points), and no large differences emerged between regions. In healthcare districts, mean points varied from 1.8 to 2.2.

Figure 34. Time to waitlisting for kidney transplantation of new RRT patients older than 20 years
Finnish Registry for Kidney Diseases 2007–2017

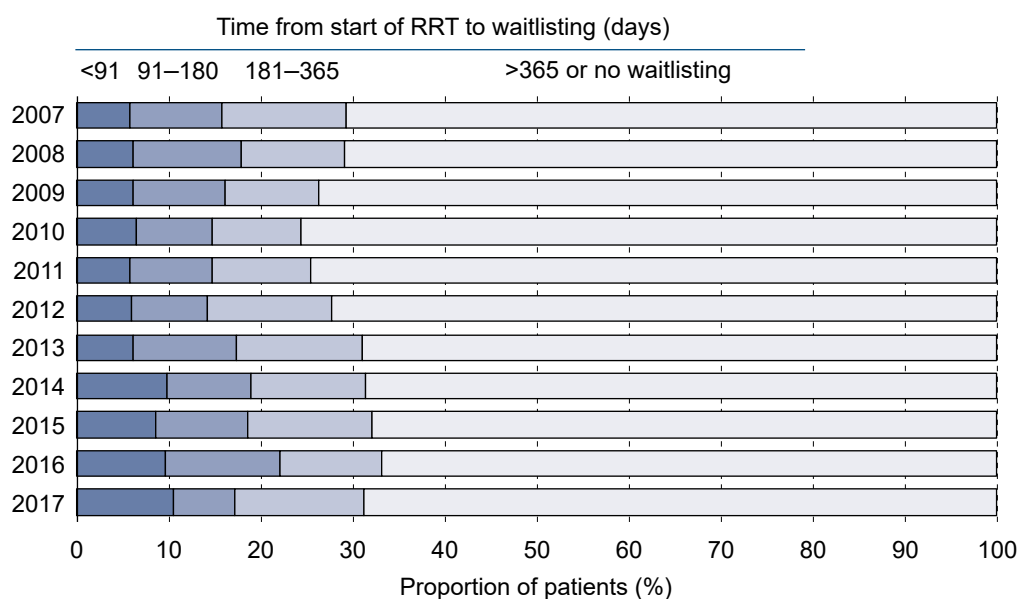
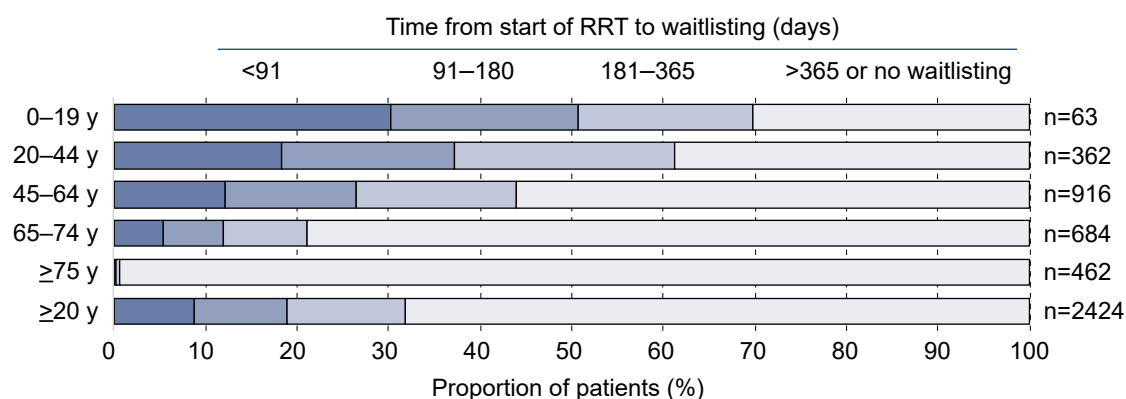


Figure 35. Time to waitlisting for kidney transplantation by age group of new RRT patients
Finnish Registry for Kidney Diseases 2013–2017



In 2007–2017, altogether 5313 patients older than 20 years entered RRT. Of these, four received a kidney transplant without preceding dialysis treatment. Because data on waitlisting for transplantation were not available after 15 October 2018, patients who entered RRT after 15 October 2017 were excluded from the analyses on pages 41 and 42 to keep the follow-up data complete. Information on waitlisting was received from the Transplantation Registry at Helsinki University Hospital.

Figure 34 shows the time from start of RRT until wait-

listing for kidney transplantation. In 2014–2017, 9–10% of patients who entered RRT were waitlisted within 90 days, while the corresponding proportion in 2007–2013 was 6%. The proportions of patients waitlisted within 180 and 365 days have also slightly grown, but this appears to be totally explained by the increased proportion of patients waitlisted within 90 days from start of dialysis.

Figure 35 presents according to age group the time from start of RRT to waitlisting for kidney transplantation of patients who entered RRT in 2013–2017.

Figure 36. Time to waitlisting for kidney transplantation of new RRT patients older than 20 years in healthcare districts and regions
Finnish Registry for Kidney Diseases 2013–2017

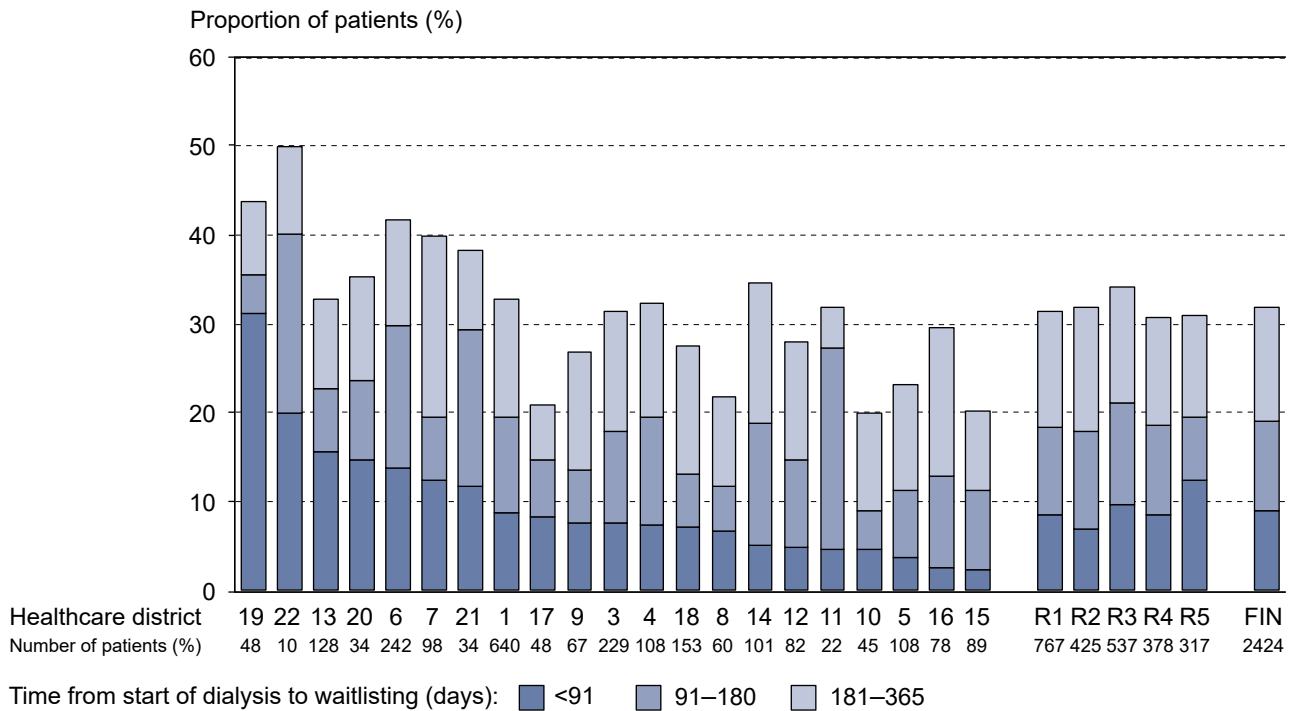


Figure 36 shows the proportions of patients entering RRT in 2013–2017 who had been waitlisted for kidney transplantation within 90, 180, and 365 days of start of RRT. Patients who entered RRT after 15 October 2017 were excluded from the analyses.

In the entire country, 9% of patients had been waitlisted within 90 days of start of RRT, and this proportion showed a range of 2–31% in healthcare districts ($P<0.001$) and 7–12% in regions ($P=0.083$). From start of RRT, 11% of female and 8% of male patients were waitlisted within 90 days ($P=0.018$).

Of the patients, 19% had been waitlisted within 180 days of start of RRT. This proportion ranged from 9% to 40% in healthcare districts ($P<0.001$) and from 18% to 21% in regions ($P=0.437$). Within 180 days of start of RRT, 23% of women and 17% of men were waitlisted for kidney transplantation ($P=0.003$). Within 365 days of start of RRT, 32% of patients had been waitlisted, with the proportion varying between 20% and 50% in healthcare districts ($P=0.004$) and between 31% and 34% in regions ($P=0.368$). Of women, 35%, and of men 31% had been waitlisted within 365 days ($P=0.037$).

Figure 37. Time on dialysis before first kidney transplantation
Finnish Registry for Kidney Diseases 1970–2017

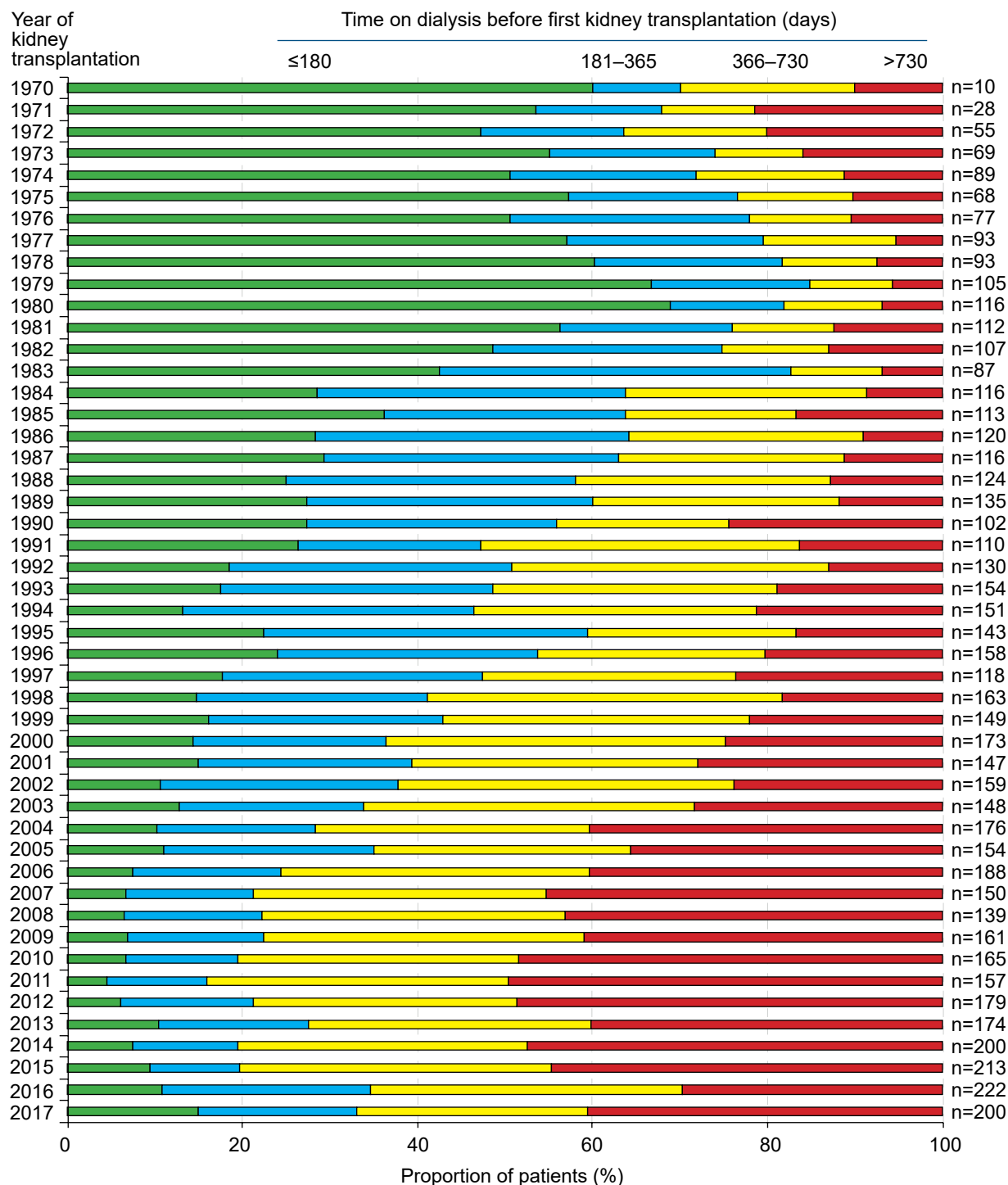


Figure 37 shows time on dialysis before receiving first kidney transplantation in 1970–2017. The proportion of patients receiving kidney transplantation within six months of start of RRT decreased continually between 1970 and 2011, but thereafter the proportion has increased from 4%

to 15%. The same trend was observed among patients on dialysis over two years before first kidney transplantation. The increase in this proportion has ceased, actually diminishing during the last decade.

Figure 38. Distribution of blood pressure of kidney transplantation patients older than 20 years
Finnish Registry for Kidney Diseases 2007–2017

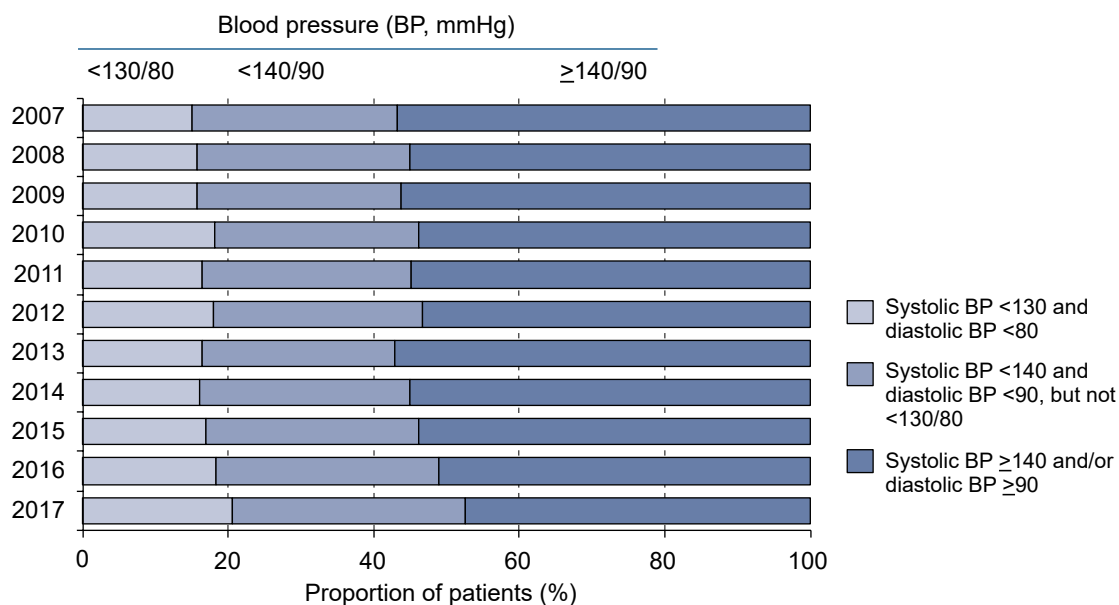
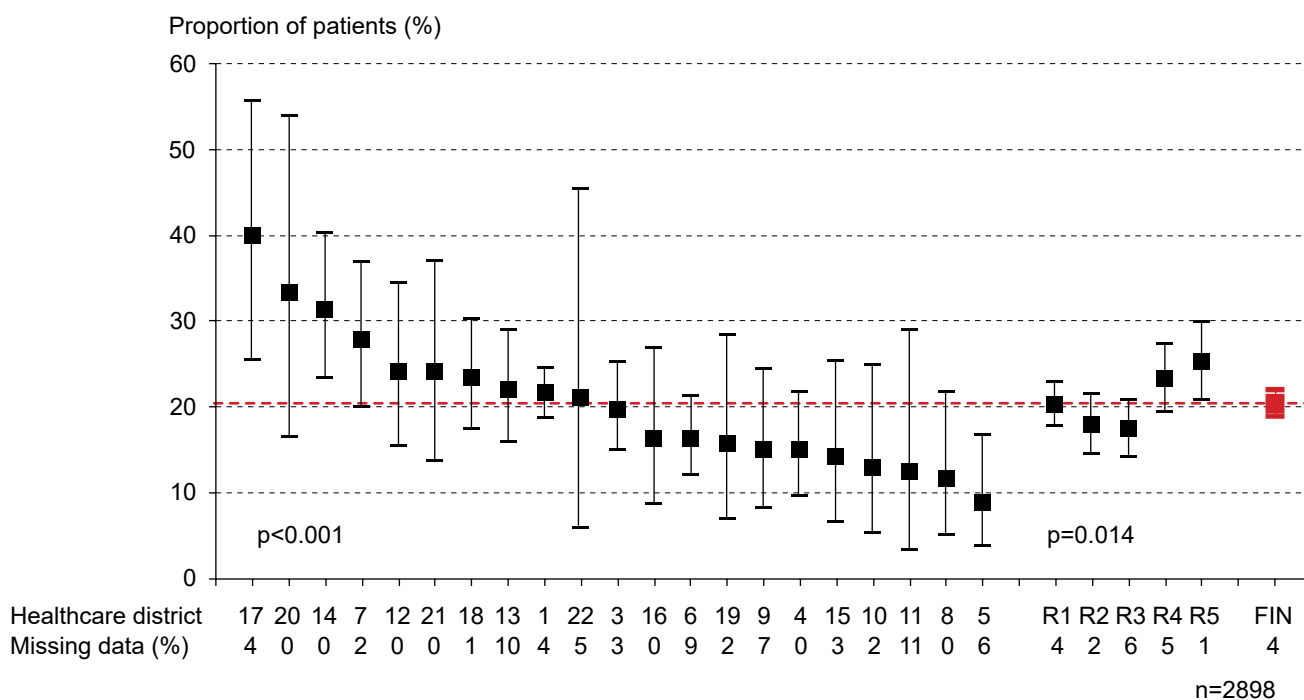


Figure 39. Proportion of kidney transplantation patients older than 20 years with blood pressure <130/80 mmHg in healthcare districts and regions
Finnish Registry for Kidney Diseases 2017



The KDIGO guidelines suggest that the blood pressure target of kidney transplantation patients be lower than 130 mmHg for systolic blood pressure and lower than 80 mmHg for diastolic blood pressure. Figure 38 shows the blood pressure distribution of kidney transplantation patients at the end of the years 2007–2017. The proportion of patients reaching the target (<130/80 mmHg) was 15% in 2007 and

21% in 2017.

At the end of 2017, the proportion of kidney transplantation patients attaining the blood pressure target varied between 9% and 40% in healthcare districts ($p<0.001$) and between 17% and 25% in regions ($p=0.014$) (Figure 39). No significant difference was observed between the sexes.

Figure 40. Distribution of serum LDL cholesterol among kidney transplantation patients older than 20 years
Finnish Registry for Kidney Diseases 2007–2017

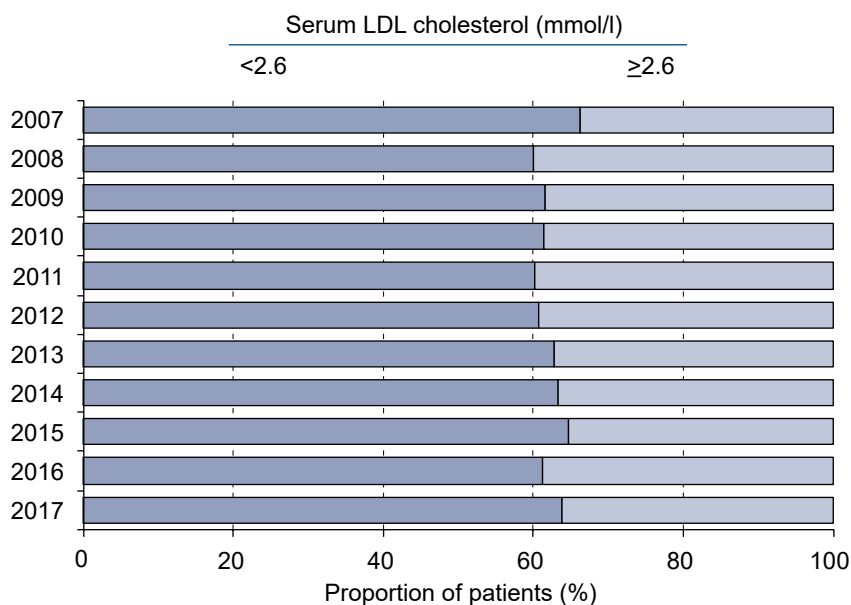
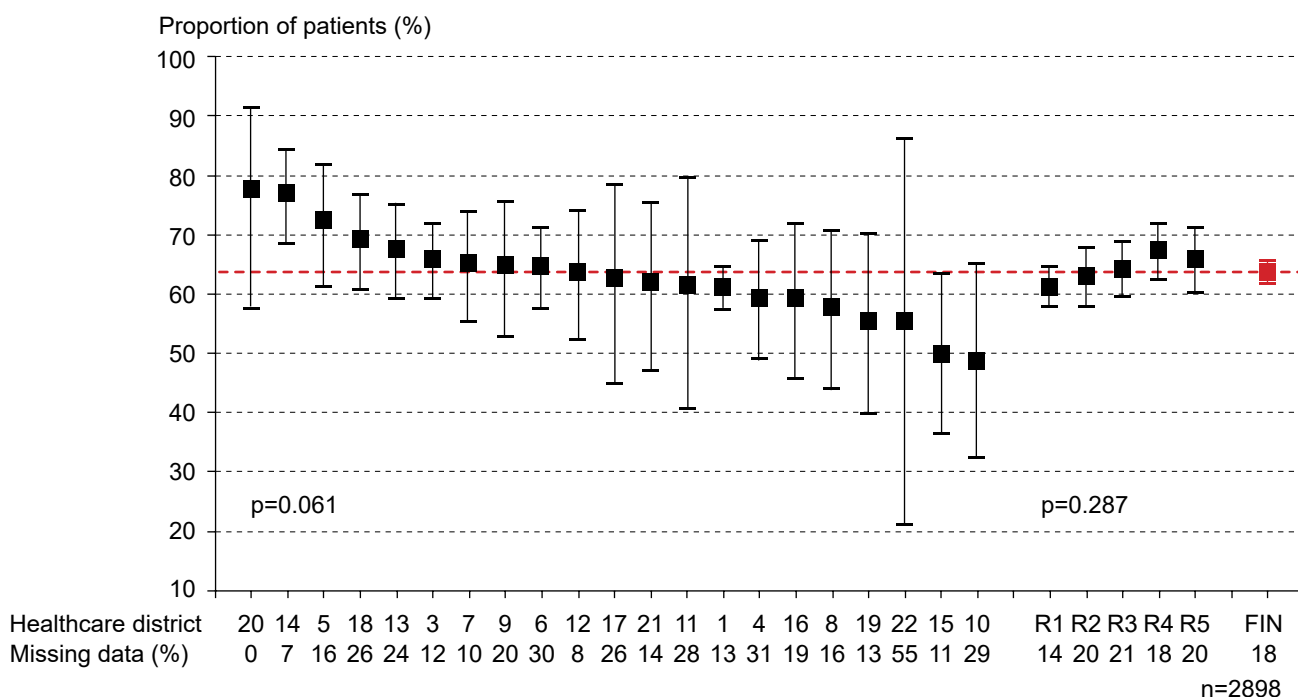


Figure 41. Proportion of kidney transplantation patients older than 20 years with serum LDL cholesterol <2.6 mmol/l in healthcare districts and regions
Finnish Registry for Kidney Diseases 2017



According to the KDIGO and KDOQI guidelines, kidney transplantation patients' concentration of serum low-density lipoprotein (LDL) cholesterol should be less than 2.6 mmol/l. In 2017, 64% of kidney transplantation patients reached this target (Figure 40).

The proportion of kidney transplantation patients reaching the treatment target for LDL cholesterol varied between 49% and 78% in healthcare districts ($p=0.061$) and be-

tween 61% and 67% in regions ($p=0.287$) (Figure 41). No significant difference was observed between the sexes.

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 higher than 4.5 mmol/l were excluded (2% of patients).

Figure 42. Immunosuppressive medication of kidney transplant recipients at end of year
Finnish Registry for Kidney Diseases 2007–2017

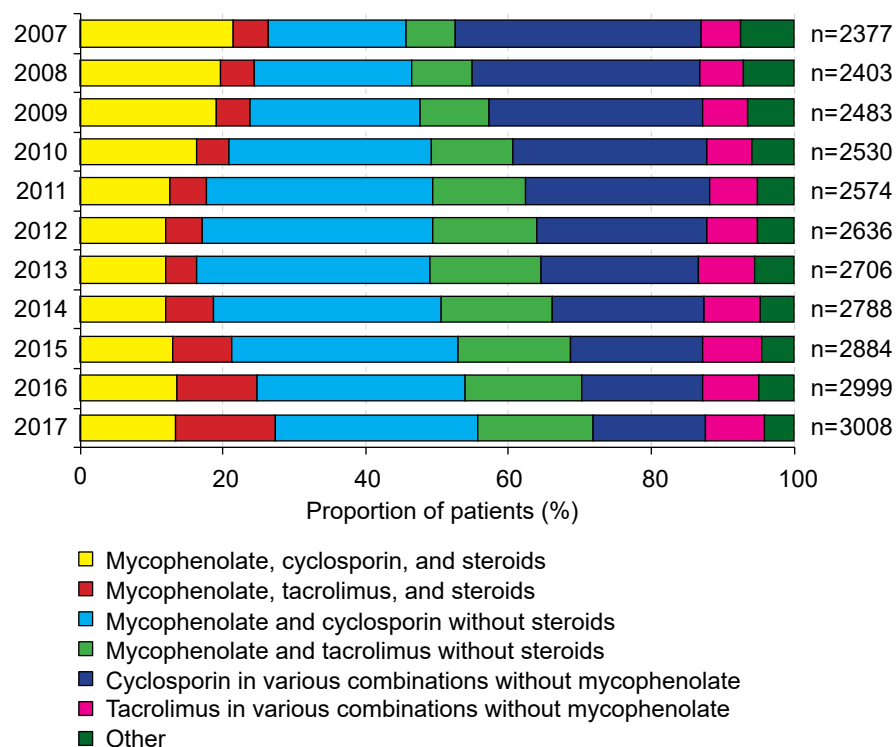
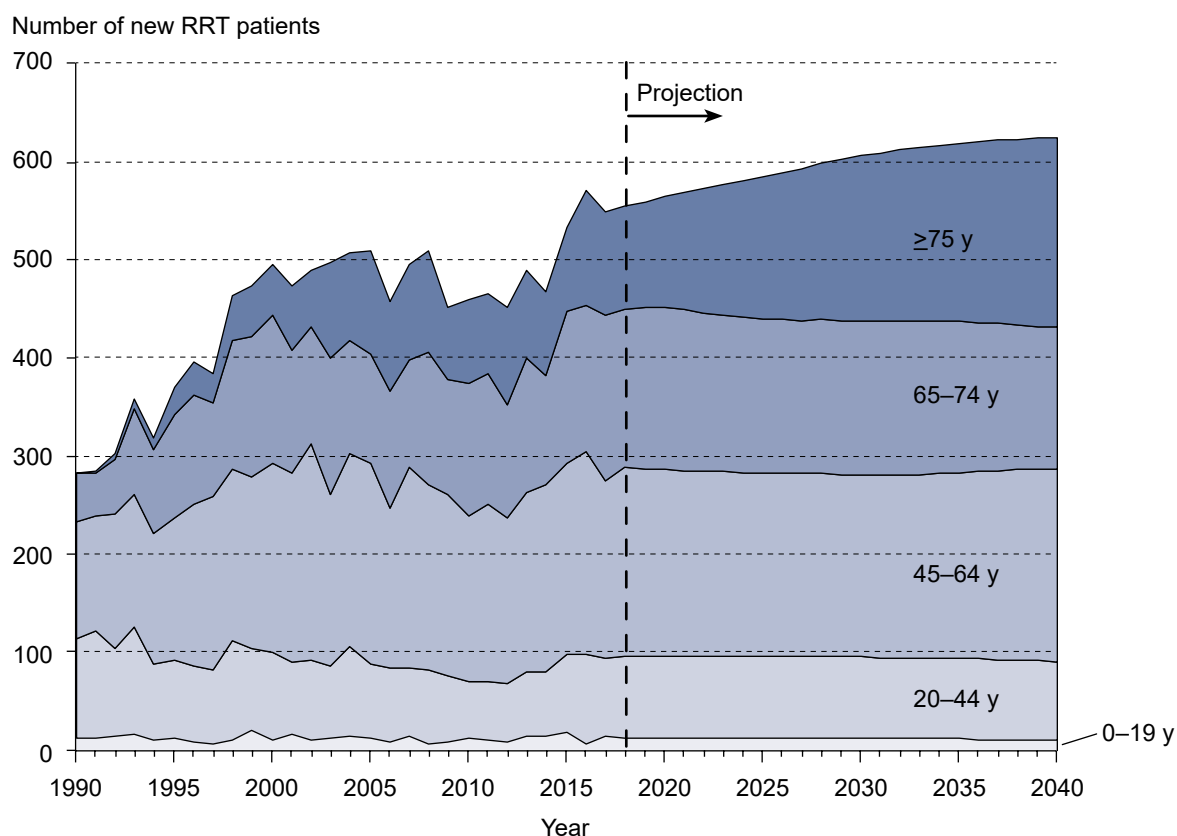


Figure 42 shows immunosuppressive medication of kidney transplantation patients at the end of the year. In 2007–2017, the use of mycophenolate in various combinations has increased from 54% to 73%. At the same time, the use of cyclosporin has decreased from 75% to 58%, and

the use of tacrolimus has increased from 17% to 39%. Of the patients, 63% used steroids in 2007, but the proportion decreased rapidly thereafter, with only 38–47% of patients using steroids after 2010. The use of azathioprine has decreased from 30% to 14% in 2007–2017.

Figure 43. Projected annual number of new RRT patients
Finnish Registry for Kidney Diseases 1990–2017



In 2015–2017, on average 550 patients entered RRT annually, which is considerably more than in earlier years. During 2000–2014 the number of new RRT patients remained virtually unchanged at about 450 per year. The Finnish Registry for Kidney Diseases published in Report 2014 a projection for the number of RRT patients in the coming years. That projection failed to predict the sudden increase in the number of new RRT patients in 2015–2017.

Figure 43 presents a new projection of the annual number of patients entering RRT until the year 2040. The projection is based on the assumption that the average annual incidence of RRT in 2015–2017 will remain unchanged in age and gender groups. The population projection of Sta-

tistics Finland (updated on 16 November 2018, <http://www.tilastokeskus.fi/til/vaenn/tau.html>) was taken into account. According to the projection of the Finnish Registry for Kidney Diseases, the number of patients entering RRT in 2040 will be 625. The proportion of new patients older than 75 years is forecasted to increase from 19% in 2017 to 31% in 2040.

According to Statistics Finland, there will be 5.6 million inhabitants in Finland in 2040, which is similar to the figure for the year 2017. In 2040, the number of inhabitants aged over 75 years will be 82% larger than in 2017, whereas in the younger age groups the number of inhabitants will decrease or remain unchanged.

Figure 44. Projected number of dialysis patients according to age group
Finnish Registry for Kidney Diseases 1990–2017

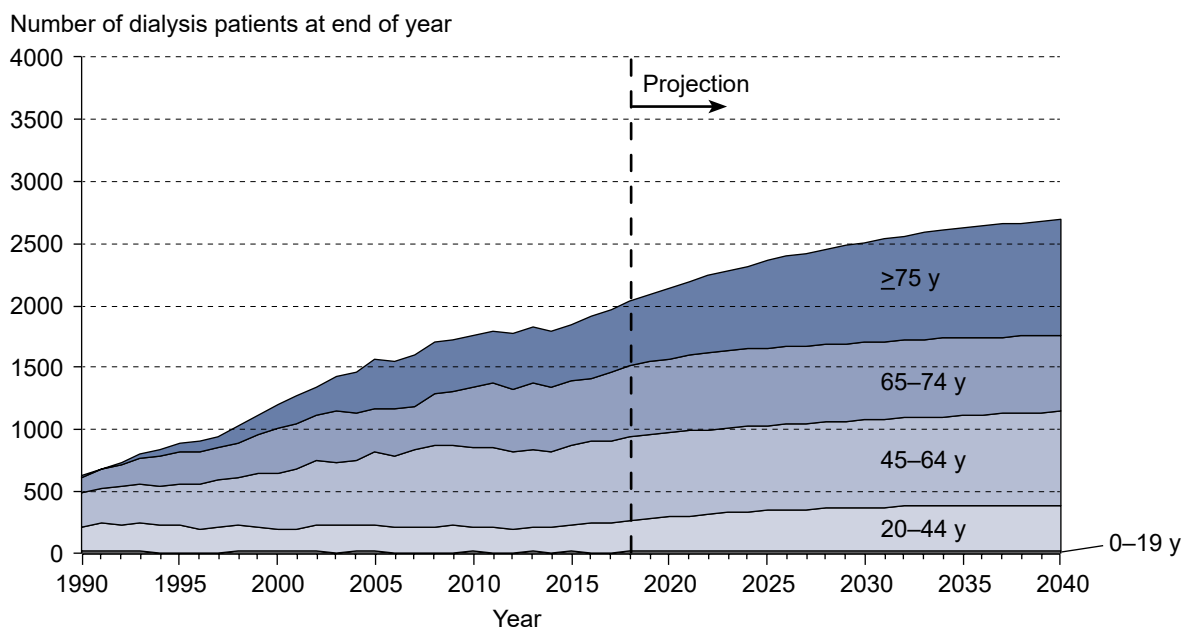
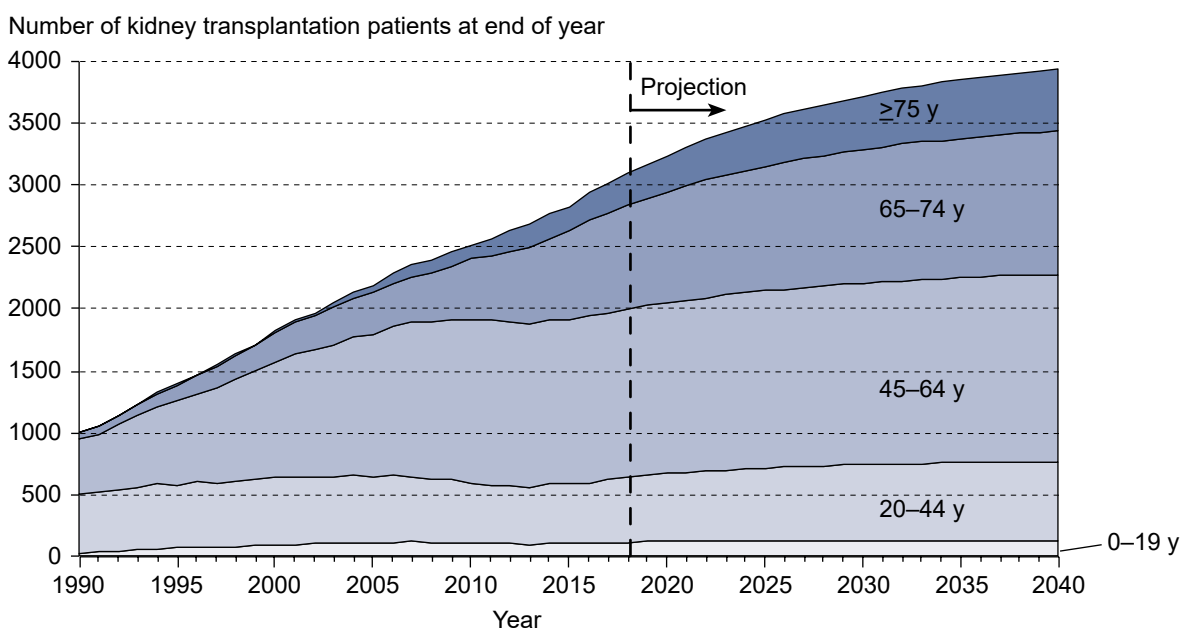


Figure 45. Projected number of kidney transplantation patients according to age group
Finnish Registry for Kidney Diseases 1990–2017



Figures 44 and 45 present the projected numbers of prevalent dialysis and kidney transplantation patients until the year 2040. The following assumptions were made: 1) the number of new RRT will develop according to the projection in Figure 43 on page 47, 2) dialysis and kidney transplantation patients' average mortality in 2010–2017 will remain unchanged in age and gender groups, 3) the annual number of kidney transplantations will be 250 until the year 2040, and 4) the average risk of graft loss in 2013–2017 will remain unchanged in age and gender groups.

According to the projection and compared with 2017, the number of dialysis patients will be 19% larger in 2025, 27% larger in 2030, and 36% larger in 2040 (Figure 44). At the end of 2017, 26% of dialysis patients were 75 years or old-

er; in 2040, the proportion of elderly patients will be 36%.

Compared with 2017, the number of kidney transplantation patients will be 17% larger in 2025, 23% larger in 2030, and 31% larger in 2040. The proportion of transplantation patients aged 75 years or older was 8% in 2017; this figure is anticipated to grow to 13% in 2040.

In 2014–2017, an average of 248 kidney transplantations were performed yearly, forming the basis of the assumptions used in the projections. If the number of kidney transplantations could be increased, e.g. to 280 per year, the number of dialysis patients would increase less (by 18% in 2030 and 27% in 2040) and the number of transplantation patients would increase more (by 33% in 2030 and by 44% in 2040).

- Age
 at end of year 2005:18, 2013:16, 2014:17, 2017:22–23
 of new RRT patients 2007:10, 2013:9–10, 2014:9–10,
 2017:12–14
- Alport's syndrome 2011:25,27
- Amyloidosis 2006:6, 2014:12,13,23, 2016:14,27, 2017:16–
 18,29–30
- 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
- Blood pressure-lowering medication 2004:26, 2006:29,
 2007:33, 2012:31,34, 2013:41,43, 2014:34,36
- CAPD (continuous ambulatory 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
- Causes of death
 type of treatment 2008:23
- Changes in type of treatment 2003:11, 2008:12, 2011:21,
 2012:20, 2013:23, 2014:24, 2015:24, 2016:28–29,
 2017:31
- Comorbidities
 adjustment for 2009:25–26
 amputation 2007:31
 angina pectoris 2007:24
 arterial disease other than coronary disease 2007:29–30
 cerebrovascular hemorrhage or infarction 2007:32
 coronary heart disease 2007:24–26
 heart failure 2007:28
 high blood pressure 2004:25, 2012:30–31,33–34,
 2013:40–43, 2014:33–36, 2015:34,41, 2016:43,44,
 2017:39,44
 hyperlipidemia 2007:34, 2012:35, 2013:44, 2014:37,
 2016:45, 2017:45
 left ventricular hypertrophy 2007:27
 myocardial infarction 2007:26
- Congenital nephrosis of Finnish type 2011:25,27,
 2017:16–17
- Dialysis time, sufficiency of 2012:29, 2013:39, 2014:32,
 2015:33, 2016:40, 2017:38
- Erythropoiesis-stimulating agents 2013:35, 2016:33,34
- Finnish population
 age groups 2003:2, 2008:6, 2012:7, 2013:7, 2014:7,
 2015:8, 2016:9, 2017:10
 by sex 2003:2, 2008:6, 2012:7, 2013:7, 2014:7, 2015:8,
 2016:9, 2017:10
 in healthcare districts 2003:1, 2008:5, 2012:6, 2013:6,
 2014:6, 2015:7, 2016:8, 2017:9
 in regions 2003:1–2, 2008:5–6, 2012:6–7, 2013:6–7,
 2014:6–7, 2015:7–8, 2016:8–9, 2017:9–10
- Glomerular filtration rate 2009:12, 2012:32, 2013:28,
 2016:16,17
- Goodpasture's syndrome 2016:14, 2017:17–18
- Graft survival
 calendar time period 2003:16, 2008:20, 2011:30,31
 diagnosis 2003:17
 risk of loss 2008:20, 2011:30,31
- Granulomatosis with polyangiitis 2006:7, 2017:17
- Hemodiafiltration 2010:18, 2011:11,18, 2012:23,25,
 2013:27, 2014:14,21, 2015:13,14,21, 2016:15,18,25,
 2017:19,27
- Hemolytic-uremic syndrome 2011:25,27, 2016:14,
 2017:17–18
- High blood pressure, see comorbidity
- Home dialysis 2012:24, 2014:21, 2015:13,14,19,21,
 2016:15,18,23,25,29, 2017:19,25,27
- Home hemodialysis 2010:12,18, 2011:11,17,18,
 2012:23,25, 2013:18,27, 2014:14,19,21,
 2015:13,14,19,21, 2016:15,18,23,25,29, 2017:19,25,27
- Immunosuppressive treatment 2003:18, 2008:19, 2017:46
- Incidence of RRT
 90 days after start of RRT 2003:3, 2009:9–10, 2012:23,
 2013:11,27, 2014:11,14, 2015:13,14, 2016:13–14,
 2017:19
 age group 75 years and older 2012:11, 2014:9, 2015:10
 age groups 2004:4, 2009:8,10, 2010:9–10, 2011:8–
 10,23–25, 2012:9,11,12, 2013:9–10, 2014:9–10,
 2015:10–11, 2016:11–12, 2017:12–14
 by sex 2004:4, 2009:8, 2010:9, 2011:9,10, 2012:16,
 2013:10, 2014:10, 2015:11, 2016:12, 2017:13–14
 children 2003:3, 2008:7, 2009:7, 2010:7, 2011:7,23,
 2012:8, 2013:9, 2014:8, 2015:9, 2016:10, 2017:11
 diagnosis 2003:4, 2008:8, 2009:11, 2010:11,
 2011:12,25, 2012:13, 2013:12–13, 2014:12–13,
 2015:12, 2016:14, 2017:16–17
 in healthcare district 2003:3, 2008:7, 2011:7,8,11,
 2012:8–11, 2013:8,9,27, 2014:8,9,14, 2015:9,10,13,
 2016:10–11,15, 2017:11–12,19
 in regions 2003:2–3, 2008:7, 2009:7,9, 2010:7–8,
 2011:7,8,11, 2012:8–11, 2013:8,9,11,13, 2014:8,9,11,14,
 2015:8,9,10,13, 2016:10–11,13,15, 2017:11–12,15,19
 international 2003:5, 2009:13, 2010:13, 2011:13,
 2012:14, 2013:14, 2014:15, 2015:15, 2016:19, 2017:20
 projection 2010:23, 2014:26, 2017:47
 standardized 2003:2–3, 2007:9, 2009:9, 2010:8,
 2012:10, 2013:11, 2014:11, 2016:13, 2017:15
 type of treatment 2003:11, 2008:12, 2011:11,25,
 2012:20,23, 2013:23,27, 2014:14,24, 2015:13,14,
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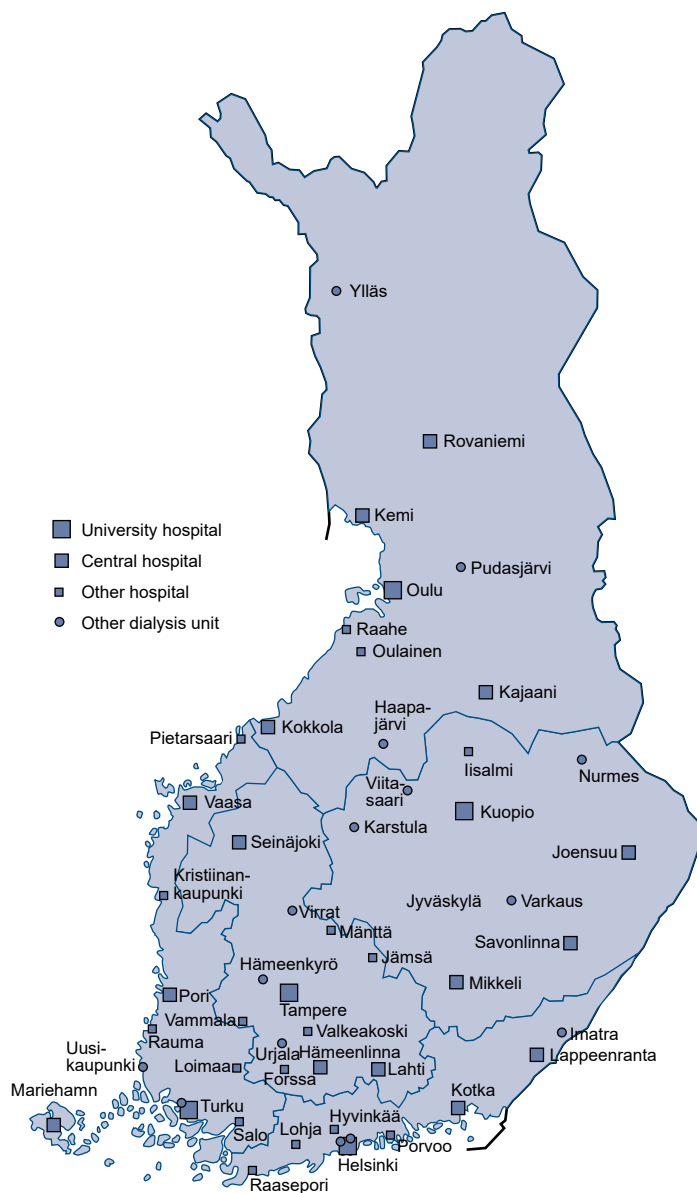
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Report 2017



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