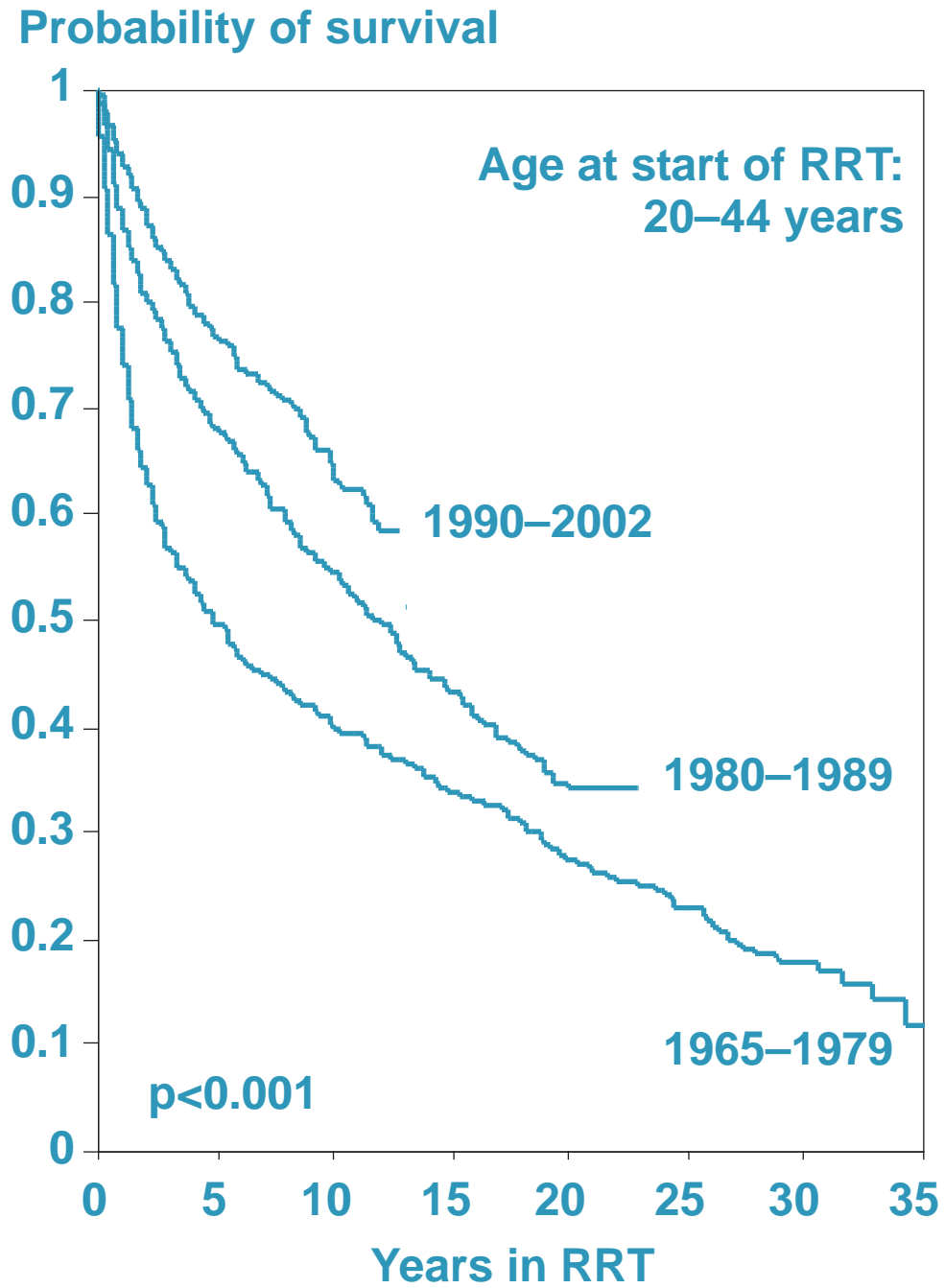


Report 2002



Finnish Registry for Kidney Diseases – Report 2002

Contents

Finnish Registry for Kidney Diseases – Report 2002	ii
Board of the Finnish Registry for Kidney Diseases	iii
The Finnish population and its distribution in healthcare districts (1992–2002)	1
Healthcare districts and regions in Finland	1
The Finnish population according to region, age group, and gender (2002)	2
Standardized incidence of RRT in regions (1992–2002)	2
Number of new RRT patients and incidence of RRT by healthcare district and region (1998–2002)	3
Standardized incidence of RRT in regions 90 days after start of RRT (1992–2002)	3
Incidence of RRT according to diagnosis (1965–2002)	4
International comparison of incidence of RRT in 2001	5
Patients in RRT at end of year according to healthcare district and region (1998–2002)	6
Patients in RRT at end of 2002 according to region, age group, and gender (2002)	7
Standardized prevalence of RRT in regions (1992–2002)	7
Prevalence of RRT in healthcare districts on 31 December 2002	8
Prevalence of RRT at end of year according to type of treatment (1965–2002)	9
Prevalence of RRT at end of year according to diagnosis (1965–2002)	9
International comparison of prevalence of RRT on 31 December 2001	10
Net changes in type of treatment (2002)	11
Mortality of RRT patients by region (1997–2002)	12
Standardized mortality of RRT patients in regions (1992–2002)	12
Standardized mortality of RRT patients in regions (patients who died before 90 days after start of RRT were excluded from analysis) (1992–2002)	12
Number of patient-years according to diagnosis (1997–2002)	13
RRT patients' probability of survival according to RRT start period and age group (1965–2002)	14
Effect of different variables on RRT patients' survival (1998–2002)	15
Multivariate model of RRT patients' survival (1998–2002)	16
Kt/V of patients receiving peritoneal dialysis or hemodialysis (1999–2002)	17
Serum creatinine according to type of treatment (1997–2002)	17
Serum albumin according to type of dialysis (1997–2002)	18
Ionized calcium in plasma according to type of dialysis (1997–2002)	18
Serum phosphate according to type of dialysis (1997–2002)	18
Blood pressure according to type of treatment (1997–2002)	19
Pulse pressure according to type of treatment (1997–2002)	19
Serum cholesterol according to type of treatment (1999–2002)	20
Serum LDL cholesterol according to type of treatment (1999–2002)	20
Serum triglycerides according to type of treatment (1999–2002)	21
Serum HDL cholesterol according to type of treatment (1999–2002)	21
Serum CRP according to type of treatment (2002)	22
Index of Reports 1998–2002	24

Finnish Registry for Kidney Diseases – Report 2002

The Finnish Registry for Kidney Diseases Report 2002 provides demographic data on renal replacement therapy (RRT) in Finland to the end of the year 2002. The earlier trend continues, with the prevalence of RRT increasing throughout the country; i.e. the number of dialysis and kidney transplantation patients per capita is on the rise. The incidence of RRT, by contrast, has not increased during the past five years, and in an international comparison, the incidence in Finland was the second lowest (see p. 5). The prevalence is also low in relation to other countries (see p. 10). The proportion of patients on peritoneal dialysis has clearly decreased: in 1992, 15% of all RRT patients were receiving peritoneal dialysis, whereas the proportion in 2002 was only 8%. During the same period the proportion of hemodialysis patients increased from 24% to 33%, while the proportion of patients with a kidney transplant remained stable at 60–62%.

RRT patients' age- and gender-standardized mortality has decreased by 26% over the past ten years; in 2002, it was 97 deaths/1000 patient-years (see p. 12). The age-specific survival of RRT patients has also improved markedly. In 1965–1979, only 49% of 20- to 44-year-olds survived five years after the start of RRT. In 1980–1989, the corresponding proportion was 68%, and in 1990–2002, it was 76% (see p. 14). This report presents analyses of factors predicting survival in RRT. High age, low serum albumin concentration, and high serum concentrations of phosphate and creatinine correlate with poor prognosis (see pp. 15 and 16). Diagnosis of kidney disease is another important prognostic factor.

Laboratory data of all RRT patients are reported yearly to the Finnish Registry for Kidney Diseases. On pages 17–22, the laboratory variables for 2002 and 1997 (or 1999 if a variable was not reported in 1997) are shown according to type of treatment.

The Finnish Registry for Kidney Diseases is financed by Finland's Slot Machine Association (RAY). Stockmann Foundation, MCP Medicare, Janssen-Cilag, and Baxter have sponsored the renewal of database software. Statistics in this report were updated using data obtained from the Registry for follow-up of kidney transplantation patients, which is maintained by the Kidney Transplantation Unit of Helsinki University Central Hospital. The Board of the Finnish Registry for Kidney Diseases thanks all supporters and participating hospitals for fruitful cooperation.

Helsinki, 16 October 2003

Patrik Finne
Administrative Director

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Table 1. The Finnish population and its distribution in healthcare districts
Finnish Registry for Kidney Diseases 1992–2002

Healthcare district (1000 inhabitants)		Year							Change (%) 1992–2002
		1992	1995	1998	1999	2000	2001	2002	
1	Helsinki-Uusimaa	1257	1306	1358	1375	1389	1404	1415	12.61
3	Varsinais-Suomi	435	441	449	451	453	455	456	4.94
4	Satakunta	239	237	234	232	231	230	229	-4.24
5	Kanta-Häme	164	165	165	165	165	166	166	0.93
6	Pirkanmaa	429	435	443	446	448	452	455	6.23
7	Päijät-Häme	208	208	207	207	207	207	207	-0.27
8	Kymenlaakso	190	188	185	184	183	182	182	-4.23
9	Etelä-Karjala	132	131	130	130	130	130	129	-2.18
10	Etelä-Savo	111	110	108	107	107	106	105	-5.10
11	Itä-Savo	72	70	68	67	67	66	65	-8.91
12	Pohjois-Karjala	180	179	176	174	173	172	171	-4.73
13	Pohjois-Savo	259	258	255	254	252	251	250	-3.21
14	Keski-Suomi	259	261	263	263	264	265	265	2.32
15	Etelä-Pohjanmaa	202	201	198	197	196	195	195	-3.91
16	Vaasa	167	167	167	166	166	166	166	-0.51
17	Keski-Pohjanmaa	79	80	79	79	78	78	77	-2.33
18	Pohjois-Pohjanmaa	354	361	365	367	369	372	374	5.70
19	Kainuu	92	91	88	87	86	84	83	-9.27
20	Länsi-Pohja	72	72	70	69	69	68	67	-7.20
21	Lappi	130	130	127	125	123	121	121	-7.26
22	Åland	25	25	26	26	26	26	26	5.06
Region South		1579	1625	1673	1689	1702	1715	1726	9.34
South-West		699	704	708	709	709	710	711	1.81
West		1170	1176	1180	1181	1183	1185	1189	1.62
East		880	879	870	866	862	860	857	-2.60
North		727	733	728	726	725	723	723	-0.67
Entire country		5055	5117	5160	5171	5181	5195	5206	2.99

On 31 December 2002, there were 5.206 million inhabitants in Finland (Table 1). During the past ten years the population has increased rapidly in the southern region. In the eastern and northern regions, the populations have correspondingly decreased. Since 1992, the populations have increased in seven healthcare districts and decreased in 14.

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

Figure 1. Healthcare districts and regions in Finland
Finnish Registry for Kidney Diseases 2002

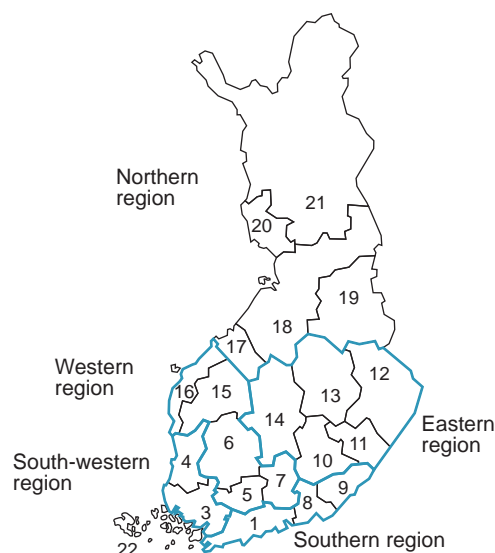


Table 2. The Finnish population according to region, age group, and gender
Finnish Registry for Kidney Diseases 2002

Region		Age group (years)					Entire country
		0–19 (%)	20–44 (%)	45–64 (%)	65–74 (%)	>75 (%)	
South	Men	208 (25)	313 (38)	227 (27)	55 (7)	30 (4)	833 (100)
	Women	200 (22)	312 (35)	243 (27)	70 (8)	68 (8)	893 (100)
	Total	408 (24)	625 (36)	470 (27)	125 (7)	98 (6)	1726 (100)
South-West	Men	83 (24)	115 (33)	100 (29)	29 (8)	18 (5)	346 (100)
	Women	79 (22)	113 (31)	100 (27)	36 (10)	38 (10)	366 (100)
	Total	163 (23)	228 (32)	200 (28)	65 (9)	56 (8)	711 (100)
West	Men	144 (25)	194 (33)	165 (28)	48 (8)	30 (5)	581 (100)
	Women	138 (23)	182 (30)	165 (27)	60 (10)	62 (10)	608 (100)
	Total	283 (24)	376 (32)	330 (28)	107 (9)	92 (8)	1189 (100)
East	Men	103 (24)	134 (32)	126 (30)	37 (9)	22 (5)	422 (100)
	Women	99 (23)	126 (29)	119 (27)	46 (10)	45 (10)	435 (100)
	Total	203 (24)	260 (30)	245 (29)	83 (10)	67 (8)	857 (100)
North	Men	99 (27)	120 (33)	99 (27)	28 (8)	16 (4)	362 (100)
	Women	95 (26)	109 (30)	94 (26)	33 (9)	29 (8)	360 (100)
	Total	194 (27)	229 (32)	194 (27)	61 (8)	45 (6)	723 (100)
Entire country	Men	638 (25)	876 (34)	718 (28)	197 (8)	116 (5)	2545 (100)
	Women	612 (23)	842 (32)	721 (27)	244 (9)	242 (9)	2661 (100)
	Total	1250 (24)	1718 (33)	1439 (28)	441 (8)	358 (7)	5206 (100)

Table 2 shows the distribution of the Finnish population according to region, age, and gender. In the southern region, the proportion of 20- to 64-year-olds was the largest (63%) and that of inhabitants older than 65 years was the smallest (13%). In the other regions, the average corresponding proportions were 59% and 17%.

In Figure 2, the incidence of renal replacement therapy (RRT, i.e. dialysis and kidney transplantation) in 1992–2002 is shown regionally as smoothed averages. The incidence rates are age- and gender-standardized using the Finnish population on 31 December 2002 as a reference population. The population changes in 1992–2002 have been considered. Standardization removes the effect of age and gender on the regional differences in incidence rates. In the entire country, the incidence has remained virtually unchanged since 1998.

Figure 2. Standardized incidence of RRT in regions
Finnish Registry for Kidney Diseases 1992–2002

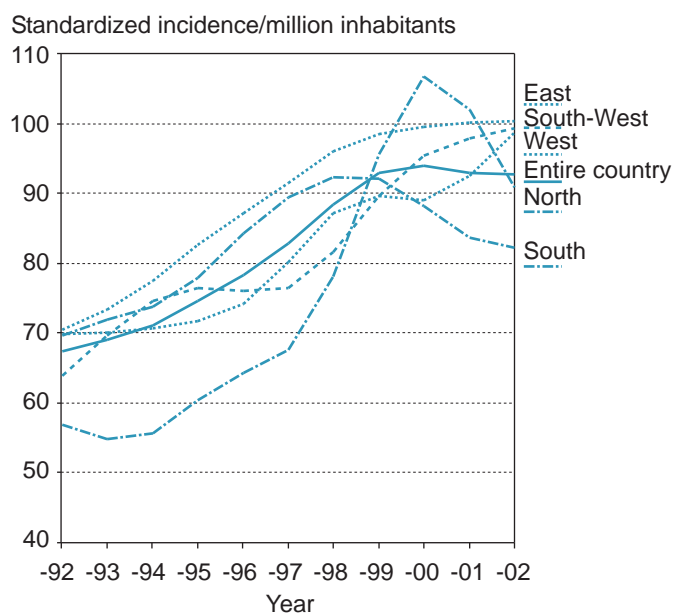


Table 3. Number of new RRT patients and incidence of RRT by healthcare district and region
Finnish Registry for Kidney Diseases 1998–2002

Healthcare district	Number of new RRT patients						Incidence of RRT/million inhabitants					
	1998	1999	2000	2001	2002	1998–2002 on average	1998	1999	2000	2001	2002	1998–2002 on average
1 Helsinki-Uusimaa	125	117	109	101	108	112	92	85	78	72	76	81
3 Varsinais-Suomi	42	44	44	44	39	43	94	98	97	97	85	94
4 Satakunta	20	18	26	24	33	24	86	77	113	105	144	105
5 Kanta-Häme	16	15	16	18	14	16	97	91	97	109	84	96
6 Pirkanmaa	49	50	52	45	43	48	111	112	116	100	94	107
7 Päijät-Häme	14	19	13	19	31	19	68	92	63	92	149	93
8 Kymenlaakso	12	16	16	14	19	15	65	87	87	77	105	84
9 Etelä-Karjala	11	13	20	9	7	12	84	100	154	69	54	92
10 Etelä-Savo	10	5	6	11	7	8	93	47	56	104	67	73
11 Itä-Savo	16	10	8	4	6	9	234	148	120	61	92	131
12 Pohjois-Karjala	14	15	16	16	25	17	80	86	92	93	146	99
13 Pohjois-Savo	34	27	36	38	29	33	133	106	143	151	116	130
14 Keski-Suomi	21	27	24	24	21	23	80	103	91	91	79	89
15 Etelä-Pohjanmaa	15	17	16	17	28	19	76	86	82	87	144	95
16 Vaasa	17	9	5	7	12	10	102	54	30	42	72	60
17 Keski-Pohjanmaa	7	8	7	6	3	6	89	102	90	77	39	79
18 Pohjois-Pohjanmaa	22	35	39	49	28	35	60	95	106	132	75	94
19 Kainuu	6	12	12	8	12	10	68	138	140	95	144	117
20 Länsi-Pohja	4	7	9	7	5	6	57	101	131	103	74	93
21 Lappi	8	7	16	7	6	9	63	56	130	58	50	71
22 Åland	1	1	4	2	1	2	39	39	155	77	38	70
Region South	148	146	145	124	134	139	88	86	85	72	78	82
South-West	63	63	74	70	73	69	89	89	104	99	103	97
West	111	110	102	106	128	111	94	93	86	89	108	94
East	95	84	90	93	88	90	109	97	104	108	103	104
North	47	69	83	77	54	66	65	95	114	106	75	91
Entire country	464	472	494	470	477	475	90	91	95	90	92	92
Children <15 y	9	17	8	11	8	11	9	18	9	12	9	11

The number of new RRT patients and the incidence of RRT are shown according to healthcare district and region in Table 3. In the entire country, the incidence has increased 2% during the past five years. In the south-western, western, and northern regions, the incidence was 14–16% greater in 2002 than in 1998. In the southern region, the incidence had decreased by 12%, and in the eastern region by 6%. In 1998–2002, the average incidence was largest in the eastern region and smallest in the southern region. In the healthcare districts, the five-year average incidence was 60–131 new RRT patients/million inhabitants.

In Figure 3, the age- and gender-standardized incidence of RRT 90 days after start of RRT is shown regionally as smoothed averages. The Finnish Registry for Kidney Diseases does not store data on patients who have regained renal function before 90 days after start of RRT. In Figure 3, data on patients who have died or moved abroad within 90 days after start of RRT have also been excluded.

Figure 3. Standardized incidence of RRT in regions
90 days after start of RRT
Finnish Registry for Kidney Diseases 1992–2002

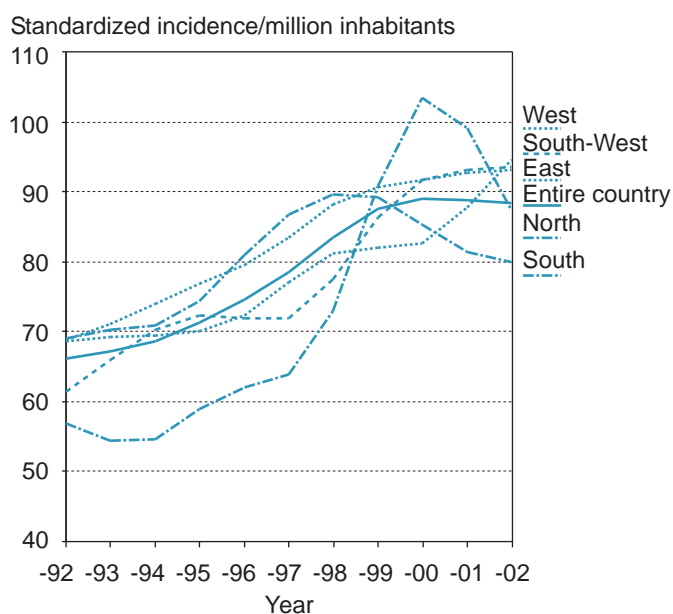
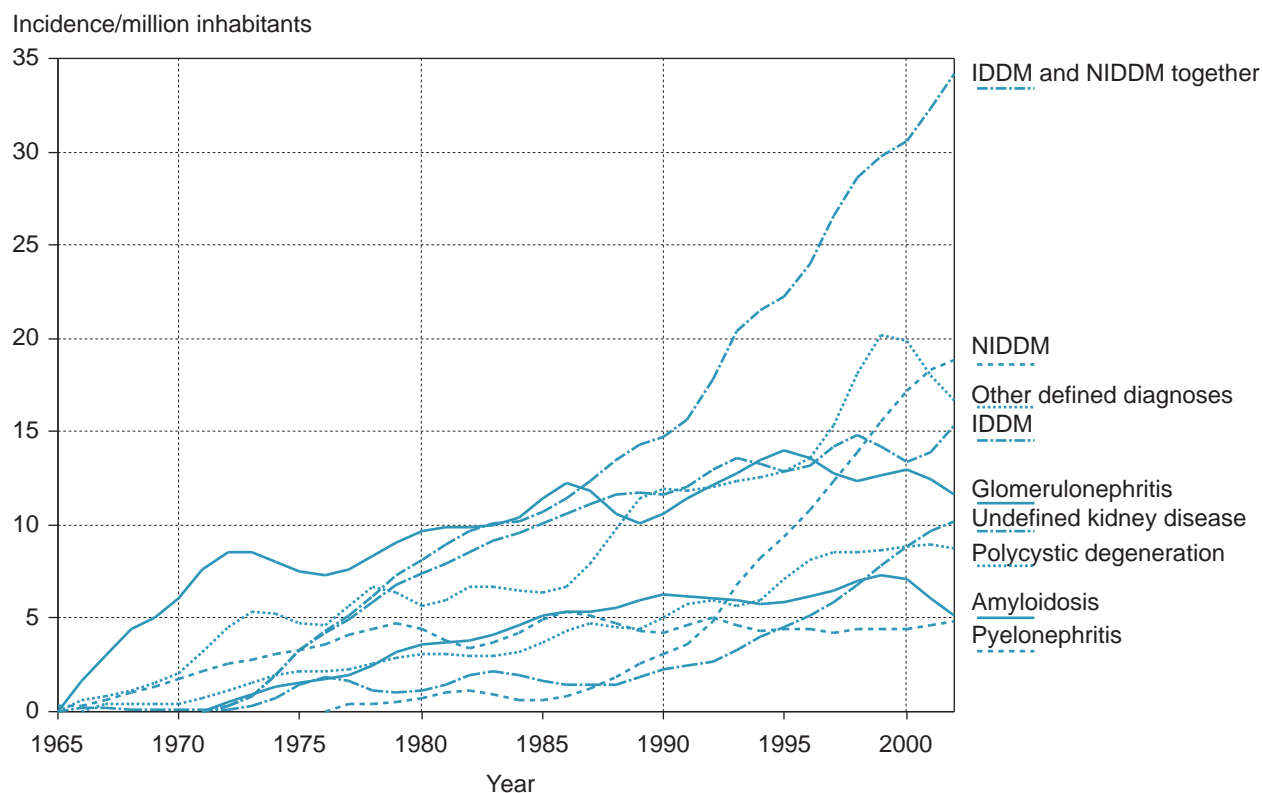


Figure 4. Incidence of RRT according to diagnosis
Finnish Registry for Kidney Diseases 1965–2002



The incidence of RRT according to diagnosis is shown as smoothed averages in Figure 4. Insulin-dependent diabetes mellitus (IDDM) and Non-IDDM (NIDDM) are the most common diseases causing chronic uremia. In 2002, 40% of all new RRT patients were diabetes patients; in 1992, the corresponding proportion was 25%. The rate of new

glomerulonephritis patients has remained virtually unchanged during the past ten years. The group “other defined diagnoses” includes nephrosclerosis, other systemic diseases, urinary tract obstruction, congenital diseases, and tubulointerstitial nephritis.

Figure 5. International comparison of incidence of RRT in 2001
Finnish Registry for Kidney Diseases 2001

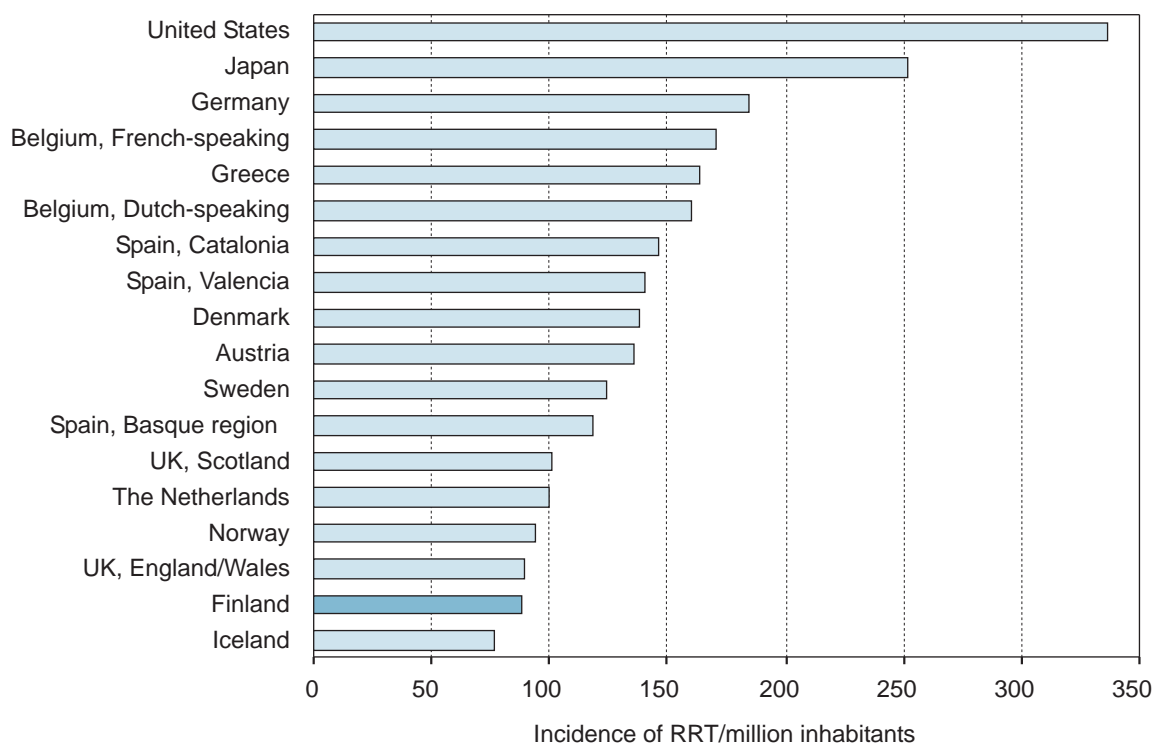


Figure 5 shows the incidence of RRT in 2001 in countries reporting to the ERA-EDTA Registry (<http://www.era-edta-reg.org>) and in Germany, Japan, and the United States (USRDS, Report 2003). The incidence of RRT in Finland was the second lowest. In Denmark and Sweden, the

incidence had increased faster than in Finland. In 2001, the incidence rates in Denmark and Sweden were 57% and 41% larger than in Finland, respectively, while one year earlier the corresponding figure was 36% for both countries.

Table 4. Patients in RRT at end of year according to healthcare district and region
Finnish Registry for Kidney Diseases 1998–2002

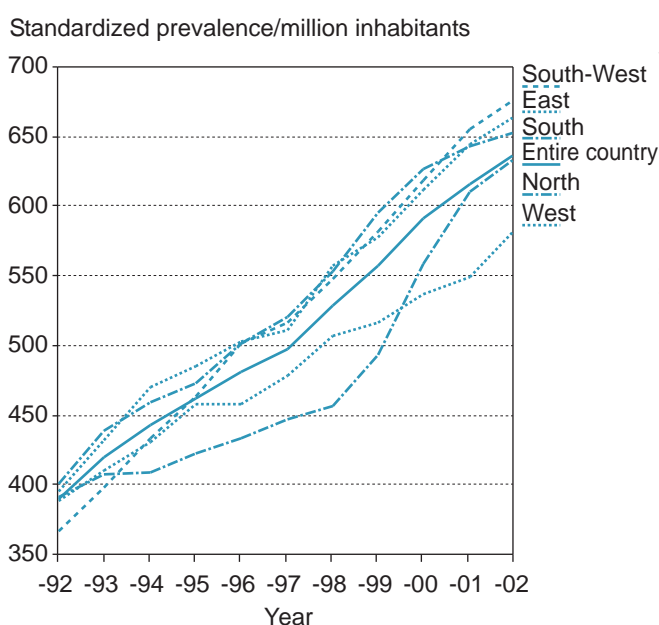
Healthcare district		Number of RRT patients					Prevalence of RRT/million inhabitants				
		1998	1999	2000	2001	2002	1998	1999	2000	2001	2002
1	Helsinki-Uusimaa	728	793	835	862	888	536	577	601	614	628
3	Varsinais-Suomi	240	265	282	294	294	535	587	623	647	644
4	Satakunta	130	134	147	163	181	556	576	637	710	791
5	Kanta-Häme	64	65	73	83	87	388	393	442	501	524
6	Pirkanmaa	261	278	295	308	311	589	624	658	681	683
7	Päijät-Häme	102	103	104	102	120	493	498	503	493	579
8	Kymenlaakso	92	95	96	102	106	497	516	525	560	583
9	Etelä-Karjala	60	68	83	87	87	460	524	640	671	672
10	Etelä-Savo	47	47	52	60	62	435	438	488	566	590
11	Itä-Savo	41	43	46	45	45	600	637	691	683	689
12	Pohjois-Karjala	92	92	101	109	119	524	528	583	632	694
13	Pohjois-Savo	186	199	210	223	230	729	784	833	888	919
14	Keski-Suomi	119	124	128	132	132	452	471	485	499	498
15	Etelä-Pohjanmaa	82	88	91	91	103	414	446	464	467	529
16	Vaasa	85	74	74	72	81	509	445	446	434	489
17	Keski-Pohjanmaa	28	32	35	36	32	355	408	448	464	413
18	Pohjois-Pohjanmaa	154	169	198	227	240	422	461	536	610	642
19	Kainuu	41	49	53	54	60	467	564	618	639	719
20	Länsi-Pohja	30	31	38	43	47	429	448	554	634	700
21	Lappi	62	61	65	67	68	489	488	528	551	564
22	Åland	17	16	17	19	18	663	622	660	731	686
Region	South	880	956	1014	1051	1081	526	566	596	613	626
	South-West	387	415	446	476	493	546	585	629	670	693
	West	594	608	637	656	702	503	515	539	553	590
	East	485	505	537	569	588	557	583	623	661	686
	North	315	342	389	427	447	432	471	537	590	619
Entire country		2661	2826	3023	3179	3311	516	546	583	612	636

The number of RRT patients and the prevalence of RRT on 31 December 1998–2002 are shown in Table 4. In 2002, the prevalence was higher than in 1998 in all healthcare districts but one. In the entire country, the prevalence has increased by 23% since 1998. On 31 December 2002, the prevalence was highest in the south-western region and lowest in the western region. During the past five years the prevalence has increased the most in the northern region (43%) and the least in the western region (17%).

Table 5. Patients in RRT at end of 2002 according to region, age group, and gender
Finnish Registry for Kidney Diseases 2002

Region		Number of RRT patients						Prevalence of RRT/million inhabitants					
		0– 19 y	20– 44 y	45– 64 y	65– 74 y	>75 y	All	0– 19 y	20– 44 y	45– 64 y	65– 74 y	>75 y	All
South	Men	25	124	318	106	38	611	120	396	1399	1943	1260	733
	Women	15	112	208	93	42	470	75	359	857	1326	619	526
	Total	40	236	526	199	80	1081	98	378	1119	1596	816	626
South-West	Men	9	59	129	64	16	277	108	512	1293	2203	887	801
	Women	7	43	89	57	20	216	88	382	889	1588	529	591
	Total	16	102	218	121	36	493	98	448	1091	1863	644	693
West	Men	18	94	214	80	29	435	125	485	1294	1676	967	748
	Women	10	70	115	41	31	267	72	384	697	688	497	440
	Total	28	164	329	121	60	702	99	436	996	1127	649	590
East	Men	19	90	177	67	27	380	184	672	1407	1798	1237	900
	Women	7	44	91	52	14	208	71	348	762	1141	313	478
	Total	26	134	268	119	41	588	128	515	1093	1437	615	686
North	Men	8	58	133	41	18	258	81	484	1337	1456	1156	712
	Women	4	50	78	41	16	189	42	458	829	1256	544	525
	Total	12	108	211	82	34	447	62	471	1090	1349	756	619
Entire country	Men	79	425	971	358	128	1961	124	485	1353	1819	1107	771
	Women	43	319	581	284	123	1350	70	379	805	1164	508	507
	Total	122	744	1552	642	251	3311	98	433	1078	1457	701	636

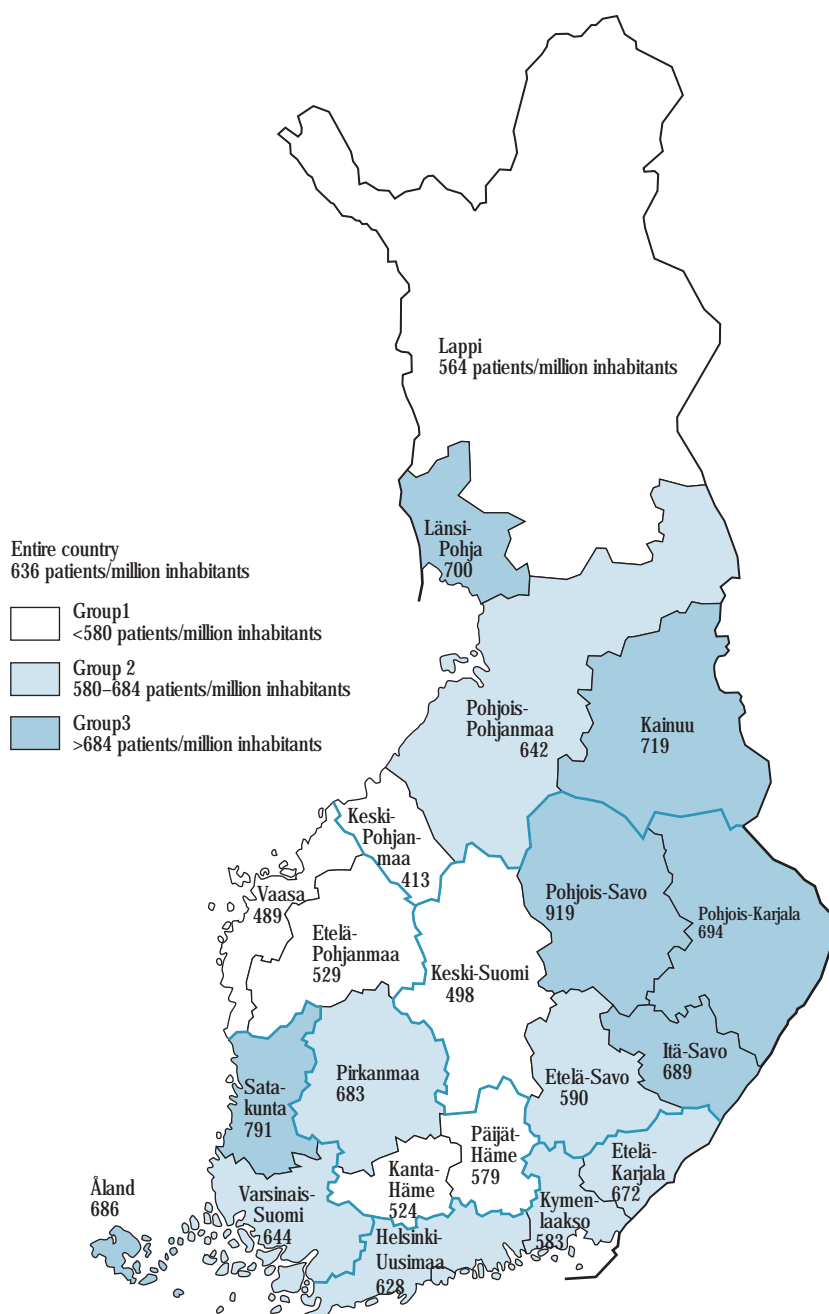
Figure 6. Standardized prevalence of RRT in regions
Finnish Registry for Kidney Diseases 1992–2002



The number of RRT patients in the regions on 31 December 2002 is shown according to age group and gender in Table 5. In the entire country, prevalence was 52% higher among men than women. Prevalence was highest in 65- to 74-year-olds (1457 patients/million age-matched inhabitants) and lowest in those younger than 20 years (98 patients/million age-matched inhabitants).

In Figure 6, the prevalence rates for 1992–2002 are age- and gender-standardized using the Finnish population on 31 December 2002 as a reference population. The population changes during this period have been considered. Standardization removes the effect of age and gender on the regional differences in prevalence rates.

Figure 7. Prevalence of RRT in healthcare districts on 31 December 2002
Finnish Registry for Kidney Diseases 2002



The healthcare districts shown on the map are grouped according to the prevalence of RRT at the end of 2002 (Figure 7). The prevalence was <580 in seven districts, 580–684 in seven districts, and >684 patients/million inhabitants in seven districts. The borders of the regions are indicated with thick lines.

Figure 8. Prevalence of RRT at end of year according to type of treatment
Finnish Registry for Kidney Diseases 1965–2002

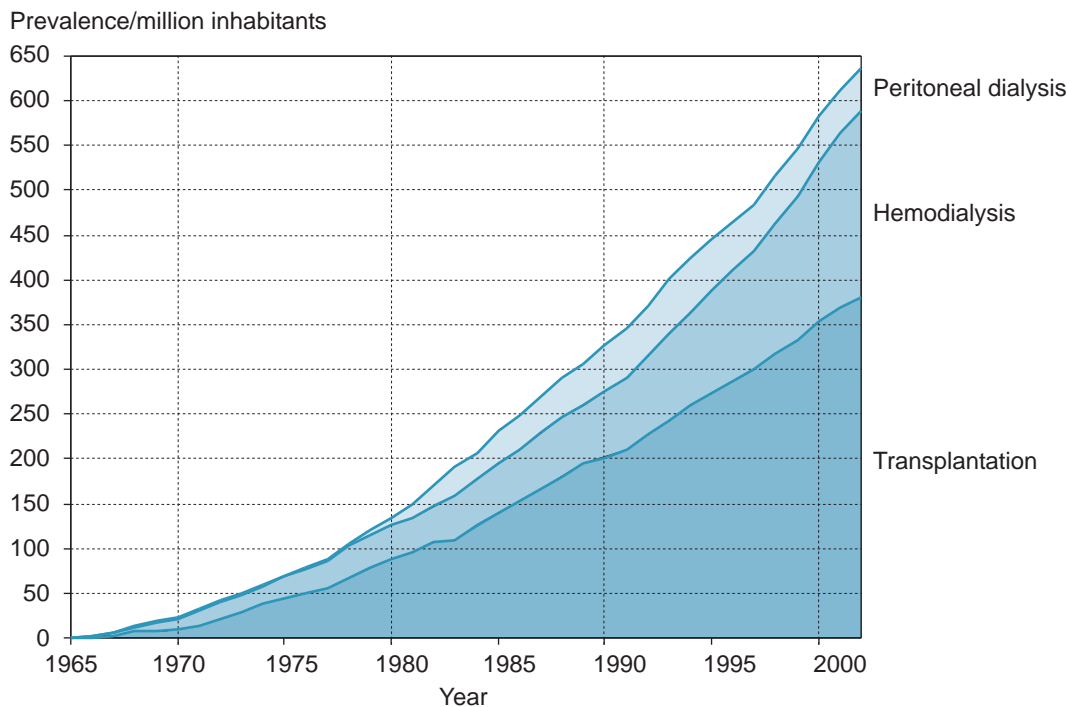


Figure 9. Prevalence of RRT at end of year according to diagnosis
Finnish Registry for Kidney Diseases 1965–2002

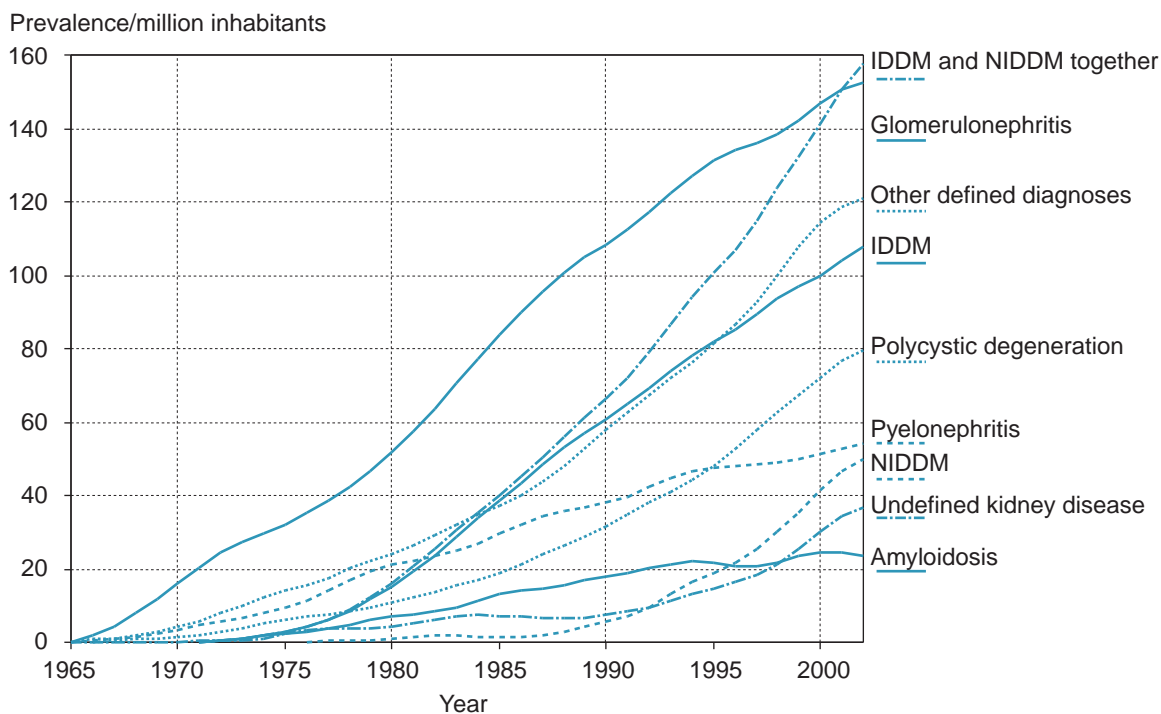


Figure 8 shows prevalence of RRT according to type of treatment. The numbers of hemodialysis patients and patients with a kidney transplant have increased continuously since 1965. During the past ten years the number of patients on peritoneal dialysis has remained unchanged.

Prevalence of RRT according to diagnosis is shown as smoothed averages in Figure 9. Until 2001, glomerulonephritis was the most common cause of chronic uremia,

but at the end of 2002 the most common kidney diagnosis of RRT patients was diabetes (prevalence rate 163/million inhabitants). At the end of 2002, 26% of all RRT patients had diabetes; ten years earlier this proportion was 21%. The group “other defined diagnoses” includes nephrosclerosis, other systemic diseases, urinary tract obstruction, congenital diseases, and tubulointerstitial nephritis.

Figure 10. International comparison of prevalence of RRT on 31 December 2001
Finnish Registry for Kidney Diseases 2001

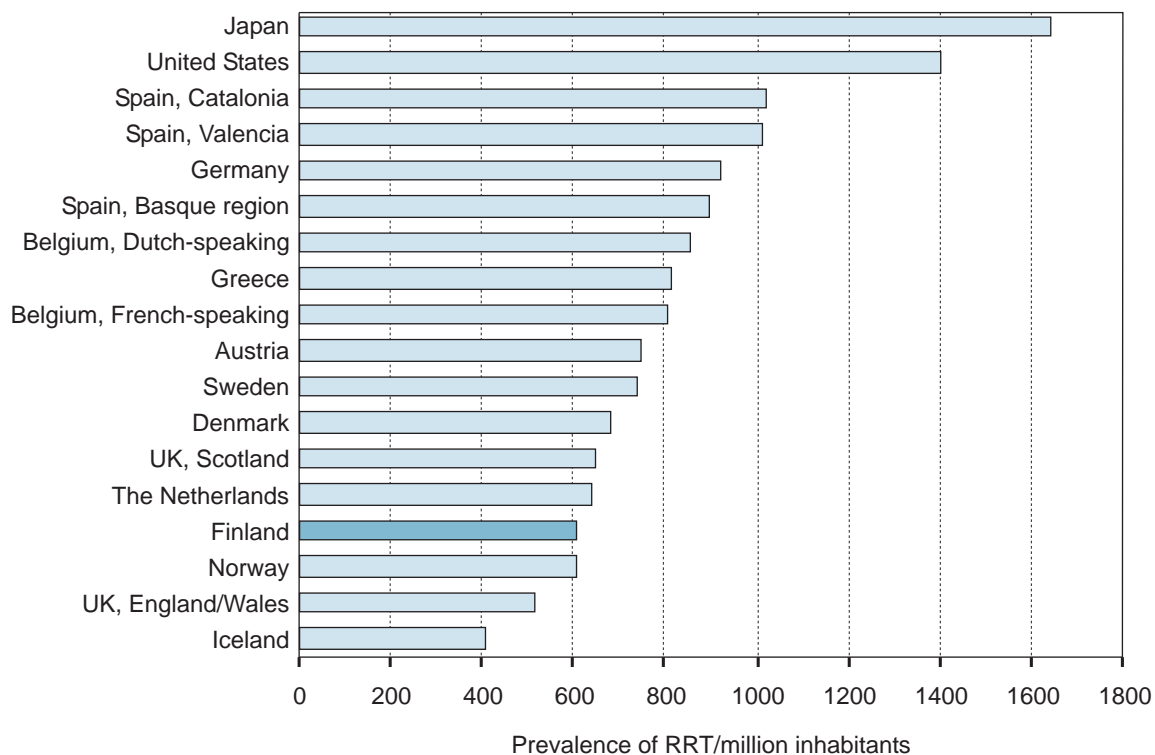
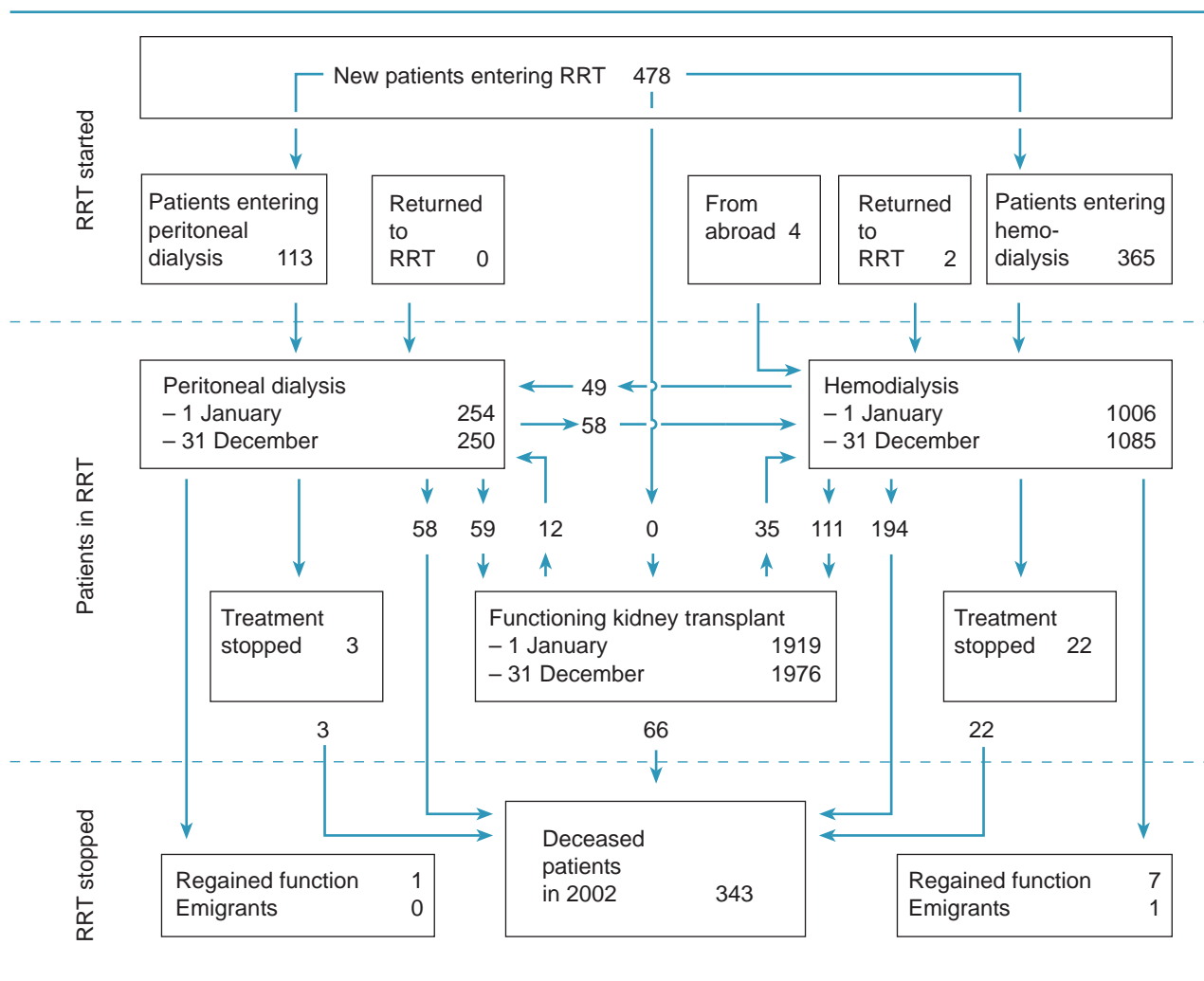


Figure 10 displays the prevalence of RRT in 2001 in countries reporting to the ERA-EDTA Registry (<http://www.era-edta-reg.org>) and in Germany, Japan, and the United States (USRDS, Report 2003). The prevalence rate in Finland was the fourth lowest. In Norway, the prevalence rate was only marginally lower than in Finland. In Denmark and Sweden, the prevalence rates were 11% and 21% higher than the Finnish rate, respectively. International incidence rates are shown in Figure 5.

Figure 11. Net changes in type of treatment
Finnish Registry for Kidney Diseases 2002



During 2002, 478 new patients entered RRT (Figure 11). In addition, two patients returned to RRT and four patients came from abroad. In all, 3179 patients were receiving RRT at the beginning of the year. Altogether 343 patients died and dialysis for eight patients was discontinued because the patients' own kidney function resumed. Of those who

died, 66 had a functioning transplant, 58 were receiving peritoneal dialysis, and 194 were on hemodialysis. The RRT of 25 uremic patients was discontinued, and all of these died during 2002. In addition, two uremic patients whose RRT was discontinued in 2001 died in 2002 (not shown in Figure 11). A kidney transplant was received by 170 patients.

Table 6. Mortality of RRT patients by region
Finnish Registry for Kidney Diseases 1997–2002

Region	Deaths/1000 patient-years							Deaths/1000 patient-years ¹⁾						
	1997	1998	1999	2000	2001	2002	1997–2002	1997	1998	1999	2000	2001	2002	1997–2002
South	118	97	77	87	81	90	91	109	94	71	80	75	86	86
South-West	83	101	94	96	78	97	91	75	93	89	91	67	90	84
West	122	132	154	107	125	114	126	115	122	133	97	117	107	115
East	123	119	115	111	101	103	112	112	106	105	101	83	99	101
North	105	126	123	88	93	85	103	102	120	102	85	81	81	95
Entire country	113	113	109	97	95	97	104	105	105	97	90	85	93	96

¹⁾Patients who died before 90 days after start of RRT were excluded from analysis

Figure 12. Standardized mortality of RRT patients in regions
Finnish Registry for Kidney Diseases 1992–2002

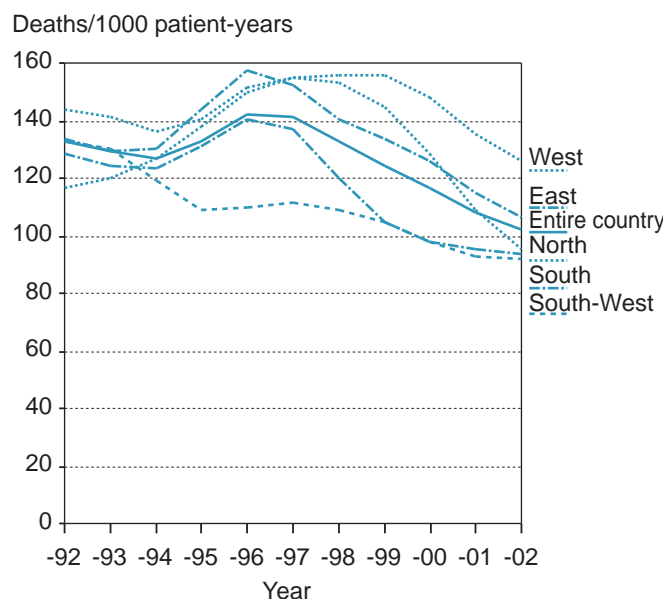
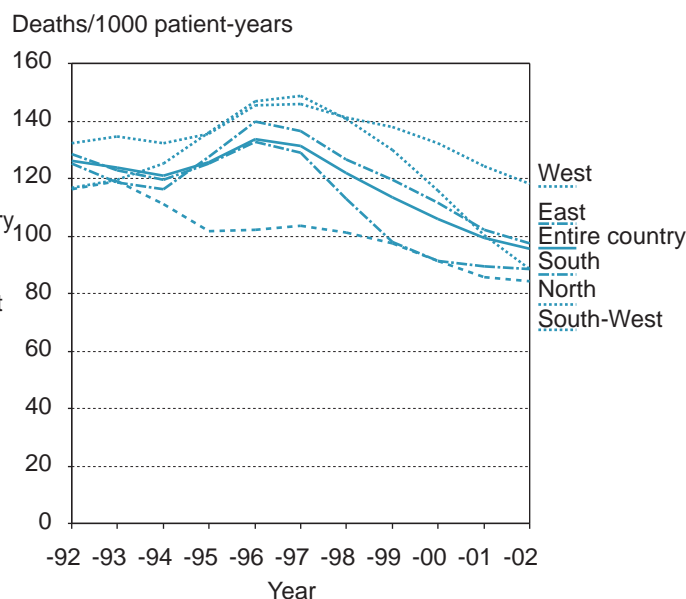


Figure 13. Standardized mortality of RRT patients in regions (patients who died before 90 days after start of RRT were excluded from analysis)
Finnish Registry for Kidney Diseases 1992–2002



RRT patients' mortality according to region is presented in Table 6. Regional differences in mortality have been speculated to be partially caused by hospitals' different practices of reporting patients who die after a short period in dialysis to the Finnish Registry for Kidney Diseases. Table 6 shows the mortality of patients who have been in RRT at least 90 days separately. The average mortality in 1997–2002 was highest in the western region and lowest in the south-western region.

In Figures 12 and 13, mortality in the regions is shown as smoothed averages. The regional mortality rates for

1992–2002 have been age- and gender-standardized using all patient-years in 2002 as a reference population. The changes in age and gender distribution in this ten-year period have been considered. In the entire country, the standardized mortality rate was 26% lower in 2002 than in 1992. When patients who died within 90 days from start of RRT were excluded (Figure 13), the standardized mortality rate was 25% lower in 2002 than in 1992.

Table 7. Number of patient-years according to diagnosis
Finnish Registry for Kidney Diseases 1997–2002

Diagnosis	Patient-years (%)				Change (%) 1997–2002
	1997		2002		
Glomerulonephritis	695	(28.5)	800	(24.5)	15
IDDM	448	(18.4)	561	(17.2)	25
Polycystic degeneration	281	(11.5)	416	(12.7)	48
Pyelonephritis	247	(10.1)	284	(8.7)	15
NIDDM	116	(4.8)	258	(7.9)	123
Undefined kidney disease	84	(3.4)	191	(5.8)	127
Nephrosclerosis	96	(3.9)	127	(3.9)	33
Amyloidosis	105	(4.3)	125	(3.8)	19
Urinary tract obstruction	84	(3.4)	111	(3.4)	32
Congenital diseases	78	(3.2)	102	(3.1)	30
Other systemic diseases	77	(3.1)	100	(3.1)	30
Congenital nephrosis, Finnish type	44	(1.8)	55	(1.7)	25
Other kidney diseases	14	(0.6)	54	(1.7)	290
Tubulointerstitial nephritis	51	(2.1)	48	(1.5)	-6
Malignancies	12	(0.5)	18	(0.6)	51
Metabolic diseases	8	(0.3)	13	(0.4)	55
All	2441	(100)	3262	(100)	34

The number of patient-years in 1997 and 2002 according to the diagnosis of different kidney diseases is shown in Table 7. The number of patient-years indicates patients' time in RRT during the year. Glomerulonephritis is the most common diagnosis when IDDM and NIDDM are considered as separate diagnoses. The proportion of glomerulonephritis has decreased constantly since 1997. IDDM is the second

most common diagnosis. The proportion of patient-years due to NIDDM has increased considerably, in 2002 ranking as the fifth most common diagnosis. The proportion of polycystic degeneration has increased and that of pyelonephritis decreased. Overall, the number of patient-years has increased by 34% since 1997.

Figure 14. RRT patients' probability of survival according to RRT start period and age group
Finnish Registry for Kidney Diseases 1965–2002

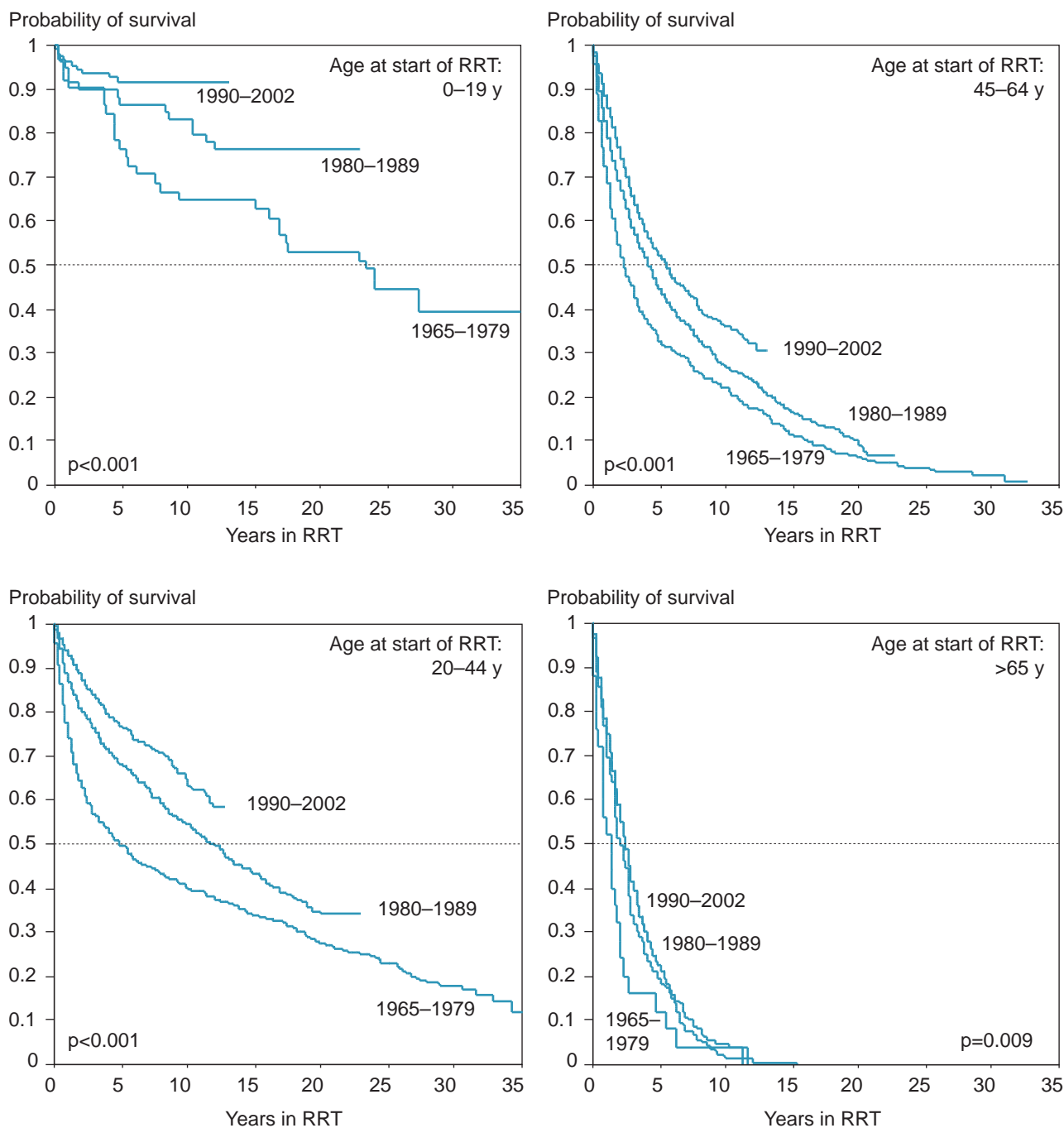


Figure 14 displays RRT patients' probability of survival according to RRT start period and age group. The age groups were included to eliminate the effect of age on survival probability. However, the average age within the age groups was also affected by RRT start period: in the age group of patients younger than 20 years, the average age at start of RRT has decreased over the years, whereas in the other age groups, the average age has increased ($p < 0.001$). Despite this, the survival probabilities for all age groups have improved since 1965.

Table 8. Effect of different variables on RRT patients' survival
Finnish Registry for Kidney Diseases 1998–2002

Variable (before start of RRT)	Change (increase)	P-value	Relative risk	95% confidence interval	N
Age	1 y	<0.001	1.05	(1.04–1.06)	2240
Serum albumin	1 g/l	<0.001	0.94	(0.93–0.95)	2143
Diagnosis		<0.001			2240
	<i>Glomerulonephritis</i>		1 (reference)	–	323
	<i>Polycystic deg.</i>	0.075	0.66	(0.41–1.04)	228
	<i>IDDM</i>	<0.001	2.51	(1.75–3.60)	361
	<i>NIDDM</i>	<0.001	2.20	(1.60–3.00)	394
	<i>Pyelonephritis</i>	0.121	0.63	(0.36–1.13)	114
	<i>Amyloidosis</i>	<0.001	2.75	(1.93–3.92)	147
	<i>Other defined</i>	0.001	1.72	(1.25–2.36)	452
	<i>Undefined</i>	0.026	1.51	(1.05–2.17)	221
Serum creatinine	100 µmol/l	<0.001	0.90	(0.87–0.94)	2196
Serum phosphate	1 mmol/l	<0.001	1.26	(1.12–1.42)	2172
Serum triglycerides	1 mmol/l	0.001	1.12	(1.04–1.19)	923
Diastolic blood pressure	10 mmHg	0.005	0.91	(0.85–0.97)	2148
Weight	10 kg	0.007	0.93	(0.88–0.98)	2173
Hematocrit	1%	0.007	0.98	(0.96–0.99)	2132
Length	10 cm	0.008	0.90	(0.84–0.97)	2113
Body-mass index	1 kg/m ²	0.080	0.98	(0.97–1.00)	2082
Serum C-reactive protein (CRP)	10 mg/l	0.093	1.03	(1.00–1.06)	849
Hemoglobin	10 g/l	0.132	0.93	(0.85–1.02)	1167
Systolic blood pressure	10 mmHg	0.253	0.98	(0.95–1.01)	2148
First treatment (HD vs PD)		0.262	1.12	(0.92–1.37)	2230
Serum HDL cholesterol	1 mmol/l	0.455	0.87	(0.61–1.25)	912
Serum cholesterol	1 mmol/l	0.544	0.98	(0.92–1.04)	1653
Serum urea	10 mmol/l	0.616	0.98	(0.91–1.06)	2189
Glycosylated hemoglobin-A _{1c}	1%	0.706	1.01	(0.97–1.04)	896
Plasma ionized calcium	0.1 mmol/l	0.731	0.91	(0.54–1.54)	2067
Pulse pressure	10 mmHg	0.755	1.01	(0.97–1.05)	2148
Serum LDL cholesterol	1 mmol/l	0.799	0.99	(0.90–1.09)	849
Gender (female vs male)		0.993	1.00	(0.85–1.17)	2240

In Table 8, the Cox regression method was employed to calculate the effect of different variables on patients' survival in RRT. The relative risk was adjusted for age. The variables were sorted in order of importance so that the most significant ones (according to p-value) were listed first. The diagnosis is a group variable in which glomerulonephritis was used as a reference group (relative risk = 1) with which other groups were compared.

Table 9. Multivariate model of RRT patients' survival
Finnish Registry for Kidney Diseases 1998–2002

Variable (before start of RRT)	Change (increase)	P-value	Relative risk	95% confidence interval
Age	1 y	<0.001	1.05	(1.05–1.06)
Serum albumin	1 g/l	<0.001	0.95	(0.94–0.96)
Diagnosis of kidney disease		<0.001		
	<i>Glomerulonephritis</i>		1 (reference)	
	<i>Polycystic degeneration</i>	0.696	0.91	(0.57–1.46)
	<i>IDDM</i>	<0.001	2.53	(1.73–3.70)
	<i>NIDDM</i>	<0.001	2.01	(1.45–2.78)
	<i>Pyelonephritis</i>	0.348	0.75	(0.41–1.36)
	<i>Amyloidosis</i>	<0.001	2.34	(1.62–3.38)
	<i>Other defined diagnosis</i>	0.011	1.63	(1.12–2.37)
	<i>Undefined diagnosis</i>	<0.001	1.90	(1.36–2.64)
Serum phosphate	1 mmol/l	<0.001	1.38	(1.21–1.57)
Serum creatinine	100 µmol/l	<0.001	0.90	(0.86–0.94)

N = 2112

A backward stepwise selection procedure was used to select the variables in Table 9. All variables that were significant ($p < 0.05$) in Table 8 (excluding triglycerides because of the small number of patients) were included in the multivariate modeling. The final model included, in descending order of importance, age, serum albumin, diagnosis of kidney disease, serum phosphate, and serum creatinine.

Figure 15. Kt/V of patients receiving peritoneal dialysis or hemodialysis
Finnish Registry for Kidney Diseases 1999–2002

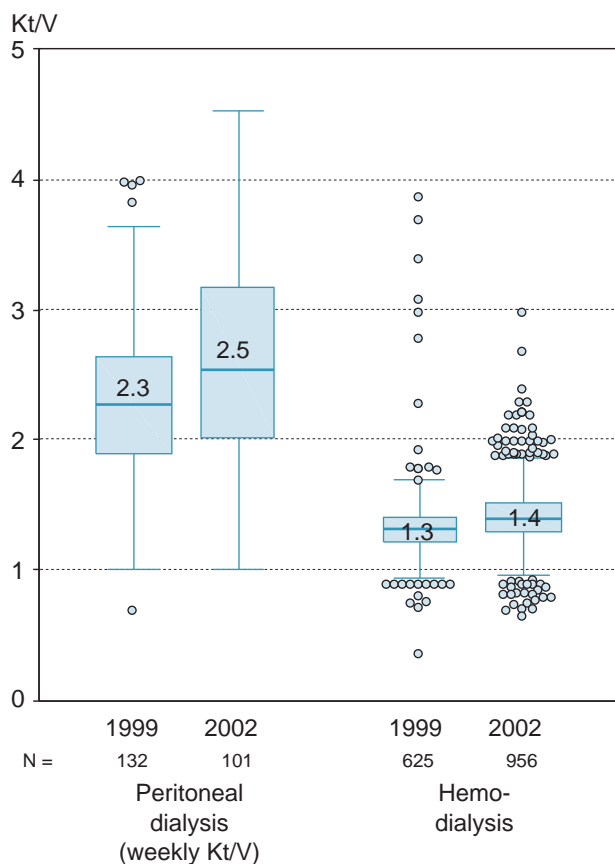
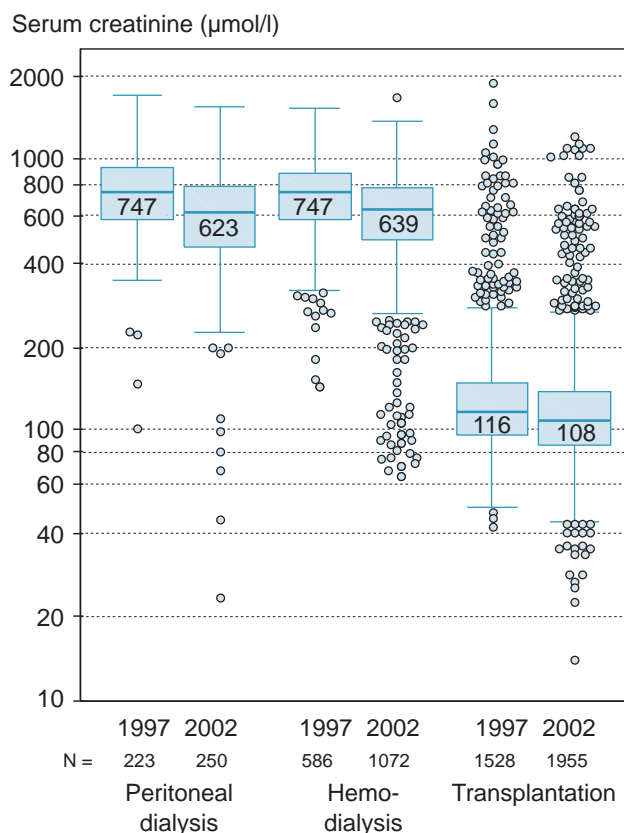


Figure 16. Serum creatinine according to type of treatment
Finnish Registry for Kidney Diseases 1997–2002

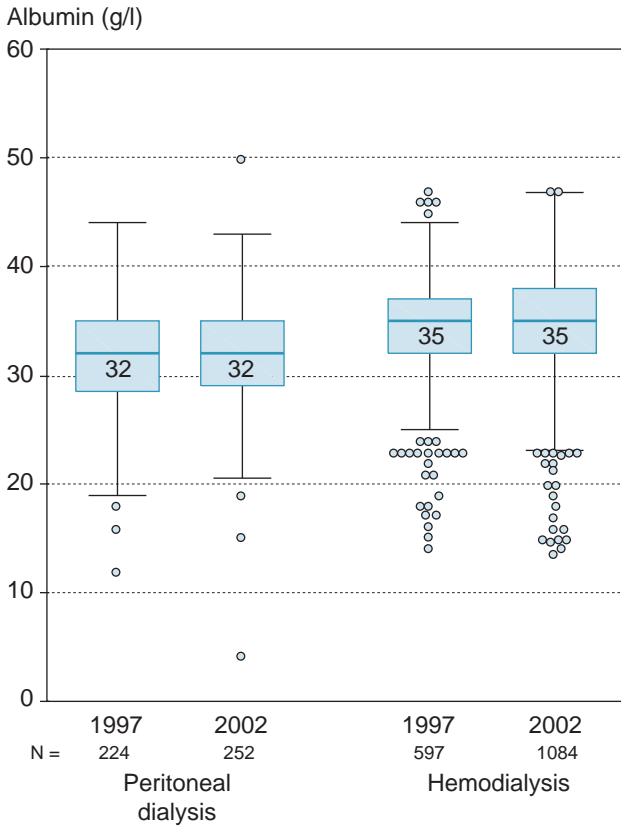


Figures 15 to 26 show laboratory and other variables reported by the hospitals annually for all RRT patients. Dialysis patients' Kt/V values in 1999 and 2002 are presented in Figure 15. The values of patients on hemodialysis and peritoneal dialysis are calculated differently so they cannot be compared. In addition, the reporting hospitals use different

calculation methods. However, the Kt/V values appear to have remained unchanged since 1999.

Dialysis patients' concentration of serum creatinine was somewhat smaller at the end of 2002 than in 1999 (Figure 16). Among transplantation patients, the concentration of serum creatinine has remained virtually unchanged.

Figure 17. Serum albumin according to type of dialysis
Finnish Registry for Kidney Diseases 1997–2002



Dialysis patients' concentration of serum albumin at the end of 1997 and 2002 is shown in Figure 17. The level of serum albumin has not changed within the past five years. Both in 1997 and 2002, hemodialysis patients had a higher concentration of serum albumin than patients on peritoneal dialysis ($p < 0.001$).

The concentration of ionized calcium in plasma has remained constant since 1997 (Figure 18). No differences were present between patients on hemodialysis and those on peritoneal dialysis.

The concentration of serum phosphate was somewhat higher among hemodialysis than among peritoneal dialysis patients in both 1997 ($p < 0.018$) and 2002 ($p < 0.042$) (Figure 19). For both groups, phosphate concentration was lower in 2002 than in 1997.

Figure 18. Ionized calcium in plasma
according to type of dialysis
Finnish Registry for Kidney Diseases 1997–2002

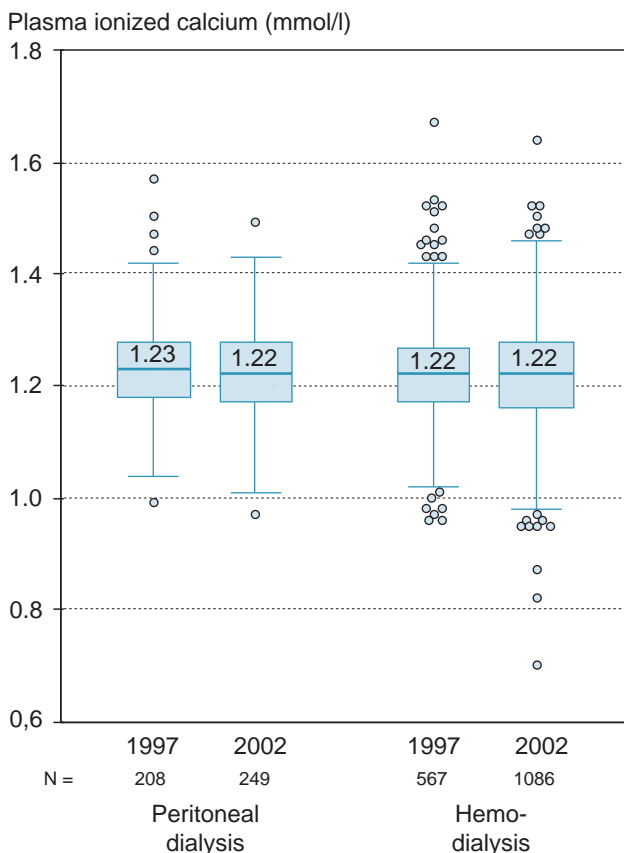


Figure 19. Serum phosphate
according to type of dialysis
Finnish Registry for Kidney Diseases 1997–2002

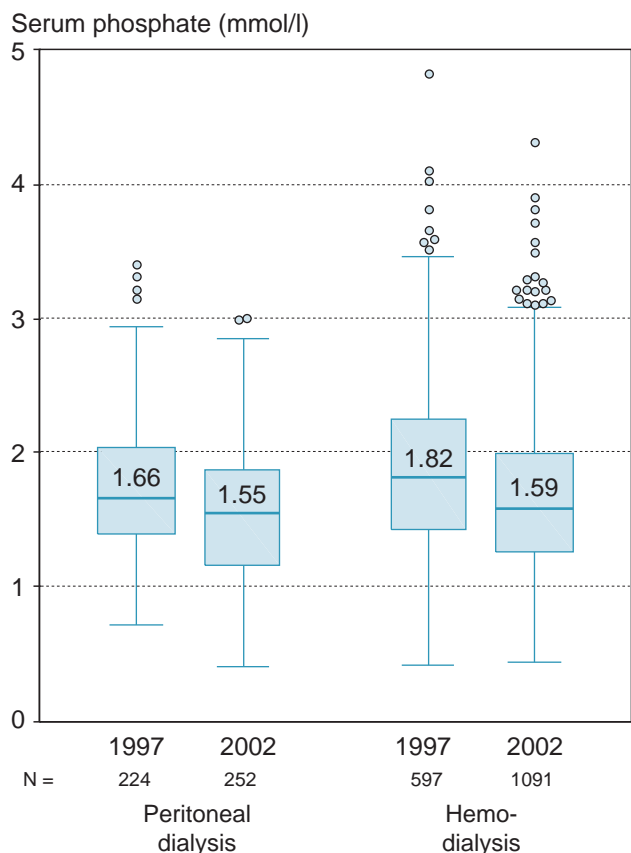


Figure 20. Blood pressure according to type of treatment
Finnish Registry for Kidney Diseases 1997–2002

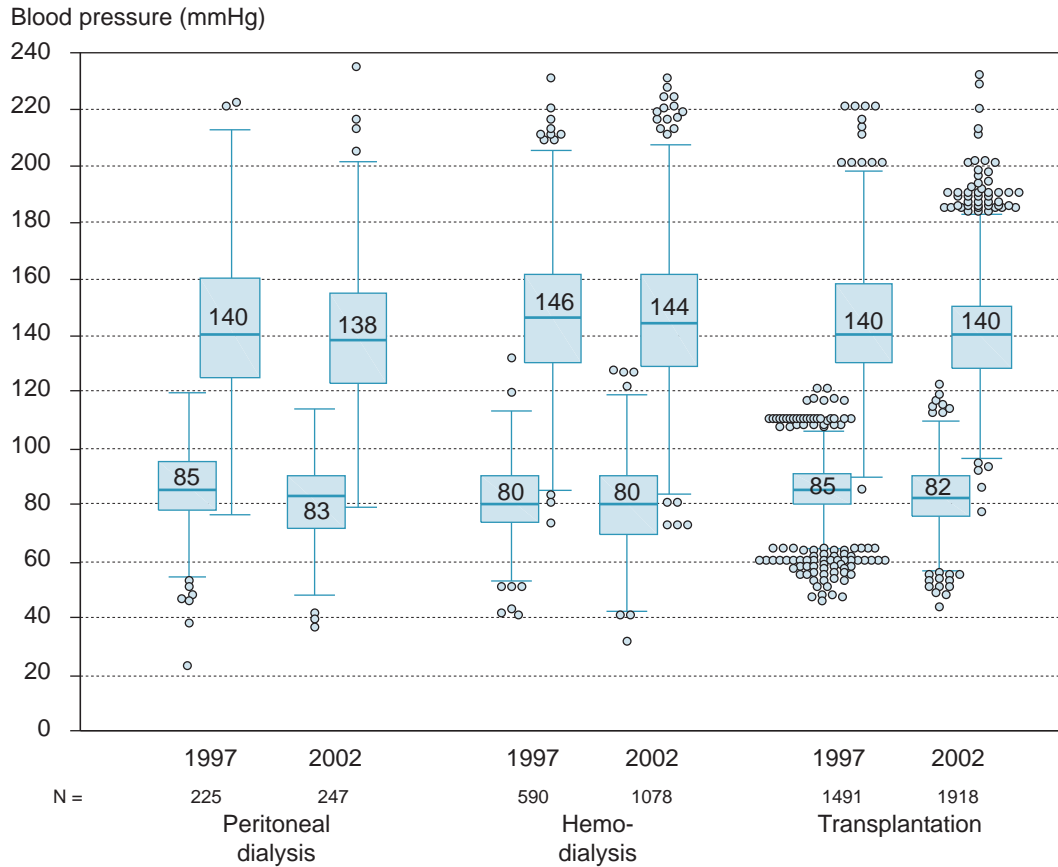
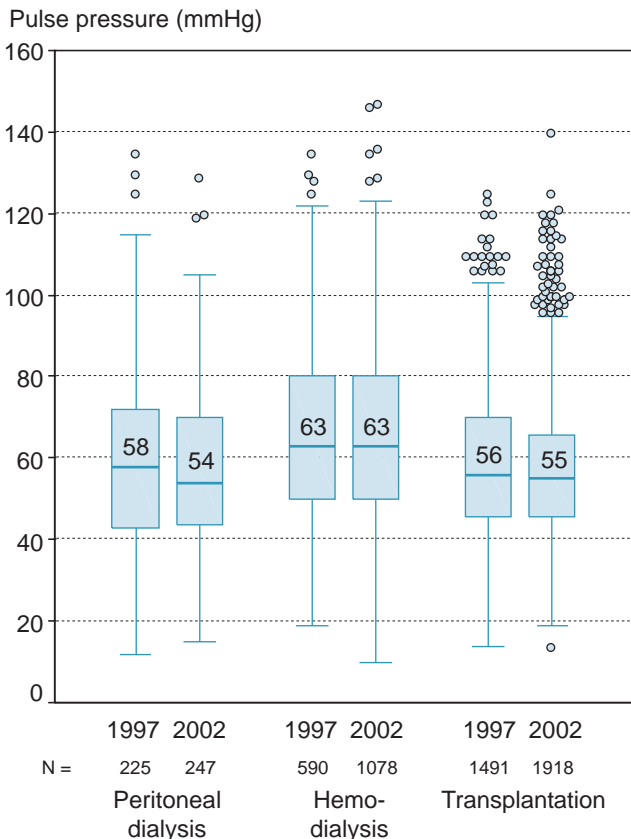


Figure 21. Pulse pressure according to type of treatment
Finnish Registry for Kidney Diseases 1997–2002



RRT patients' blood pressure has remained virtually unchanged since 1997 (Figure 20). At the end of 2002, systolic blood pressure of hemodialysis patients was higher than that of peritoneal dialysis patients ($p < 0.001$) or transplantation patients ($p < 0.001$). Diastolic blood pressure was somewhat lower among hemodialysis patients than other patients ($p < 0.05$).

Pulse pressure is the difference between systolic and diastolic blood pressure (Figure 21). Within the various treatment groups, the pulse pressure did not change considerably since 1997. Hemodialysis patients had a higher pulse pressure than peritoneal dialysis ($p < 0.001$) and transplantation ($p < 0.001$) patients.

Figure 22. Serum cholesterol according to type of treatment
Finnish Registry for Kidney Diseases 1999–2002

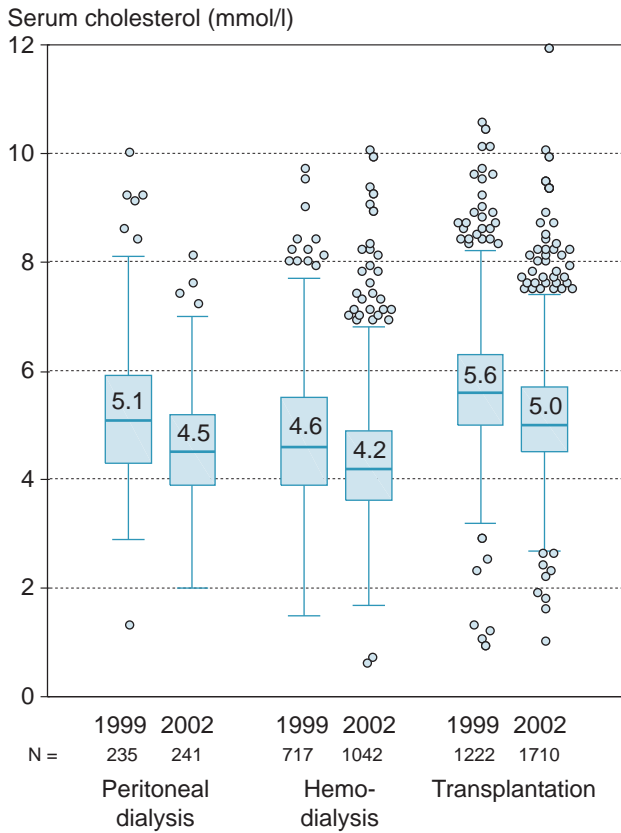
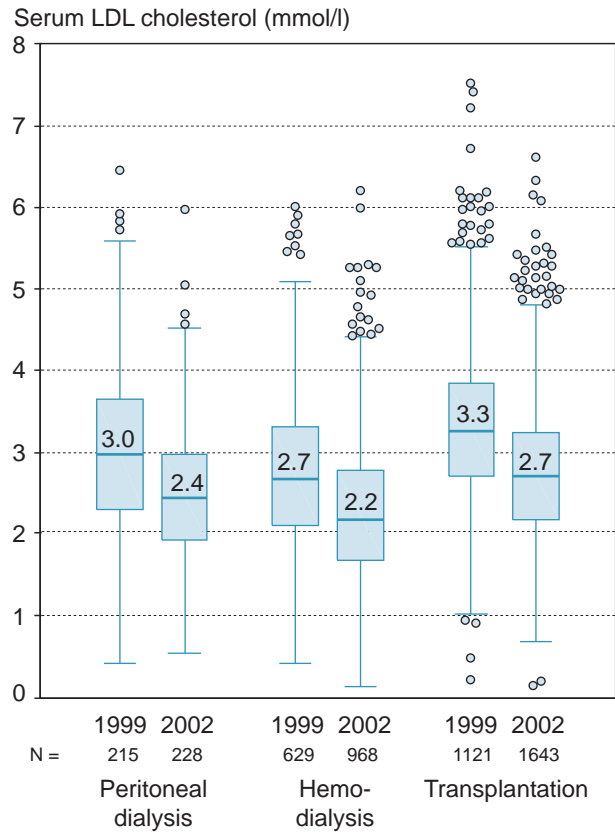


Figure 23. Serum LDL cholesterol according to type of treatment
Finnish Registry for Kidney Diseases 1999–2002

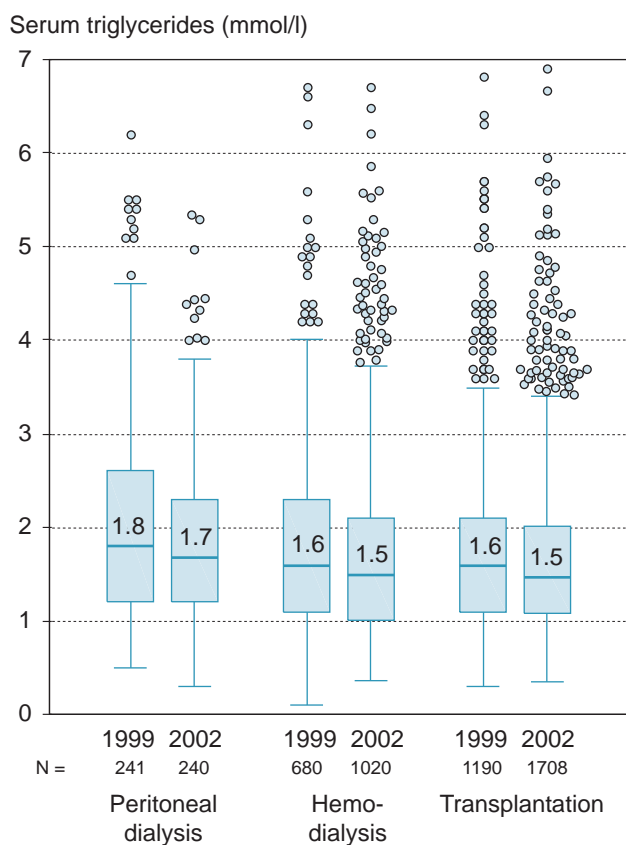


S-LDL is calculated according to Friedewald's formula:
 $S\text{-LDL} = S\text{-kol} - S\text{-HDL} - S\text{-trigl}/2.2$

Figures 22–25 present RRT patients' concentrations of serum lipids at the end of 1999 and 2002. In both years, the concentration of total cholesterol was higher in transplantation patients than in dialysis patients ($p < 0.001$)

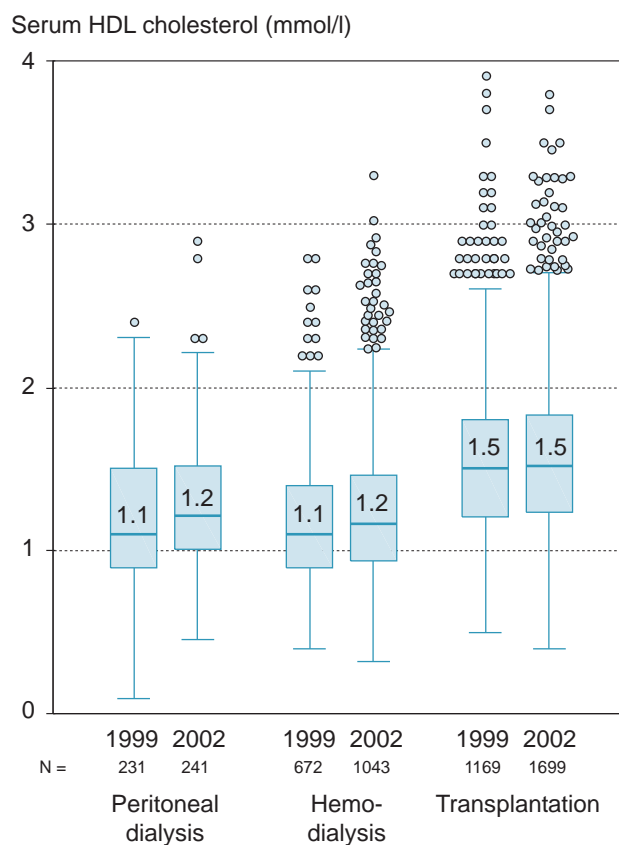
(Figure 22). Since 1999, the concentration of total cholesterol has decreased in all treatment groups. The main explanation for this is that the concentration of LDL cholesterol has dropped in all of these groups (Figure 23).

Figure 24. Serum triglycerides according to type of treatment
Finnish Registry for Kidney Diseases 1999–2002



The concentration of serum triglycerides was higher among peritoneal dialysis patients than among other patients in 1999 and 2002 ($p < 0.01$) (Figure 24). In all treatment groups, the concentration of serum triglycerides had remained virtually unchanged since 1999.

Figure 25. Serum HDL cholesterol according to type of treatment
Finnish Registry for Kidney Diseases 1999–2002



The concentration of HDL cholesterol had also remained fairly constant since 1999 (Figure 25). Transplantation patients had a considerably higher concentration of HDL cholesterol than other patients ($p < 0.001$).

Figure 26. Serum CRP according to type of treatment
Finnish Registry for Kidney Diseases 2002

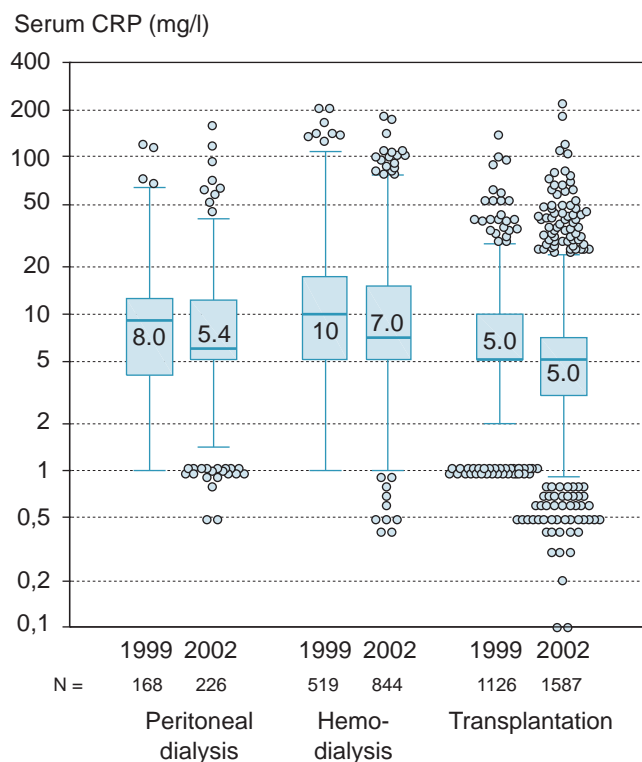
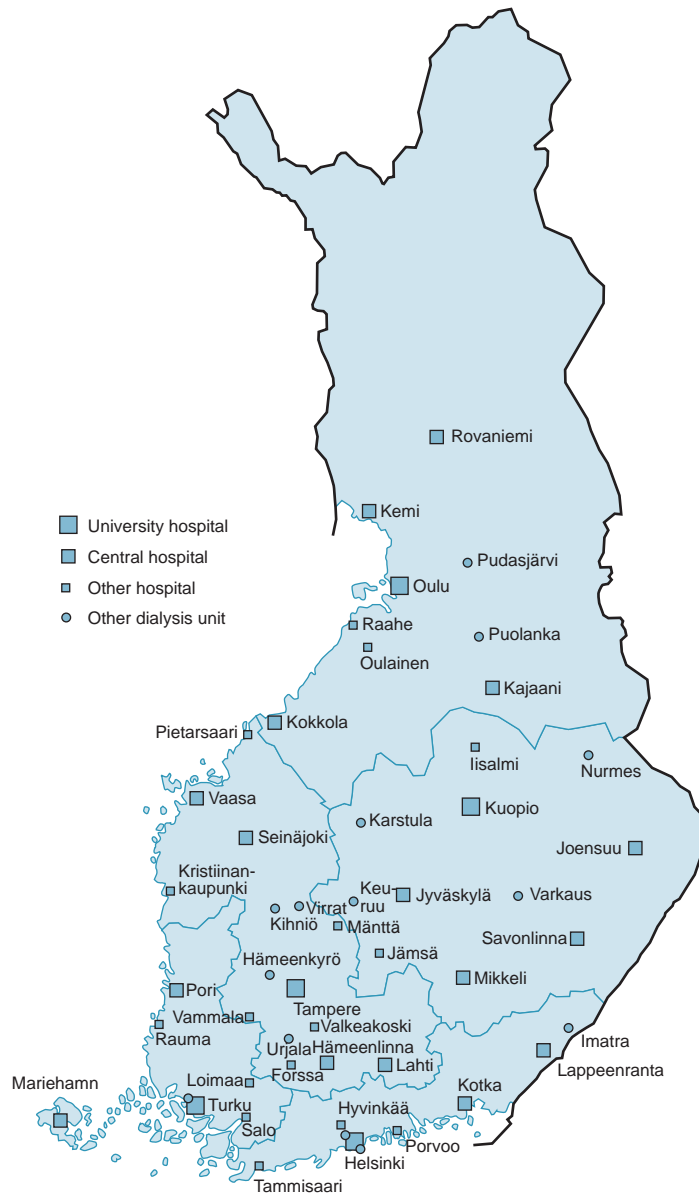


Figure 26 shows RRT patients' concentration of serum C-reactive protein (CRP) at the end of 1999 and 2002. Determination methods have become increasingly sensitive since 1999. As a result, concentrations lower than 1 mg/l are seen in 2002. In 1999, hemodialysis patients had higher concentrations of CRP than peritoneal dialysis ($p < 0.001$) and transplantation ($p < 0.001$) patients. In 2002, no significant difference was present in CRP concentrations between hemodialysis and peritoneal dialysis patients.

- Age
at end of year 1999:10, 2000:11, 2001:7, 2002:7
effect on survival 2002:14–16
of new patients with glomerulonephritis 1998:8
of new RRT patients 1998:8, 2000:9,12, 2001:4
- Body-mass index 1999:12, 2002:15
- Causes of death
type of treatment 2000:18
- Changes in type of treatment 1998:5, 1999:6, 2000:6,
2001:11, 2002:11
- Cockcroft–Gault formula 1998:10
- Comorbidity
according to kidney diagnosis 1998:7
amputation 2001:20
angina pectoris 2001:18
arterial disease other than coronary disease 2001:20
cerebrovascular hemorrhage or infarction 2001:21
coronary disease 2001:18
heart failure 2001:19
high blood pressure 1998:10, 1999:17, 2000:14–15,
2001:21, 2002:15,19
hyperlipidemia 2001:21
left ventricular hypertrophy 2001:19
myocardial infarction 2001:18–19
- Cox regression 1998:10, 2002:15–16
- Erythropoietin treatment 1999:16
- Finnish population
age groups 1998:1, 1999:2, 2000:2, 2001:2, 2002:2
gender 2001:2, 2002:2
in healthcare districts 1998:1, 1999:1, 2000:1, 2001:1,
2002:1
in regions 1998:1, 1999:1, 2000:1, 2001:1–2, 2002:1–2
- Glomerulus filtration 1998:10
- High blood pressure, see comorbidity
- High blood pressure, treatment 1999:17, 2000:14–15,
2001:21
- Immunosuppressive treatment 1998:10, 2000:12–13
- Incidence of RRT
children 1998:4, 1999:5, 2000:5, 2001:3, 2002:3
diagnosis 1998:9, 2000:9, 2001:4, 2002:4
in health care districts 1998:4, 1999:5, 2000:5, 2001:3,
2002:3
in regions 1998:4, 1999:5, 2000:5, 2001:2–3, 2002:3
international 2001:5, 2002:5
standardized 2001:3, 2002:3
type of treatment 1998:5, 1999:6, 2000:6, 2001:11,
2002:11
- Kidney transplantation
donor 2001:16
probability 1999:18
proportion receiving 2001:16
time from start of dialysis 2001:17
- Kt/V 1999:11, 2002:17
- Laboratory tests
albumin 1998:10, 1999:11–12, 2002:15,16,18
cholesterol, total 1999:13–14, 2002:20
creatinine 1998:10, 2002:15–17
CRP 1999:11, 2002:15,22
glycosylated hemoglobin-A_{1c} 2002:15
HDL cholesterol 1999:13, 2002:15,21
hematocrit 1999:16, 2002:15
hemoglobin 2002:15
ionized calcium 1998:10, 1999:15, 2002:15,18
LDL cholesterol 2002:15,20
phosphate 1999:15, 2002:15,16,18
triglycerides 1999:13, 2002:15,21
urea 1998:10, 2002:15
- Length 2002:15
- Mortality
90 days after start of RRT 2002:12
diagnosis 2000:17
earlier than 90 days after start of RRT 2001:12
in regions 2001:12, 2002:12
standardized 2001:13, 2002:12
transplantation patients' 2000:17
type of treatment 1998:5, 1999:6, 2000:6,16, 2001:11
- Patient-years
diagnosis 1998:6–7, 1999:7–8, 2000:8, 2001:15,
2002:13
age groups 1998:6–7, 1999:8, 2000:10, 2001:14
definition 1998:6, 1999:7, 2002:13
type of treatment 1998:6, 1999:7, 2000:7,10, 2001:14
- Peritonitis 1998:10
- Prevalence of RRT
age groups 1998:2, 1999:3, 2000:3, 2001:7, 2002:7
diagnosis 1999:9, 2000:8, 2001:9, 2002:9
gender 2001:7, 2002:7
in healthcare districts 1998:2–3, 1999:2,4, 2000:2,4,
2001:6,8, 2002:6,8
in regions 1998:2, 1999:2–3, 2000:2–3, 2001:6–7,
2002:6–7
international 2001:10, 2002:10
standardized 2001:7, 2002:7
type of treatment 1998:5, 1999:6,10, 2000:6–7, 2001:9,11,
2002:9,11
- Pulse pressure 2002:15,19
- Regions 1998:1, 1999:1, 2000:1, 2001:1, 2002:1
- Survival
by age group 1998:11, 2002:14
by diagnosis 1998:12
by start period of RRT 2002:14
by type of treatment 1998:11
effect of various variables 1998:10, 2002:15–16
multivariate model 2002:16
- Tobacco smoking 2001:21
- Vitamin D treatment 1999:14–15
- Weight 2002:15

Finnish Registry for Kidney Diseases Report 2002



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