ANNUAL REPORT 2022

The
Norwegian Renal Registry

(Norsk Nyreregister)

This report will also be available on:
http://www.nephro.no/registry.html

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Table of Contents

Introduction

This year the registry has worked intensively to get the new MRS-platform ready. This new digital platform will replace the old paper form reporting, and make it possible for the local centers to report data to the registry electronically and also have a local registry over their own patients. In this local registry the centers will have full access of the data on their own patients and can make center-specific analyses.

In this report we have done some layout changes, moving many of the survival curves etc. to the appendix for better overview. Remember that by contacting the registry or the local center contact it is also possible to get even more figures with results from the registry.

The section of biopsy presents this year the development over the last six years of the percentage of all biopsies that show a specific diagnosis (**Figures 3-7**).

The reporting of patients in CKD5 before renal replacement therapy is still too low from many centers. The registry hopes that the new MRS-platform will make it easier for the centers to keep track of these patients and accordingly also report them.

With regards to the dialysis population, we continue to see a steady increase in home treatment. For Norway as a whole we are still a few percentage points below the target of 30%, but with a high inter-center variation and five centers are above the target. The upcoming reporting of annual data will also collect the information on patients that receive palliative treatment, and on whether the treatment is considered life-prolonging or not. We hope this will make the analysis of treatment quality more clinically relevant. With the new MRS-platform we will also be able to include PROMs and get information from the patients about how they rate their treatment.

In this report we have included an analysis on the development of acute rejections over the later years. The specific reasons for the decreased incidence is not known but steady improvement in follow-up frequency (quality indicator of *at least 4 follow-up visits per year*) may be a part of it.

History and Organization of Norwegian Renal Registry (NRR)

The Norwegian Renal Registry is an epidemiology quality registry for patients with severe renal disease. Inclusion in the registry is based on written informed consent and patients are followed for their entire life course. Patients in whom a diagnostic kidney biopsy is obtained or who have developed chronic kidney disease stadium 5 (CKD5) are included in the registry. Acute kidney failure patients are not included in the registry unless they develop chronic kidney failure (dialysis >3 months).

The current "version" of NRR is a merge in 2016 of the Norwegian Nephrology Registry and the Norwegian Renal Biopsy Registry and consists of two sections; Section for dialysis and transplantation (at Oslo University Hospital) and Section of kidney biopsy (at Haukeland University Hospital). In the merge all historic data from the Norwegian Nephrology Registry was continued, while historic data from the Norwegian Renal Biopsy Registry was not eligible for transfer into the new registry. The historic biopsy data is however still available for analyses.

The Norwegian Nephrology Registry was formally constituted in 1994 as a collaboration between The Norwegian Renal Association (Norsk Nyremedisinsk Forening) and Oslo University Hospital-Rikshospitalet, with the latter as the formal owner. National data on renal replacement therapy (RRT) had been collected within The Renal Association since 1980 in a less formalized manner, and the transplant center had stored data on transplanted patients since the late sixties. Further, Norwegian renal units had reported to the ERA-EDTA-registry since the late sixties. Since the mid -90ies, a process of transition from a pure epidemiological registry into a quality-oriented registry has progressed.

Norwegian Renal Biopsy Registry was established in 1988. It has been run by the Renal unit at Haukeland University Hospital. Both, nephrologists and pathologists contributed with data related to non-neoplastic kidney biopsies. The aim of the registry was, first of all, to provide a platform for development of expertise and improvement of quality, second to have a material available for research. In 2012, the registry was acknowledged as one of the national quality registries. From 2012, the registry has been building a digital slide archive of kidney biopsies. In 2015, the registry had collected clinical and pathological data of about 13,000 non-neoplastic kidney biopsies. Together with the 5600 non-neoplastic kidney biopsies collected in the new registry, the total amount of biopsies is about 17,500.

National organization and policy

Norway had 5.489 mill. inhabitants (July 2022) and 11 counties with populations ranging from 241,764 to 1,280,810 inhabitants. Each county has at least one central renal unit and some central units have satellite units run in close collaboration. There is only one transplant center (two during 1963-82). Pre-transplant work-up, as well as post-transplant follow-up beyond 2 months, is handled by the county-centers. County boarders do not always coincide with the area that the different renal units cover, and this report presents data based on county boarders as well as divided in RHF and HF levels, whenever appropriate.

During 2017 Finnmark was separated from Tromsø and in March 2022 Lovisenberg started to treat patients with severe renal disease. So now there are 27 centers responsible for reporting data to NRR, and they all do. Each center is responsible to report all patients from whom a diagnostic kidney biopsy is taken, and all patients established in CKD5 on a continuous basis (eGFR <15 mL/min/1.73 m^2 that is verified after three months. *The verification eGFR date is then the CKD5 start date*). Progression to need of renal replacement

therapy (dialysis, transplantation), changes between dialysis modality (PD, "center HD", "home HD"), transfer between centers or immigration/emigration, graft loss and deaths is reported on a continuously basis. For 2022, data from the visit *closest to December 31st* 2022 was to be reported for all CKD5 patients, either if they were not treated with renal replacement therapy or if they received dialysis or had a functioning renal graft. The overall report rate by the finalization of this report was 95.6%.

Transplantation has always been considered the renal replacement treatment of choice, if possible, with a living related donor. Since 1984, also unrelated donors have been used. Acceptance criteria for transplantation have been wide, strict age limits have not been applied. Over time, an increasing number of non-transplantable patients have also been offered life-long dialysis.

Individual coverage of the registry for the entire cohort is estimated to be at least 90%. Transplanted patients are crosschecked continuously against the transplantation lists at OUS-Rikshospitalet and annual crosschecks against each of the 27 centers lists of dialysis patients are performed per December 31st each year. For patients in renal replacement therapy the individual coverage is close to 100% (currently 5 patients (0.09%) alive without consent). CKD5 patients not treated with renal replacement therapy have only been included in the registry since 2016 and the coverage is improving for each year. Based on prevalence data from the literature it is expected that there is between 550-600 prevalent CKD5 patients not on RRT in Norway. For 2022 this results in an estimated coverage of about 85%. However, considering that some Norwegian centers have reported many patients and some none, this coverage estimate is probably too high. Scaling the prevalence for the top five reporting centers give an anticipated national coverage of about 60%. A coverage analysis of non-neoplastic kidney biopsies is performed 3 to 4 times per year since 2020. The last coverage was 76%. At regular intervals, reporting of deaths to the registry is checked against the Norwegian National Registry (NO: *Folkeregisteret*).

NRR is one of the national medicine quality registries (https://www.kvalitetsregistre.no/registeroversikt). NNR has identified 22 quality indicators to cover all relevant subgroups of patients in the registry. The quality indicators are reported annually (https://www.kvalitetsregistre.no/registers/norsk-nyreregister). These data are in addition included in the present report. A list of all quality indicators can be found here: https://www.nephro.no/nnr.html.

Incidence data 2022

During 2022, a diagnostic kidney biopsy, and relevant clinical data, was available from 539 patients (Table 1). Of these were 518 biopsies registered with complete pathology data (Table 8). Also, 312 new patients with CKD5, not previously established in renal replacement therapy, were reported to the registry and 538 patients started renal replacement therapy (i.e. 98.6 per mill. inhabitants).

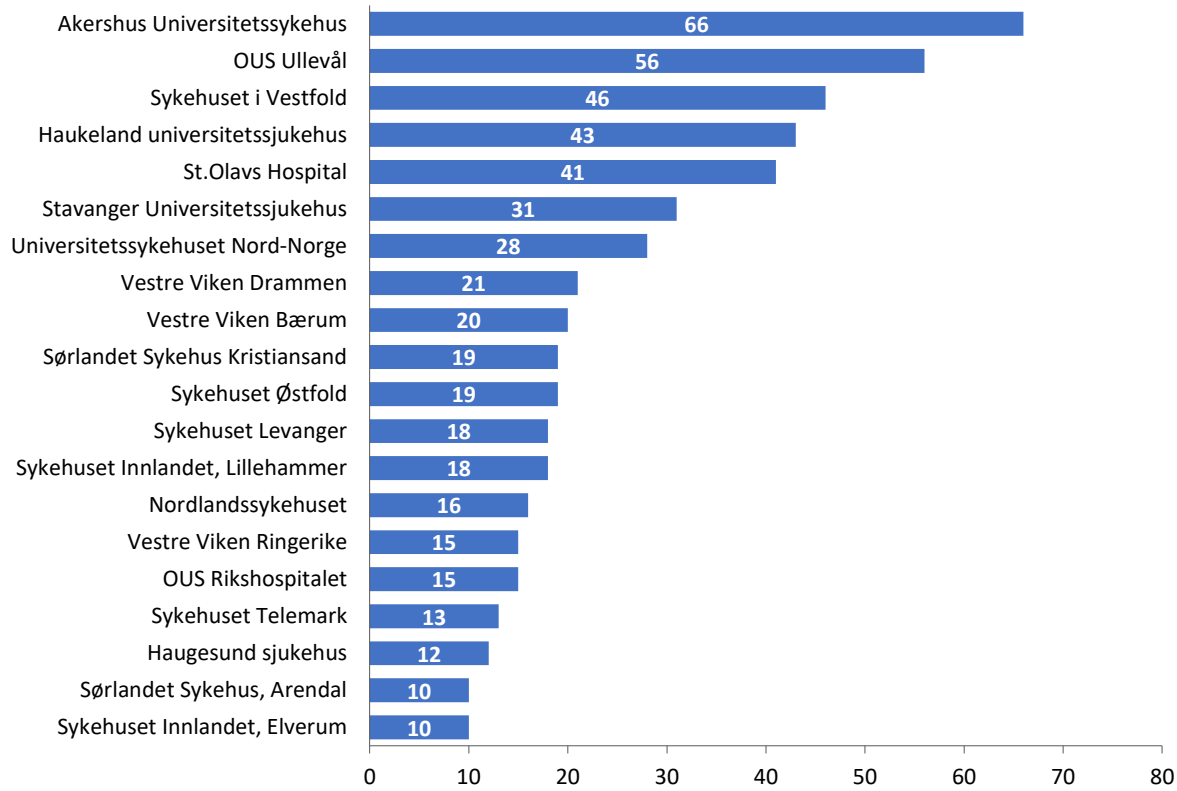
Biopsy

Table 1. Number of kidney biopsies per regional health authority

	2017	2018	2019	2020	2021	2022
Helse Sør-Øst	305	353	346	372	369	328
Helse Vest	134	137	113	115	101	97
Helse Midt	54	78	60	77	76	70
Helse Nord	52	54	54	48	49	44
Total	**545**	**622**	**573**	**612**	**595**	**539**

Helse Sør-Øst: South-Eastern Norway Regional Health Authority
Helse Vest: Western Norway Regional Health Authority
Helse Midt: Central Norway Regional Health Authority
Helse Nord: Northern Norway Regional Health Authority
Neoplastic and transplant biopsies are not included

Figure 1. Number of native kidney biopsies per hospital in 2022



Only hospitals with 10 or more non-neoplastic kidney biopsies are shown.

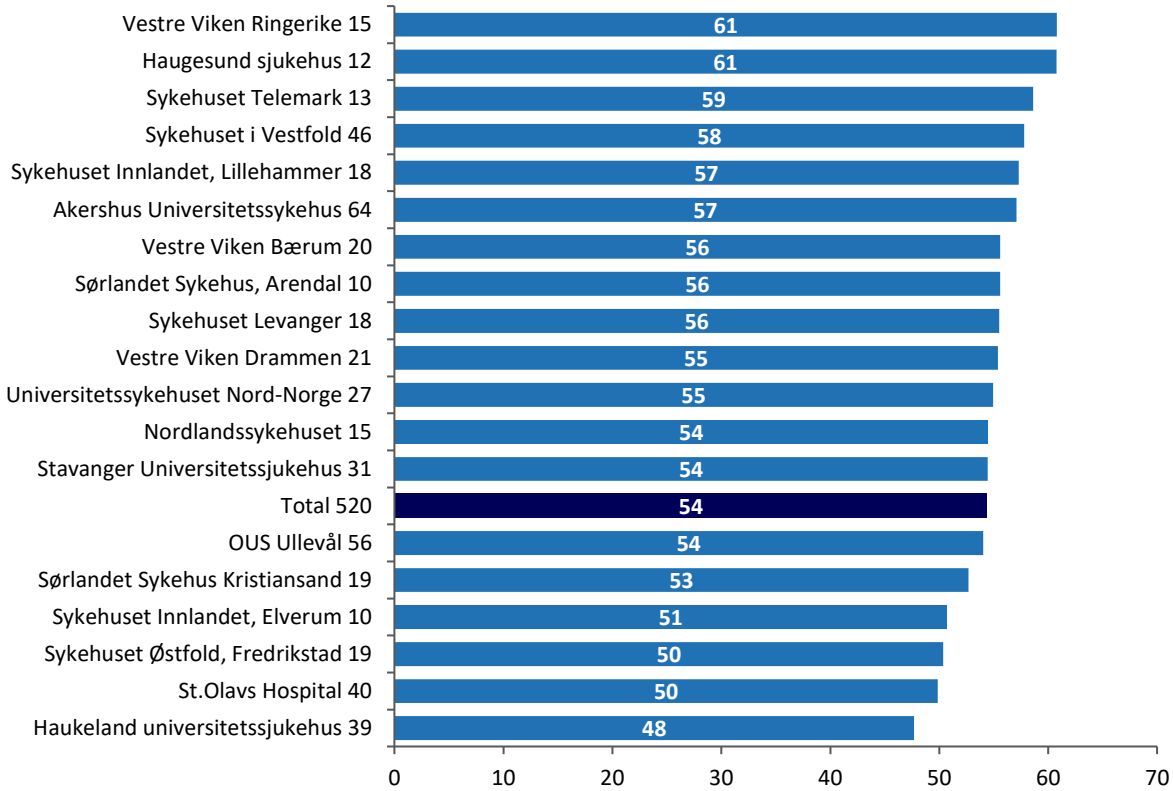
Table 2. Mean age at kidney biopsy, per Regional Health Authority in 2022

	Helse Sør-Øst	Helse Vest	Helse Midt	Helse Nord	Total
	N = 328	N = 97	N = 70	N = 44	N = 539
Mean age in years (range)	54.0 (0-90)	49.9 (12-82)	51.8 (15-84)	53.0 (16-82)	52.9 (0-90)

Mean age at kidney biopsy in 2022 was 52.9 (range 0-90) years (table 2), which is about a year lower compared to mean age at kidney biopsy last year. The highest mean age at kidney biopsy was reported in South-Eastern Norway (Helse Sør-Øst) (54.0 years), while the lowest mean age at biopsy was reported in Western Norway (Helse Vest) (49.9 years)

Of all kidney biopsies reported to the registry in 2022, 19 biopsies (3.5 %) were performed in patients under the age of 18. The majority of pediatric biopsies were performed at OUS Rikshospitalet (47.4 %) in South-Eastern Norway (Helse Sør-Øst). The percentage of kidney biopsies performed in patients above 80 years of age is 3.0 % which is slightly smaller than previous year (5.5 % in 2021). The majority of octogenerians were biopsied in South-Eastern Norway (Helse Sør-Øst) (68.8 %).

Figure 2. Mean age in years for patients over 18 years of age at kidney biopsy, total and per hospital in 2022



Only hospitals with 10 or more non-neoplastic kidney biopsies are shown.

Table 3. Number (%) of reported clinical indications for kidney biopsies, total and per Regional Health Authority in 2022

	Helse Sør-Øst N=328		Helse Vest N=97		Helse Midt N=70		Helse Nord N=44		Total N=539	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Nephrotic syndrome	59	(18.0 %)	15	(15.5 %)	12	(17.1 %)	11	(25.0 %)	97	(18.0 %)
Nephritic syndrome	41	(12.5 %)	15	(15.5 %)	9	(12.9 %)	12	(27.3 %)	77	(14.3 %)
Acute kidney failure	108	(32.0 %)	21	(21.6 %)	13	(18.6 %)	10	(22.7 %)	152	(28.1 %)
Chronic kidney failure	113	(34.5 %)	41	(42.3 %)	23	(32.9 %)	11	(25.0 %)	188	(34.8 %)
Proteinuria	147	(44.7 %)	55	(56.7 %)	29	(41.4 %)	8	(18.2 %)	239	(44.3 %)
Hematuria	99	(30.2 %)	41	(42.3 %)	23	(32.9 %)	5	(11.4 %)	168	(31.1 %)
Other	1	(0.3 %)	0	(0.0 %)	0	(0.0 %)	0	(0.0 %)	1	(0.2 %)
Proteinuria and hematuria	68	(20.7 %)	34	(35.1 %)	16	(22.9 %)	1	(2.3 %)	119	(22.1 %)

It is possible to report more than one clinical indication for a kidney biopsy. As a result, the total number of clinical indications exceeds the total number of reported kidney biopsies for 2022. A few regional differences are apparent. Nephrotic and nephritic syndrome was more frequently reported in Northern Norway, when compared to the rest of the country. This is comparable to previous years, except for 2021, when nephrotic syndrom was more frequently reported in Western Norway. Chronic kidney failure, as an indication for kidney biopsy, was slightly more frequently reported in Western Norway compared to the rest of the country. This has changed compared to recent years, when chronic kidney failure was reported less frequently in Western Norway.

Figure 3. Percentage of biopsies reported with nephrotic syndrome as a clinical indication, per health region, from 2017-2022

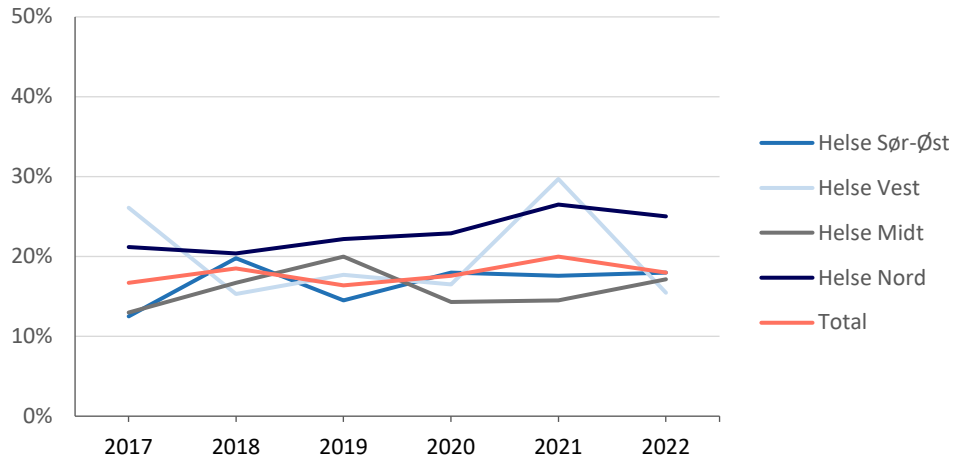


Figure 4. Percentage of biopsies reported with acute kidney failure as a clinical indication, per health region, from 2017-2022

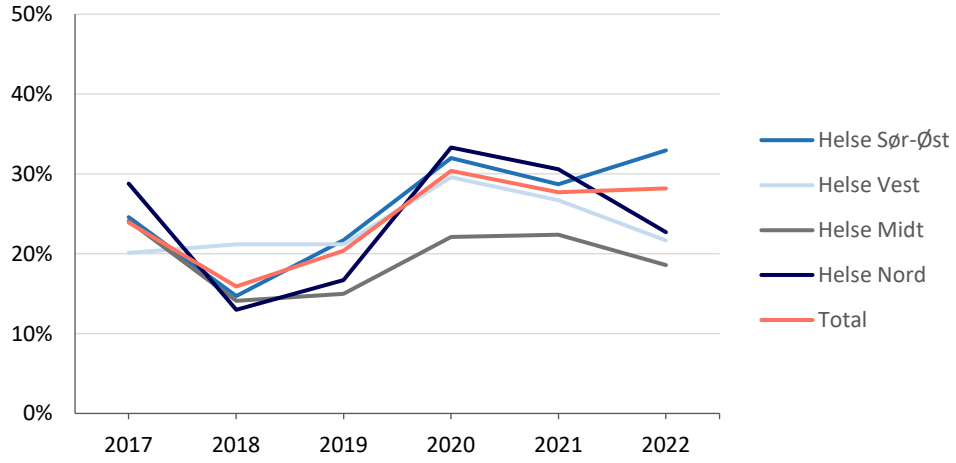


Figure 5. Percentage of biopsies reported with chronic kidney failure as a clinical indication, per health region, from 2017-2022

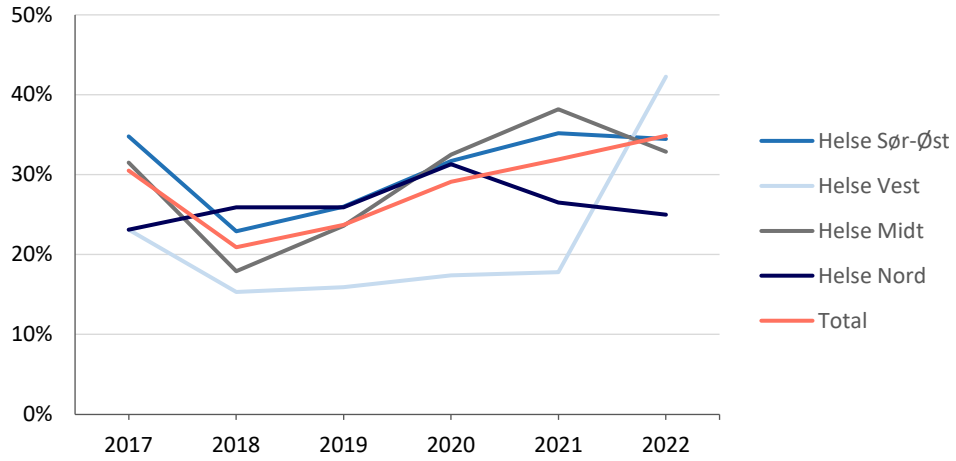


Figure 6. Percentage of biopsies reported with proteinuria as a clinical indication, per health region, from 2017-2022

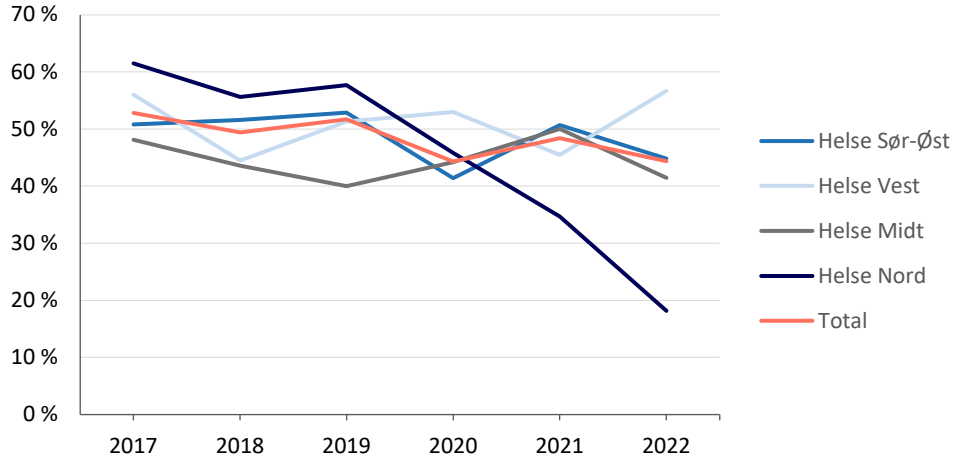


Figure 7. Percentage of biopsies reported with hematuria as a clinical indication, per health region, from 2017-2022

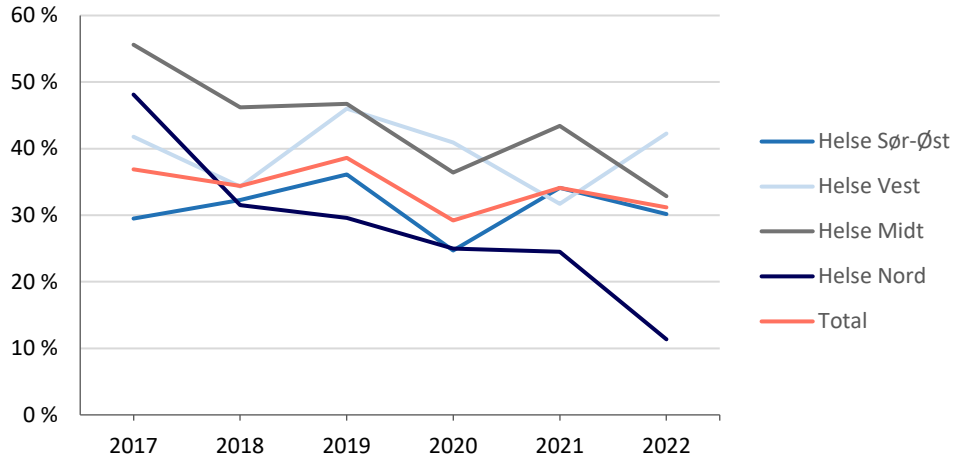


Figure 8. Albuminuria (mg/mmol creatinine) at the time of kidney biopsy in different Regional Health Regions in 2022

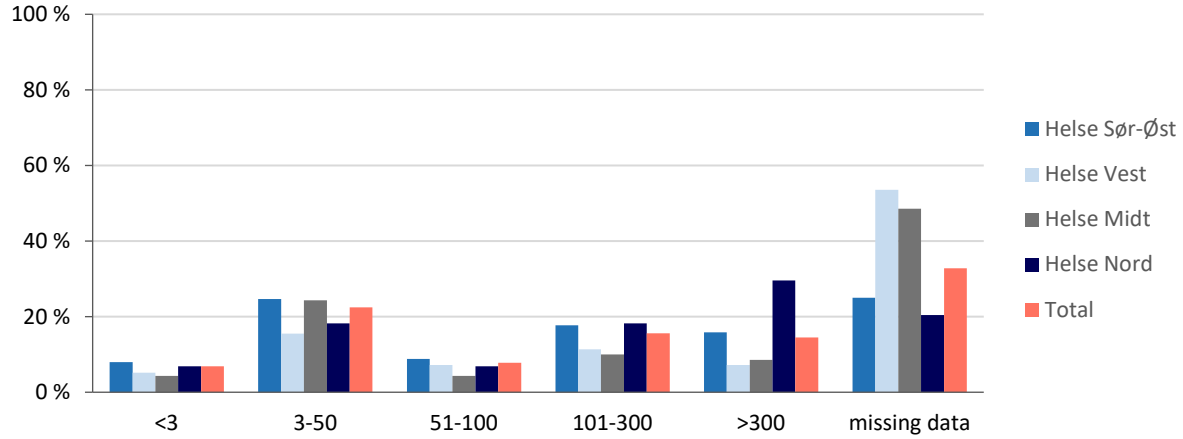


Figure 9. Serum creatinine (µmol/liter) at the time of kidney biopsy in different Regional Health Regions in 2022

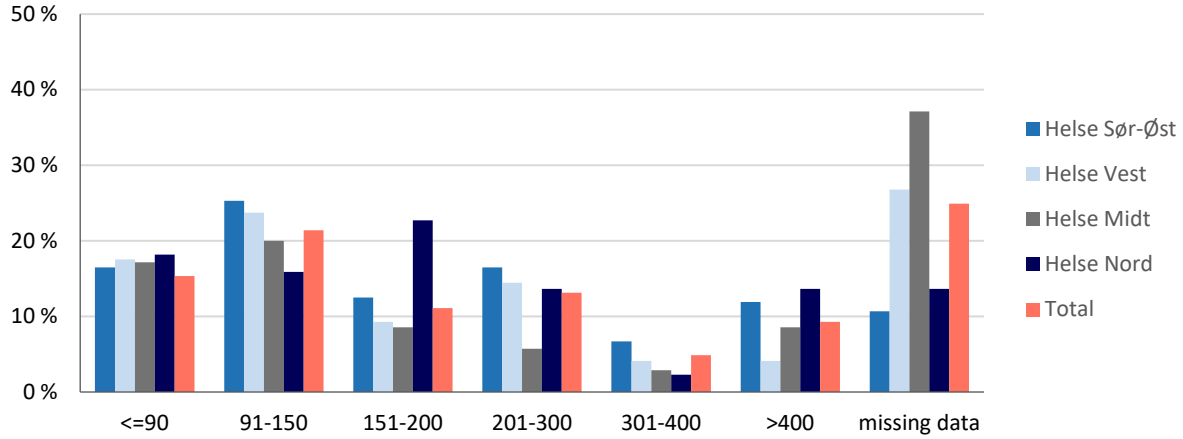
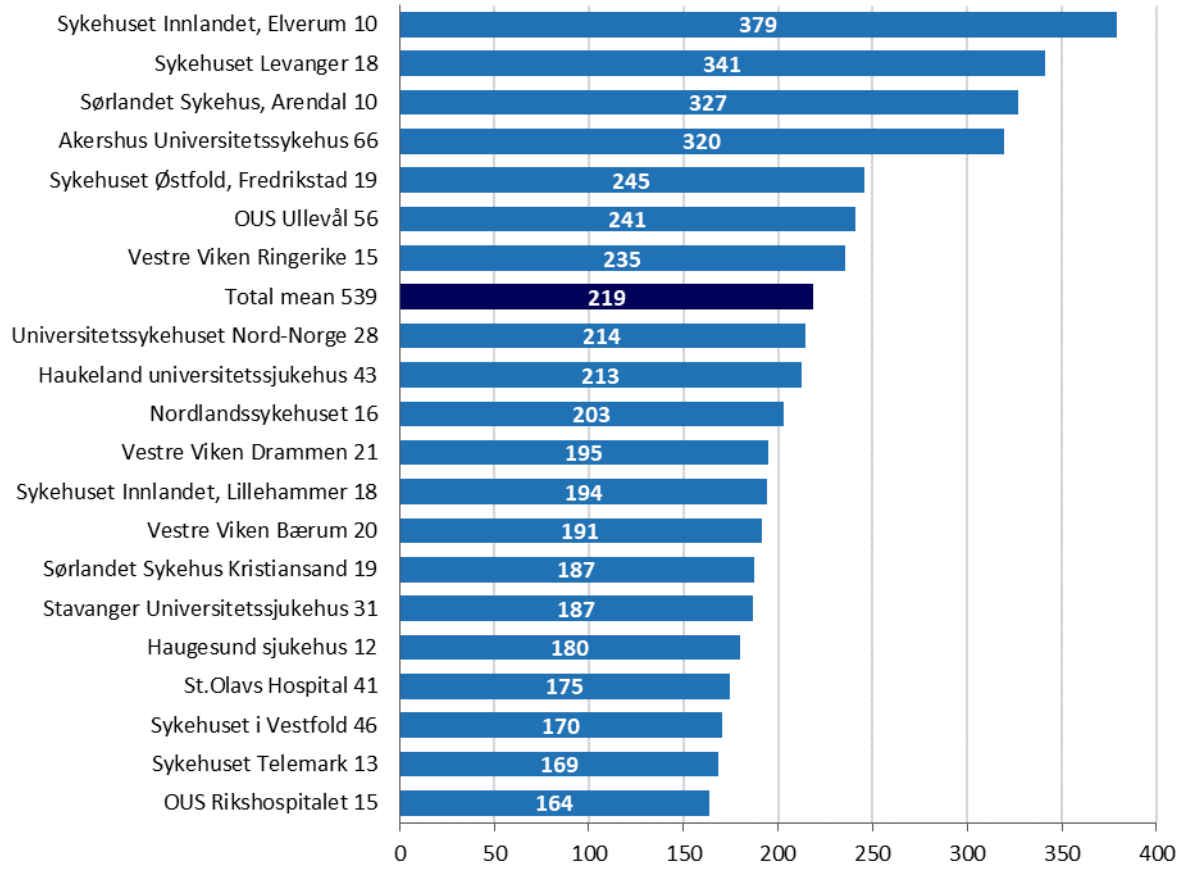


Figure 10. Mean serum creatinine at the time of kidney biopsy, per hospital in 2022



Only hospitals with 10 or more non-neoplastic kidney biopsies are shown

Figure 11. Total mean serum creatinine from 2020 – 2022

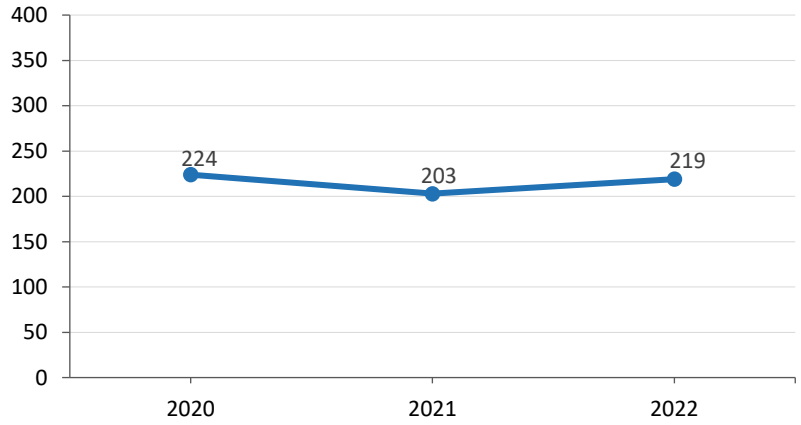


Table 4. Quality indicators for division of kidney biopsy

Quality indicator	Target	What does it indicate?
Percentage of serious complications	<2 %	Procedure related safety
Percentage of kidney biopsies with 10 or more glomeruli	90 %	Procedure related quality
Percentage of kidney biopsies with a final diagnosis within 1 month	80 %	Indicates how well routines and structure in the examination procedure by the pathology departments work
Number of primary kidney biopsies with moderate to severe chronic changes	<30 %	Indicates whether patients are being examined early by the specialist health service in the course of their kidney disease

Serious complications

A serious complication is defined as the need for blood transfusion, and/or the need for interventions. Minor, self-limiting bleeding is not considered a serious complication.

Table 5. Percentage of procedure related complications

	2017	2018	2019	2020	2021	2022
Serious complications	2.0 %	0.6 %	2.1 %	2.8 %	0.8 %	3.0 %
No complications	78.3 %	81.0 %	79.9 %	83.0 %	86.1 %	85.0 %
Not reported	13.0 %	9.8 %	11.8 %	7.7 %	6.2 %	7.4 %

Most kidney biopsies are reported without procedure related complications (table 5 and 6). In 2022, 16 (3.0%) serious complications were reported in 14 biopsies from 10 different hospitals. This exceeds the target of 2.0% and represents an increase compared to previous years. It is noted that small numbers can result in significant percentage fluctuations. In total, 7.4% of the biopsies were reported with missing data for this important quality indicator. This represents a slight increase compared to the previous year. It is crucial to aim for mor comprehensive reporting of serious procedure-related complications, as changes in the proportion of complications could impact local and/or national guidelines for kidney biopsies and patient care. Complications can be reported to the registry after the initial clinical data report has been submitted, if necessary.

Table 6. Reported complications per Regional Health Authority, in 2022

	Helse Sør-Øst (N=328)		Helse Vest (N=97)		Helse Midt (N=70)		Helse Nord (N=44)		Total (N=539)	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
None	269	(82.0 %)	89	(91.8 %)	63	(90.0 %)	37	(84.1 %)	458	(85.0 %)
Transfusion	6	(1.8 %)	1	(1.0 %)	1	(1.4 %)	1	(2.3 %)	9	(1.7 %)
Intervention	6	(1.8 %)	0	(0.0 %)	1	(1.4 %)	0	(0.0 %)	7	(1.3 %)
Other	18	(5.5 %)	0	(0.0 %)	1	(1.4 %)	2	(4.5 %)	21	(3.9 %)
Hematuria	9	(2.7 %)	0	(0.0 %)	2	(2.9 %)	1	(2.3 %)	12	(2.2 %)
Missing data	27	(8.2 %)	7	(7.2 %)	2	(2.9 %)	4	(9.1 %)	40	(7.4 %)

It is possible to report more than one complication per procedure. Clinical data were reported for 539 kidney biopsies in 2022, and 85% were reported without complications. 16 serious complications from 14 different patients were reported to the registry in 2022, 9 blood transfusions and 7 interventions. Three of the patients had diabetic nephropathy. Apart from this, there was no overlap in diagnosis. Five patients were between 70 and 80 years old, while there was significant age variation among the remaining patients. Ten patients had systolic blood pressure below 150mmHg at the time of biopsy. Nine biopsies were performed using an 18G biopsy needle, four with a 16G biopsy needle, and for the last biopsy, the needle used was not reported.

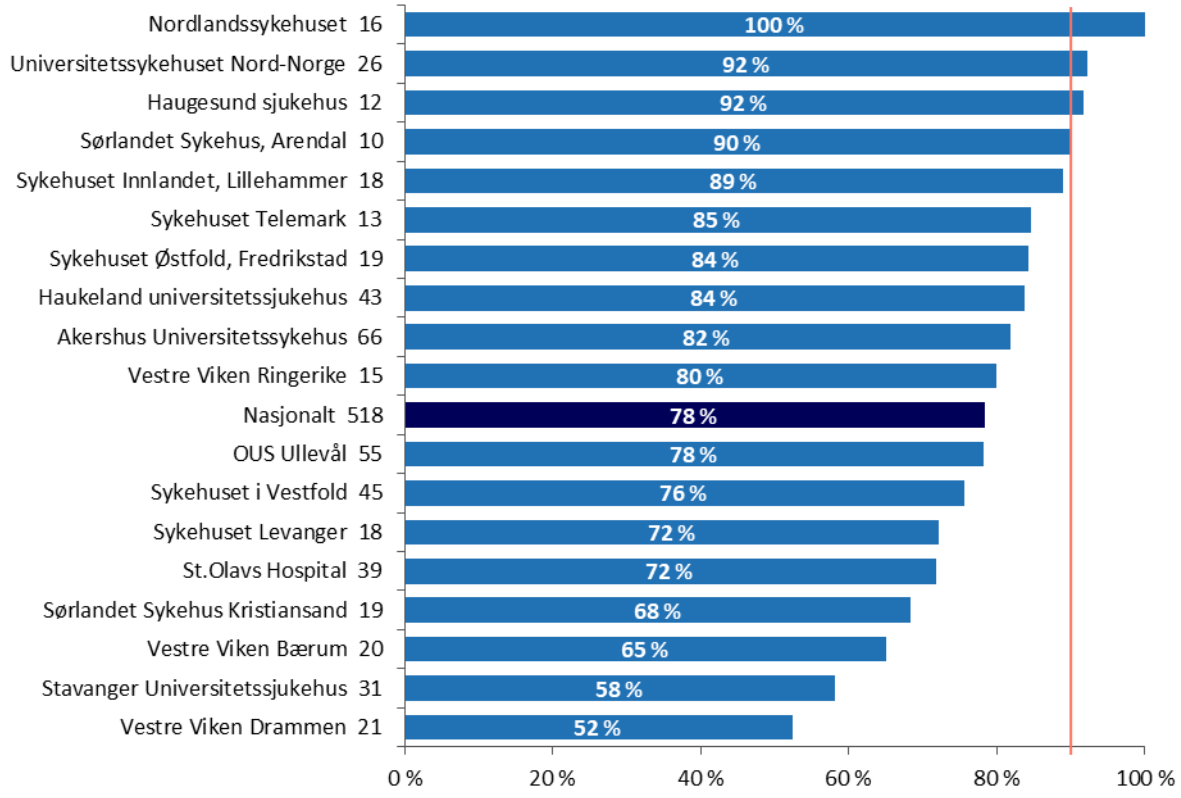
Table 7. Procedure-related parameters in 2022 total and per Regional Health Authority

	Helse Sør-Øst (N=328)		Helse Vest (N=97)		Helse Midt (N=70)		Helse Nord (N=44)		Total (N=539)	
	n	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**
Biopsy performed by										
Nephrologist	4	(1.2 %)	60	(61.9 %)	1	(1.4 %)	2	(4.5 %)	67	(12.4 %)
Radiologist	313	(95.4 %)	28	(28.9 %)	65	(92.9 %)	42	(95.5 %)	448	(83.1 %)
Other	2	(0.6 %)	0	(0.0 %)	0	(0.0 %)	0	(0.0 %)	2	(0.4 %)
Not reported	9	(2.7 %)	9	(9.3 %)	4	(5.7 %)	0	(0.0 %)	22	(4.1 %)
Biopsy needle										
14G	0	(0.0 %)	2	(2.1 %)	1	(1.4 %)	0	(0.0 %)	3	(0.6 %)
16G	17	(5.2 %)	81	(83.5 %)	65	(92.9 %)	28	(63.6 %)	191	(35.4 %)
18G	283	(86.3 %)	8	(8.2 %)	1	(1.4 %)	9	(20.5 %)	301	(55.8 %)
Unknown	12	(3.7 %)	4	(4.1 %)	1	(1.4 %)	5	(11.4 %)	22	(4.1 %)
Not reported	16	(4.9 %)	2	(2.1 %)	2	(2.9 %)	2	(4.5 %)	22	(4.1 %)
No. of passes										
1	21	(6.4 %)	30	(30.9 %)	0	(0.0 %)	0	(0.0 %)	51	(9.5 %)
2	130	(39.6 %)	41	(42.3 %)	45	(64.3 %)	25	(56.8 %)	241	(44.7 %)
3	114	(34.8 %)	16	(16.5 %)	17	(24.3 %)	8	(18.2 %)	155	(28.8 %)
4 or more	46	(14.0 %)	5	(5.2 %)	6	(8.6 %)	10	(22.7 %)	67	(12.4 %)
Not reported	17	(5.2 %)	5	(5.2 %)	2	(2.9 %)	1	(2.3 %)	25	(4.6 %)
Level of care										
Out-patient	40	(12.2 %)	10	(10.3 %)	6	(8.6 %)	0	(0.0 %)	56	(10.4 %)
In-patient	234	(71.3 %)	53	(54.6 %)	60	(85.7 %)	32	(72.7 %)	379	(70.3 %)
Not reported	54	(16.5 %)	34	(35.1 %)	4	(5.7 %)	12	(27.3 %)	104	(19.3 %)

Percentage of kidney biopsies with 10 or more glomeruli

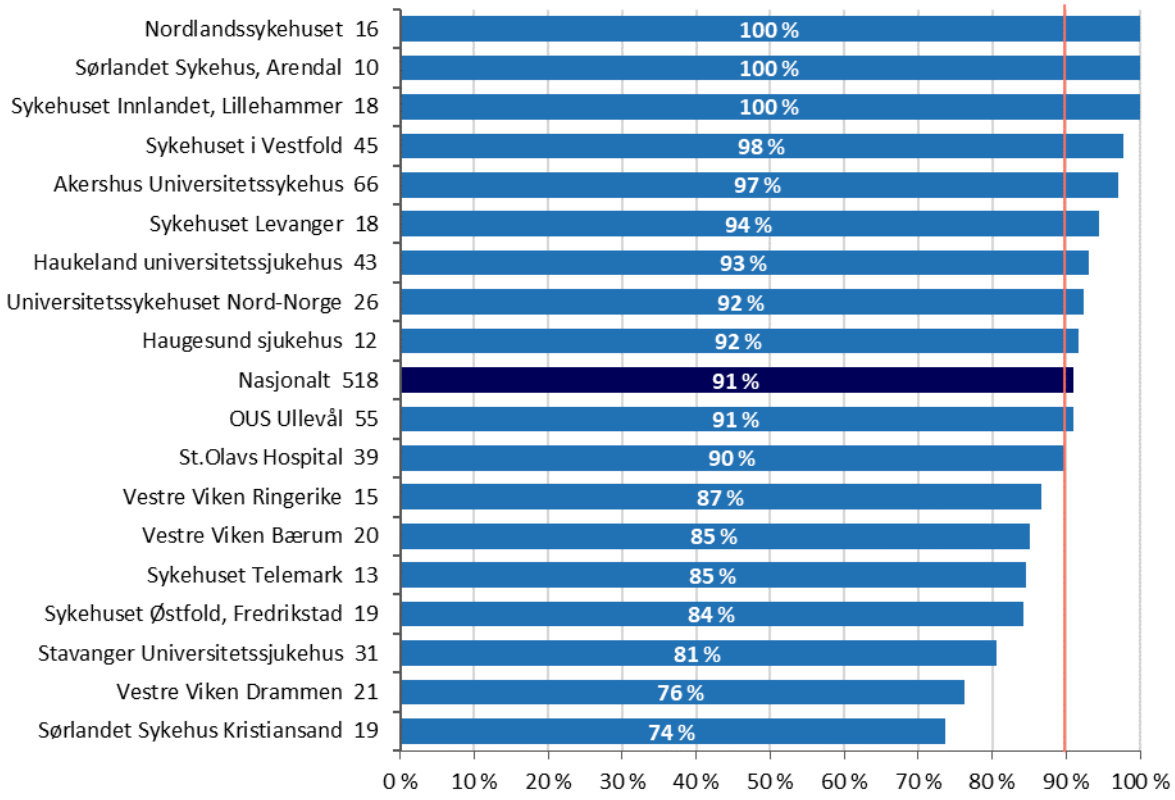
The kidneys consist of three compartments, which may be attacked by disease: the glomeruli, the tubules/interstitial tissue and the vasculature. A kidney biopsy is often necessary in order to investigate which compartment or compartments of the kidney are affected by disease and which kidney disease is responsible for the clinical picture observed. The normal kidney contains about 1 million glomeruli, capillary convolutes, which continuously filter the blood, producing pre-urine. Numerous diseases can affect the glomeruli. It is important to realize, that a disease may not affect all glomeruli and that the affected glomeruli might only show changes in a part of the glomerulus. In addition, early and late stages of a disease may be observed in different glomeruli at the same time in one biopsy. Therefore, in order to detect changes and to be able to evaluate changes, the kidney biopsy must contain sufficient material. For a reliable diagnosis, at least 10 glomeruli should be present in the biopsy material prepared for light microscopy. This number is the basis for the definition of the national quality indicator "Number of glomeruli per biopsy": **At least 90% of biopsies taken at one nephrology center should contain 10 or more glomeruli.** The number of glomeruli in a kidney biopsy may be obtained by different methods. The most common approach is to count the number of glomeruli in the paraffin embedded material prepared for light microscopy. Only 4 of 20 hospitals reported 10 or more glomeruli in 90% or more of the kidney biopsies (figure 12), thus fulfilling the national quality indicator.

Figure 12. Percent biopsies with 10 or more glomeruli, paraffin embedded material, total and per hospital in 2022



The number behind the hospital name is the number of non-neoplastic kidney biopsies with complete pathology data in 2022. The calculation is based on the number of glomeruli in the paraffin embedded biopsy tissue. Only hospitals with 10 or more non-neoplastic kidney biopsies are shown. Red line indicates quality indicator goal.

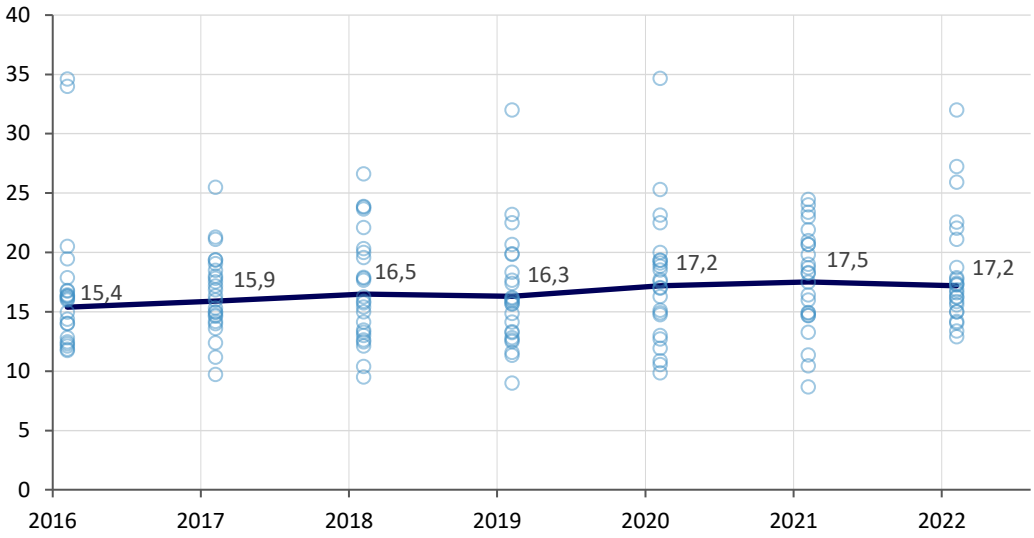
Figure 13. Percent biopsies with 10 or more glomeruli based on all material from a kidney biopsy, total and per hospital in 2022



The number behind the hospital name is the number of non-neoplastic kidney biopsies with complete pathology data in 2022. calculation is based on the number of glomeruli both in the paraffin embedded biopsy tissue, the frozen tissue for immunofluorescence (only few departments) and the tissue processed to electron microscopy. Only hospitals with 10 or more non-neoplastic kidney biopsies are shown. Red line indicates quality indicator goal.

The average number of glomeruli on a national basis shows a slight tendency to increase (figure 14).

Figure 14. Mean number of glomeruli from 2016 – 2022



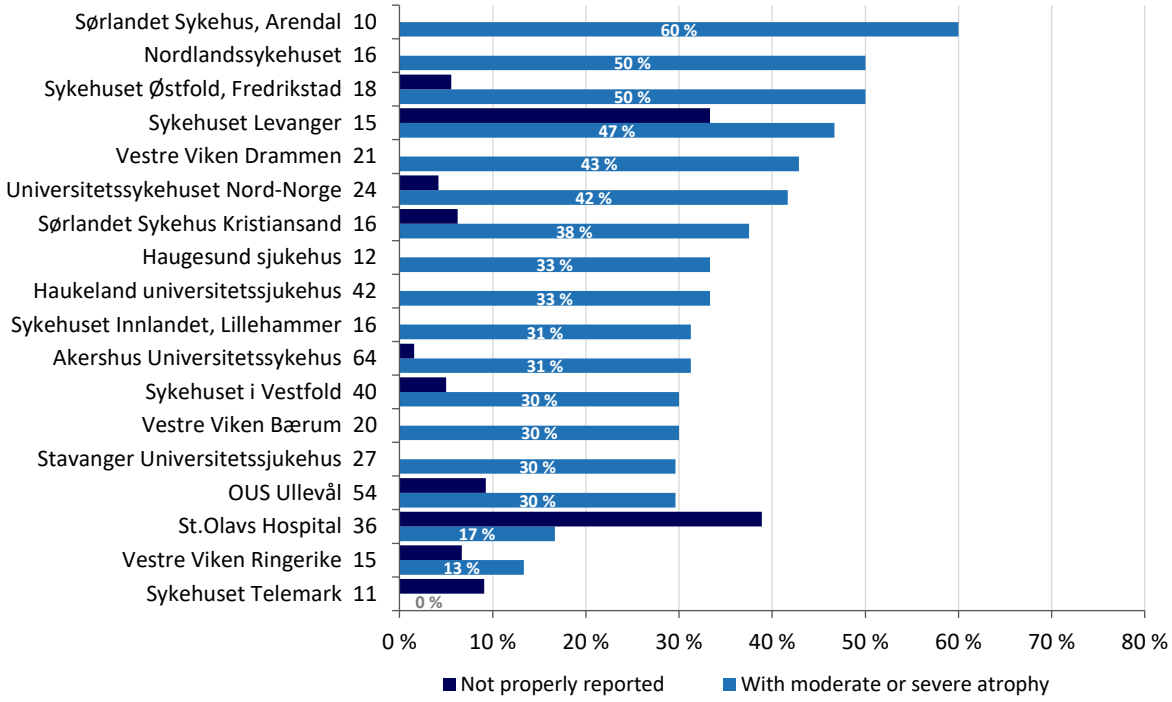
The light blue circles represent the hospitals and the dark blue line represent the mean number of glomeruli of all biopsies taken per year.

Number of primary kidney biopsies with moderate to severe chronic changes

Chronic changes in the kidney are persistent and irreversible. A high proportion of chronic changes in the biopsy indicates a high risk of loss of kidney function. A high proportion of chronic changes may also indicate that treatment cannot achieve stabilization or improvement in kidney function. It is therefore important to diagnose kidney disease early in the disease process, before the disease manifestations result in chronic, irreversible changes.
Tubular atrophy is a hallmark of chronic kidney disease. Moderate to severe tubular atrophy can indicate that the biopsy was taken late in the disease process implying that the patient was late in seeing a doctor or that the investigation process was not optimal.
The proportion of biopsies with moderate or severe tubular atrophy is calculated by dividing the number of biopsies showing moderate or severe tubular atrophy by the total number of biopsies at the center. Some patients have multiple kidney biopsies. For the calculation, only the first biopsy taken from a patient is used. The national quality indicator "Grade of chronic changes" expects that less than 30% of biopsies from one center should show moderate or severe tubular atrophy.

Figure 15 shows two issues: First, there are some nephrology units with a high number of cases with moderate to severe tubular atrophy. To explain this finding, we would assume either that more patients actually presented late in the course of the disease or that these nephrology units had different biopsy indications. Second, the numbers indicated for some nephrology units (e.g. Levanger and St. Olavs Hospital) can only be interpreted with some reservations because reports from the associated pathology department showed many missing/incomplete data for this indicator in question.

Figure 15. Percent biopsies with moderate or severe tubular atrophy and biopsies without proper registration of tubular atrophy by hospital in 2022



Light blue bars represent percent biopsies with moderate or severe tubular atrophy by hospital. Dark blue bars represent percent biopsies without proper registration of tubular atrophy by hospital. The number behind the hospital name is the number of primary non-neoplastic kidney biopsies per year. Only hospitals with 10 or more non-neoplastic kidney biopsies are shown. Red line indicates quality indicator goal.

Missing/incomplete data

Based on the results for the quality indicator "Number of primary kidney biopsies with moderate to severe chronic changes" we looked at missing/incomplete data related to chronic tubulointerstitial changes and vascular changes. The registry records data based on the pathology report for the specific kidney biopsy.
International guidelines are in place on what information should be included in a pathology report[1],[2]. "Datasett til Norsk nyreregister – seksjon for nyrebiopsi" is available on the homepage of "Den norske patologforening"[3]. This data set shall also be the basis for a standardized pathology report. The data set has recently been expanded by the work of the national specialist group for non-neoplastic kidney biopsy.
All guidelines and dataset recommend to record grade of tubular atrophy and interstitial fibrosis. Most guidelines recommend also to grade chronic vascular changes.
Figure 16 and 17 show an overview over missing/incomplete data in 2022. Missing data is the absence of any information about the parameter in the pathology report. Incomplete data means, that there is some information, but not all information related to the parameter, for example "areas of tubular atrophy" is mentioned but not graded. One of the reasons that there are most missing/incomplete data in the reports from St. Olavs Hospital might be, that pathologists are using free text descriptions of findings, whereas the other pathology departments use either structured data or preformatted text building blocks for their reports.

Figure 16. Chronic tubulointerstitial changes: missing/incomplete information

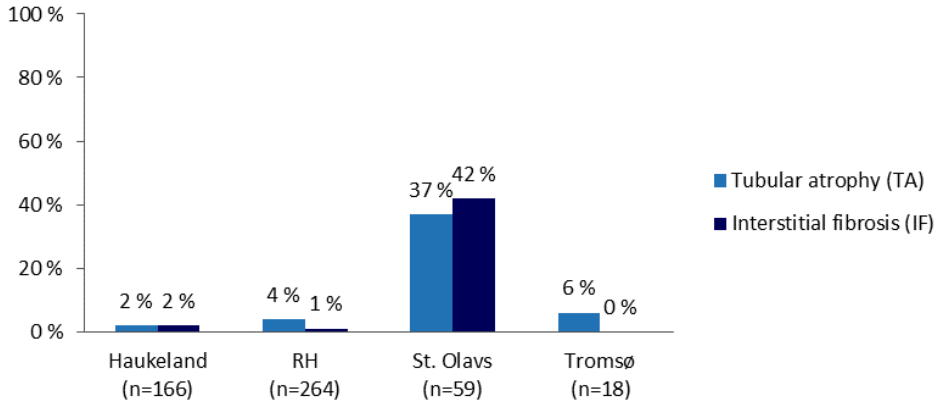
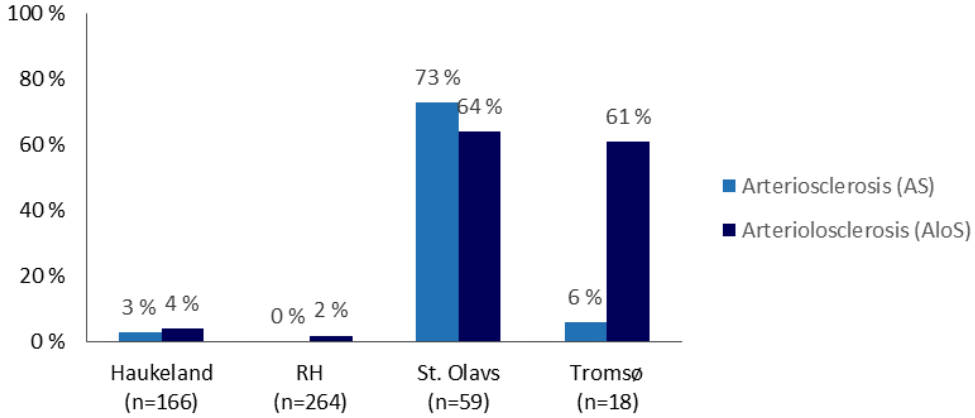


Figure 17. Chronic vascular changes: missing/incomplete information



[1] Chang A, Gibson IW, Cohen AH, Weening JW, Jennette JC, Fogo AB. A position paper on standardizing the nonneoplastic kidney biopsy report. Hum Pathol. 2012;43(8):1192-6.

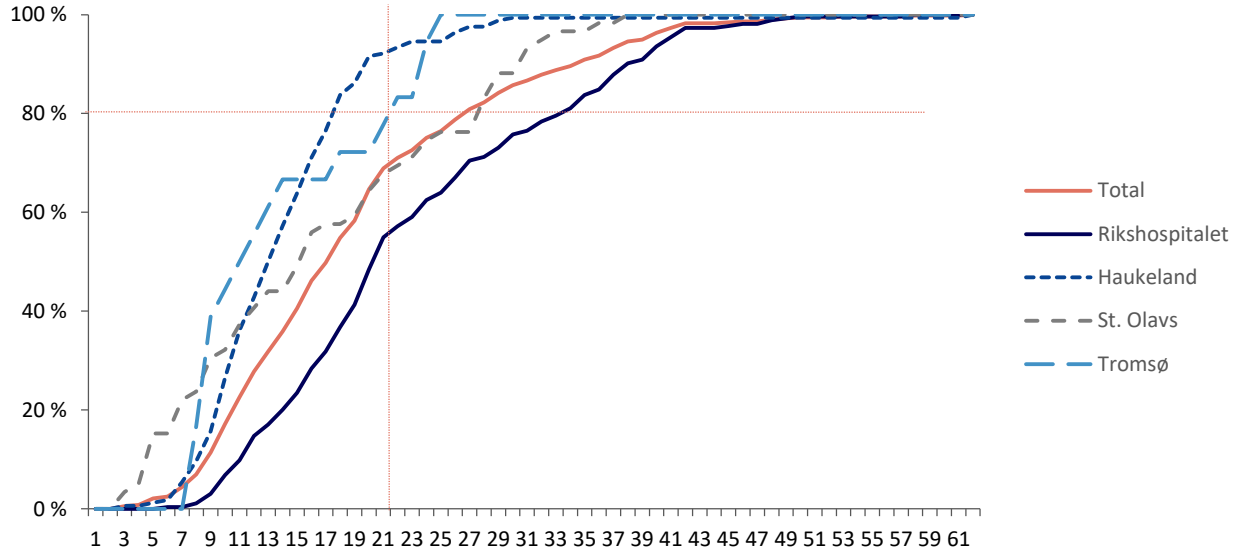
[2] Sethi S, D'Agati VD, Nast CC, Fogo AB, De Vriese AS, Markowitz GS, et al. A proposal for standardized grading of chronic changes in native kidney biopsy specimens. Kidney International. 2017;91(4):787-9.

[3] https://www.legeforeningen.no/foreningsledd/fagmed/den-norske-patologforening/faggrupper/nyrepatologi-ikke-neoplastisk/fagstoff/

Turnaround time in pathology departments

The turnaround time is the time interval from the registration of a kidney biopsy in the pathology department until the nephropathologist has signed the final report including the electron microscopic investigation. This time interval is a quality indicator, as the clinician will base treatment choices on the final pathology diagnosis. Delays in reporting may cause delays in treatment, and consequently impact patient outcomes negatively. The electron microscopy examination in particular is time-consuming, and a kidney biopsy is therefore often reported in stages. Kidney biopsies from severely ill patients are usually communicated orally by the pathologist to the clinician by telephone as soon as the biopsy is read for the first time by light microscopy. This oral report is followed by a preliminary written report, which may or may not include immunopathology findings. The final pathology report is usually signed after electron microscopy.
Only one pathology department met the quality standard of a final diagnostic report in 80 % of the cases within 21 working days (one month) (figure 19).

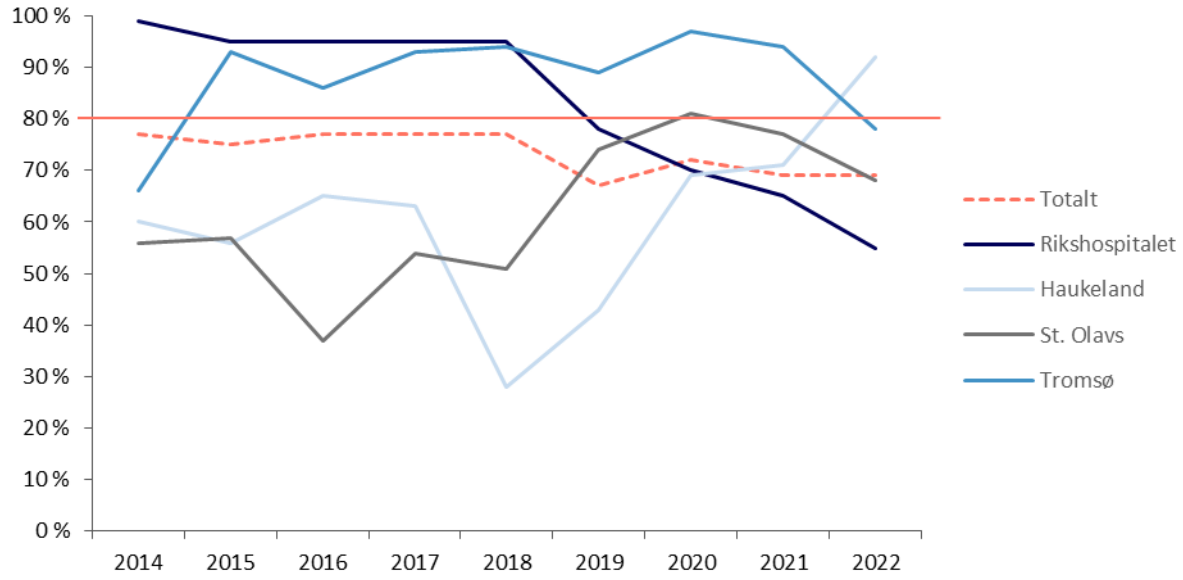
Figure 18. Percent kidney biopsies finally reported in relation to working days, total and by pathology department in 2022



Lines placed in the upper left quadrant indicate that the pathology department has reached the quality criterion of having reported 80% of biopsies within 21 working days. The slope of the individual curves indicates how quickly biopsies are answered: the steeper the faster.

Over a longer period from 2016 to 2022, we see a clear trend of improvement in turnaround time in 3 pathology departments, while the pathology department with the most kidney biopsies shows an equally clear negative trend, which also negatively influences the overall turnaround time (figure 19). While individual departments achieved the quality standard in certain years, the standard has not been reached nationally in any year since 2014.

Figure 19. Percent kidney biopsies finally reported within 21 working days, total and by pathology department from 2014 – 2022



Electron microscopic investigation of kidney biopsies

In kidney biopsy diagnostics, an electron microscope is used in addition to the light microscope. Instead of light the electron microscope sends electron beams through a very thin section of tissue. These electron beams light up on a fluorescent screen which results in a black and white image of tissue structures. The examination is also called an ultrastructural examination.With the help of the electron microscope, we can achieve higher magnification than with the light microscope. In kidney biopsy diagnostics, we need these high magnifications to be able to see tissue changes in some kidney diseases.To be able to make sections thin enough, a part of the kidney biopsy is specially fixed and embedded in a hard plastic material (EPON).
Table 8 and 9 show an overview over the number of non-neoplastic kidney biopsies per pathology department and the percentage of biopsies, where an electron microscopic investigation has been carried out. Table 9 shows that three departments routinely perform an electron microscopic examination while one department selects cases to be examined ultrastructurally.

Table 8. Number of kidney biopsies per pathology department 2014 – 2022

	2014	2015	2016	2017	2018	2019	2020	2021	2022
Rikshospitalet	277	255	243	223	279	252	314	295	264
Haukeland	219	234	186	197	191	186	161	174	166
St. Olavs	78	53	57	39	53	50	67	70	59
Tromsø	32	27	35	27	36	47	38	33	18
Førde	12	17	6	17	10	5	14	11	6
Ålesund	9	15	5	8	15	5	7	4	5
Totalt	627	601	532	511	584	545	601	587	518

Table 9. Percentage of electron microscopic investigations per pathology department per year.

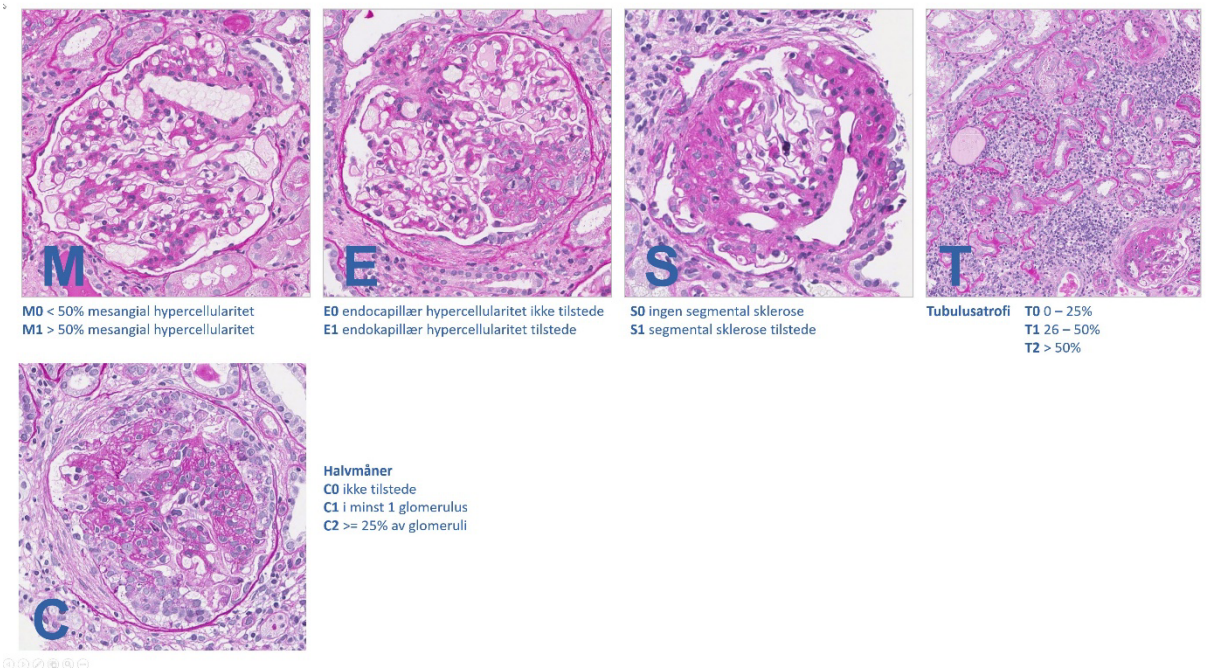
	2016	2017	2018	2019	2020	2021	2022
Rikshospitalet	94 %	95 %	96 %	91 %	95 %	96 %	96 %
Haukeland	90 %	89 %	83 %	94 %	88 %	90 %	90 %
St. Olavs	75 %	68 %	88 %	76 %	73 %	77 %	68 %
Tromsø	100 %	100 %	97 %	94 %	89 %	97 %	100 %

Oxford classification of IgA nephropathy

The Oxford classification of IgA nephropathy, the so-called MEST score, was introduced in 2009. Five morphologic features of prognostic and partly predictive value are scored (Figure 20):

- Mesangial hypercellularity (M)
- Endocapillary hypercellularity (E)
- Segmental sclerosis (S)
- Tubular atrophy (T)
- Crescents (C) were added to the model in 2016.

Figure 20: Morphologic changes included in the MEST score /Oxford classification of IgA nephropathy



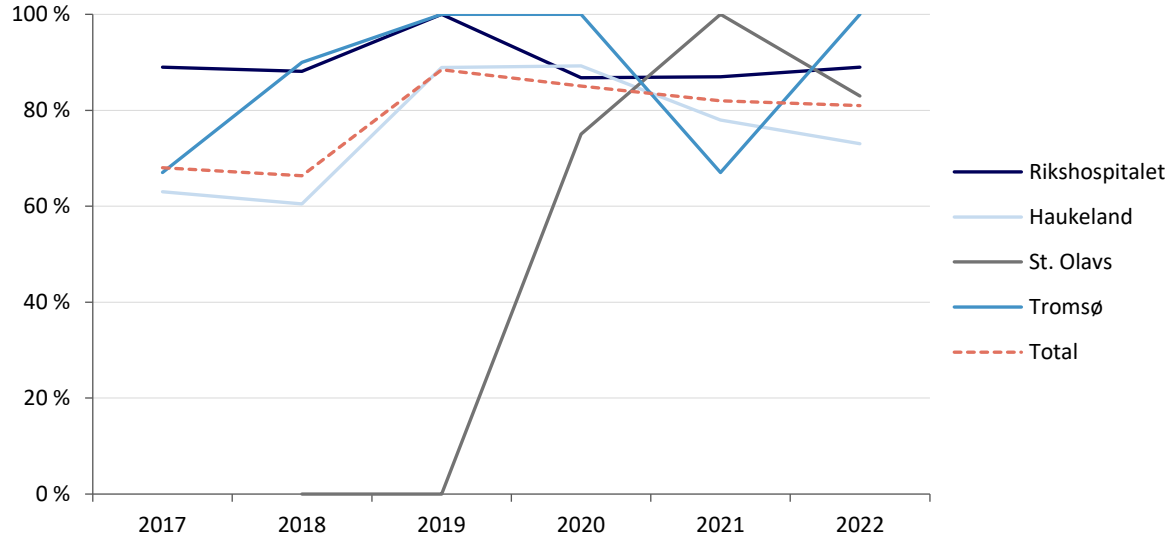
The Oxford classification gives information on how «active» and/or "chronic" an IgA nephropathy is. The higher the M (mesangial hypercellularity), E (endocapillary hypercellularity) and C (crescents) scores are, the more active the disease process is. Segmental sclerosis (S) and tubular atrophy (T) scores give information on chronic, irreversible changes.
The scoring model is of value in the clinical setting, and Norwegian pathologists have therefore started scoring IgA nephropathies according to this model. The registry has investigated to which degree pathology departments have implemented the Oxford classification of IgA nephropathy (Table 10). In 2022, four of six pathology departments have implemented the scoring system to varying degrees. In cases with less than eight glomeruli scoring according to the Oxford classification is not recommended. Thus, a 100% reporting rate is not expected.

Table 10. Total number of kidney biopsies and number of IgA nephropathies with Oxford classification, per pathology department in 2022.

Pathology department	No. of kidney biopsies	No. of IgA nephropathies	% IgA nephropathies	No. of reports with Oxford classification	% reports with Oxford classification
Rikshospitalet	264	46	17 %	41	89 %
Haukeland	166	40	24 %	29	73 %
Førde	6	0	0 %	0	-
Ålesund	5	0	0 %	0	-
St. Olavs	59	12	20 %	10	83 %
Tromsø	18	5	28 %	5	100 %
Total	518	103	20 %	85	83 %

As figure 21 shows, the rate of reports that include the Oxford classification has steadily increased over the years. The rate seems to be stabilizing at a high level.

Figure 21. Percentages IgA biopsies with Oxford classification per pathology department



Only pathology departments with five or more biopsies diagnosed with IgA is included in the table.

Table 11 shows the MEST scores from the three pathology departments with more than 10 IgA nephropathies per year.

Table 11. Oxford classification MEST in 2022

Category	**M**		**E**		**S**		**T**			**C**		
Score	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**2**	**0**	**1**	**2**
Rikshospitalet	37 %	63 %	93 %	7 %	46 %	54 %	68 %	22 %	10 %	66 %	29 %	5 %
Haukeland	38 %	62 %	55 %	45 %	14 %	86 %	52 %	48 %	0 %	52 %	45 %	3 %
St. Olavs	20 %	80 %	50 %	50 %	20 %	80 %	30 %	50 %	20 %	70 %	20 %	10 %

Table 12 gives an overview about registered non-neoplastic kidney biopsies and the related diagnoses per pathology department.

Table 12. Overview pathology diagnoses in Norway in 2022

	All	RH	HUS	St. Olavs	Tromsø
Minimal change nephropathy	27	11	13	2	0
FSGS[1] primary	18	7	8	0	2
FSGS secondary	6	0	4	1	0
Membranous GN[2]	28	10	11	6	0
IgA nephropathy	103	46	40	12	5
Mesangioprol. GN without IgA	6	4	2	0	0
Endokapillary prol. GN	4	3	1	0	0
Membranoproliferativd GN	5	4	0	0	0
ANCA associated GN	24	13	7	2	1
Anti-GBM nephritis	6	2	3	1	0
GN with crescents not ANCA	9	4	3	0	2
HSP[3]	10	5	4	1	0
Lupus nephritis - I	0	0	0	0	0
Lupus nephritis - II	2	2	0	0	0
Lupus nephritis - III	5	3	0	2	0
Lupus nephritis - IV	9	1	5	2	1
Lupus nephritis - V	5	4	0	1	0
Lupus nephritis - VI	0	0	0	0	0
Lupus nephritis - not classified	0	0	0	0	0
Diffuse proliferative GN	0	0	0	0	0
Dense deposit disease	0	0	0	0	0
Fibrillary glomerulopathy	0	0	0	0	0
Immunotactoid GP[4]	1	0	1	0	0
Cryoglobulinemia	0	0	0	0	0
Pre-eclampsia-ass. GN	0	0	0	0	0
Sclerosing GN	0	0	0	0	0
GN unclassified	3	1	2	0	0
Alport syndrome	3	2	0	1	0
Thin basement membrane GP	9	4	3	0	2
Fabry's disease	0	0	0	0	0
Other hereditary diseases	0	0	0	0	0
Diabetic nephropathy	40	29	7	2	2
Benign nephrosclerosis	31	15	9	5	1
Malign nephrosclerosis	1	0	1	0	0
Cholesterolemboli	1	1	0	0	0
Vasculitis other	0	0	0	0	0
TMA[5]	3	3	0	0	0
TMA - atypical HUS[6]	0	0	0	0	0
Scleroderma	0	0	0	0	0
Amyloidosis not classified	2	1	1	0	0
Amyloidosis - AA	6	6	0	0	0
Amyloidosis - AL	9	4	3	0	1
Amyloidosis other	0	0	0	0	0
Myeloma kidney	3	1	1	1	0
Ig[7] deposition disease	2	0	0	2	0
ATN[8]	23	19	2	2	0
Acute interstitial nephritis	0	0	0	0	0
Tubulointerstitial nephritis	30	16	8	6	0
Granulomatous TIN[9] / Sarc.	3	0	3	0	0
TIN - drug associated	10	7	1	1	0
Lithium nephropathy	2	2	0	0	0
Phosphate nephropathy	0	0	0	0	0
Oxalate nephropathy	3	2	1	0	0
TIN with uveitis	1	0	1	0	0
TIN aminoglycosides ass.	0	0	0	0	0
TIN autoimmune disease ass.	0	0	0	0	0
TIN cisplatin ass.	0	0	0	0	0
TIN hantavirus infection	0	0	0	0	0
Calcineurin inhibitor toxicity	0	0	0	0	0
Normal	14	9	1	3	1
Uncharacteristic atrophy	23	10	7	4	0
End stage kidney	2	1	1	0	0
No code - free text	10	3	6	1	0
Not representative	16	9	6	1	0
All	518	264	166	59	18

1: Focal and segmental glomerulosclerosis, 2: Glomerulonephritis, 3: Henoch Schönlein's purpura, 4: Glomerulopathy , 5: Thrombotic microangiopathy, 6: Hemolytic uremic syndrome , 7: Immunoglobin, 8: Acute tubular necrosis, 9: Tubulointerstitial nephritis,
RH: Rikshospitalet, HUS: Haukeland University Hospital

CKD5 not in RRT

New patients with CKD5 not treated with RRT that is reported to the registry has remained relatively stable at about 300 patients per year over the last years. Most patients are male (71%), with median (range) age of entering the CKD5 stage being 71 (19-93) years old. Mean BMI decreased slightly from 27.6 kg/m^2 (2021) to 26.7 kg/m^2 (2022).
Patients were known at the nephrology unit in 89% of the cases, and 84% were candidates for RRT. The percentage of patients who are not candidates for RRT at entry in the registry is declining, from 11% in 2020, 9% in 2021, and 8% in 2022. The main reason for not being a transplant candidate was comorbidity. Type II diabetes has become less prevalent in the CKD5 population, decreasing from 34% in 2020, 32% in 2021, and now to 27% in 2022.

Selected clinical chemistry values and demographic variables are available below (**Table 13**)

Table 13. Status at first time reported as CKD5 (without RRT) in 2022

	Total (n = 316)
eGFR (CKD-EPI 2021, mean) [mL/min/1.73m2])	13
eGFR (CKD-EPI 2021 - % < 15 mL/min/1.73m2)	85%
Creatinine (mean) [µmol/L]	413
Albumin (mean) [g/dL]	38
Haemoglobin (mean) [g/dL]	11.1
Haemoglobin - % with < 10 g/dL)	20%
Proteinuria (ACR>3 and/or PCR>15)	99%
ESA use	37%
Active use of vitamin D	53%
Statin use	63%
Not on antihypertensive drugs	7%
Using ACEi or ARB	48%
Using >=3 antihypertensive drug	57%
Using bicarbonate	60%

The main cause of renal failure remains vascular or hypertensive disease, at a rate of 41%, a figure that has remained stable the last five years. When chronic hypertensive nephropathy was the main reason for renal failure, this was proven by histology in 16% of the cases. Diabetes (15%), glomerulonephritis (12%) and polycystic kidney disease (12%) remain the next most prevalent reasons for renal failure. The yearly proportion of main cause of renal failure over the last three years is shown in **Table 14**.

Table 14. Reason for CKD5 over time

Reason for CKD5	**2019**	**2020**	**2021**	**2022**
Vascular or hypertensive disease	43 %	38 %	44 %	41%
Diabetes	13 %	17 %	18 %	15%
Glomerulonephritis	12 %	16 %	14 %	12%
Polycystic kidney disease	10 %	8 %	8 %	13%
Pyelo- or tubulointerstitial nephritis	8 %	7 %	7 %	8%
Other	6 %	5 %	3 %	6%
Amyloidosis	1 %	2 %	2 %	3%
Immunologic/systemic disease	4 %	3 %	2 %	1%
Unknown or unspecified reason	2 %	3 %	1 %	2%
Cancer (kidney)	0 %	0 %	0 %	0%
Myelomatosis	1 %	1 %	0 %	1%

While the percentage of patients entering CKD5 using three or more hypertensive drugs has remained steady at 60%, now at 57%, the percentage of patients using ACE-inhibitors or ARB decreased slightly from 52% in 2021to 48% in 2022.

For patients starting RRT during 2022, the median (range) time in the CKD5 stage was 13.2 months (0-64.5). The median time in CKD5 prior to RRT has been steadily increasing over the last five years, 9.9 (2018), 11.2 (2019), 12.2 (2020), 12.8 (2021), 13.2 (2022), with a similar trend for the mean.

CKD5 in RRT (Dialysis or Transplantation)

The total number of new patients in RRT is continuing a downward trend over the last three years, with 602patients in 2019, 551in 2020, 530in 2021, and now 540 in 2022 (**Figure 22**).

The majority of patients are male (70%) and median age at start of RRT was 67.8 years (mean 64.4 years), ranging from 1.8 to 95.4 years. At time of start of dialysis 38% were assessed by the treating physician to be a transplant candidate (and additionally 21% possibly candidates). Of the patients starting hemodialysis, and that had been know at the treating center for at least 4 months, 43% started dialysis using an AV-fistula as blood access, a stable level the last 10 years. A selection of clinical chemistry values and drugs used in patients starting RRT in 2022 are shown in **Table 15**.

Table 15. Status at start of RRT in 2022

	Total	HD	PD	Preempt. Tx
Number of patients	540	338	157	45
Age (mean) [year]	64.4	65.2	66.7	50.2
Age (median) [year]	67.8	68.5	69.5	51.1
eGFR (CKD-EPI 2021, mean) [mL/min/1.73m^2])	8	8	8	12
eGFR (CKD-EPI 2021 - % < 15 mL/min/1.73m^2)	96%	96%	97%	93%
Creatinine (mean) [µmol/L]	680	710	665	520
Albumin (mean) [g/dL]	35	33	36	43
Haemoglobin (mean) [g/dL]	9.9	9.5	10.4	10.8
Haemoglobin - % with < 10 g/dL)	52%	64%	34%	23%
ESA use	59%	57%	69%	36%
Active use of vitamin D	62%	59%	67%	71%
Statin use	59%	57%	65%	44%
Not on antihypertensive drugs	8%	9%	4%	13%
Using ACEi or ARB	42%	39%	47%	42%
Using ≥3 antihypertensive drug	64%	61%	74%	46%
Using bicarbonate	55%	52%	62%	56%

As expected, pre-emptively transplanted patients had a lower serum creatinine, i.e. better renal function, and a higher hemoglobin compared with those starting hemodialysis. The proportion of transplanted patients using ESA increased from 20% (2021) to 36% (2022), compared to 25% in 2019. Despite no changes in mean haemoglobin, the proportion with haemoglobin <10 g/dL decreased from 30% (2021) to 23% (2022).

In **Figure 22 to 25** below the annual incidence of new patients in RRT by first treatment modality, age and if they are considered as Tx-candidates by the local treating physician is presented.

Figure 22:

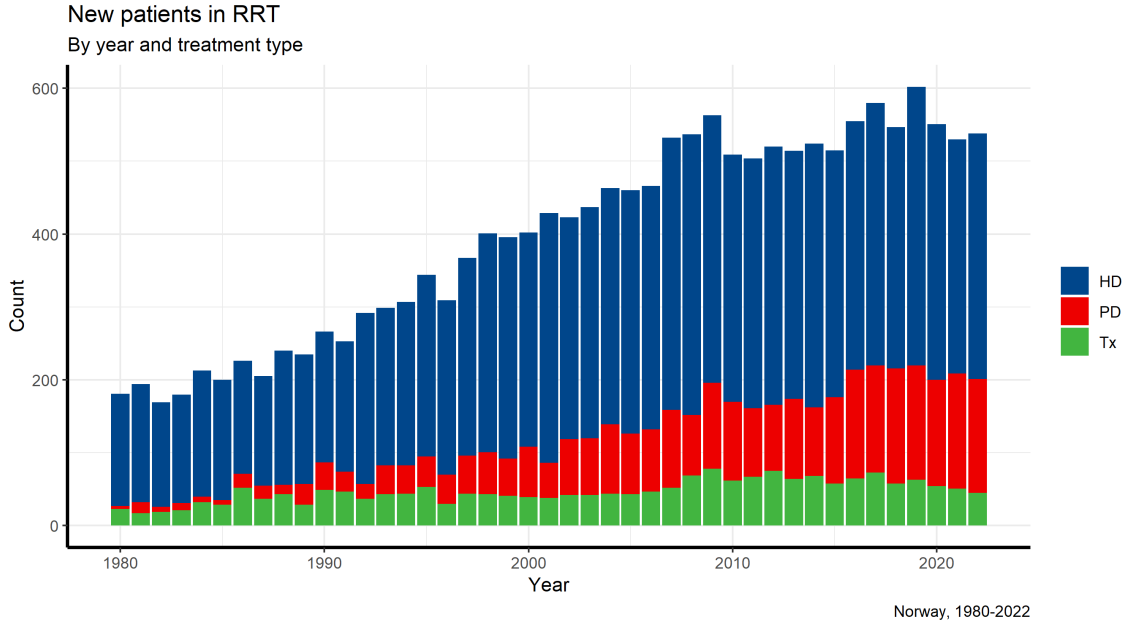


Figure 23:

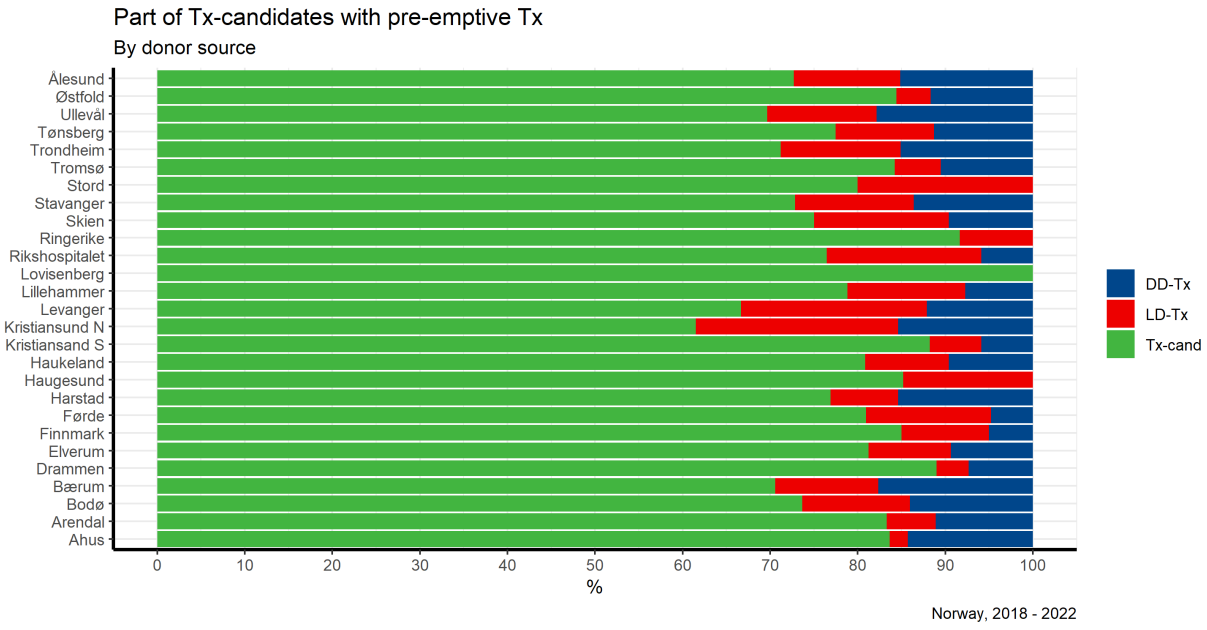


Figure 24:

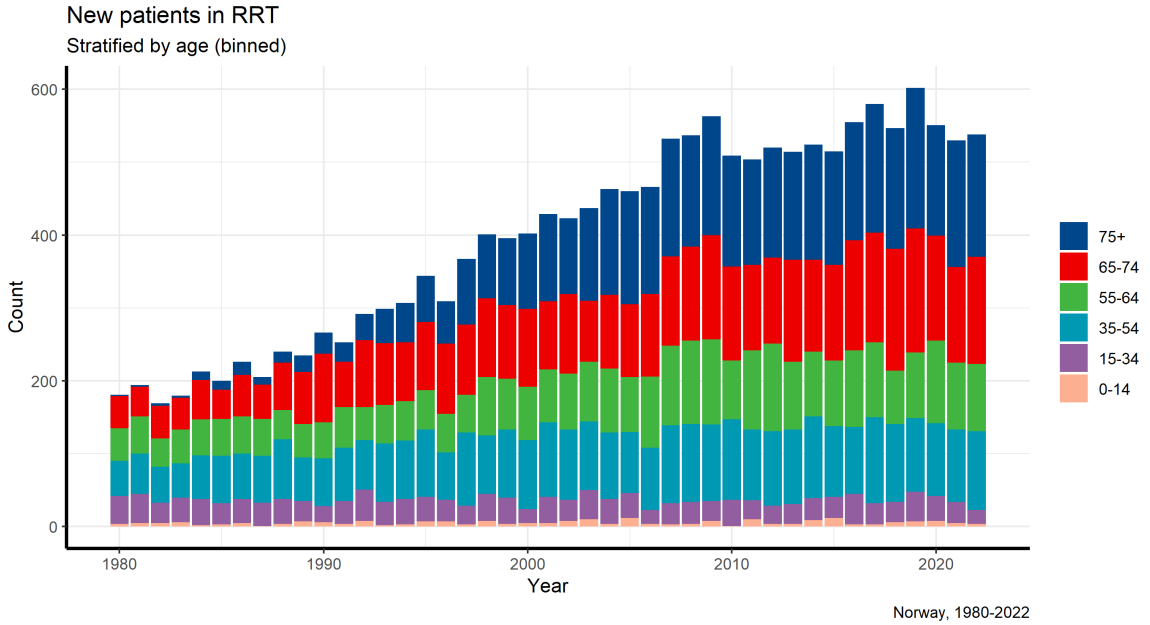
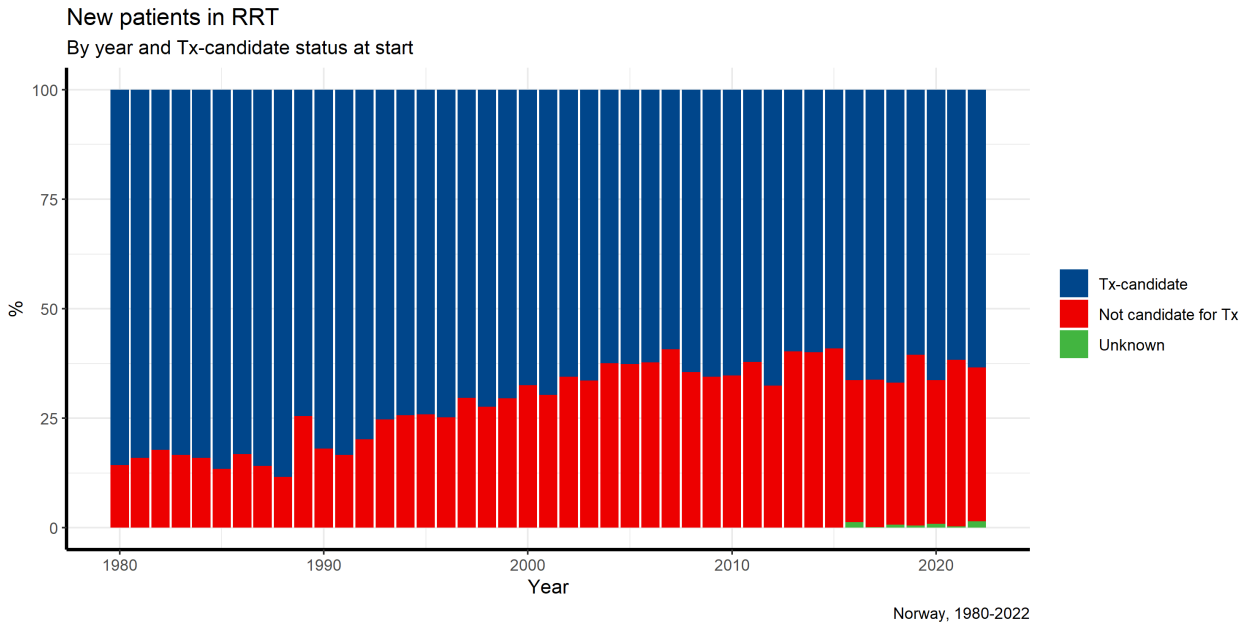


Figure 25:



Since registration started in 1980 it has been a continuous shift in patient age. (**Figure 26**) Both the maximum and the median age at start of RRT have increased. Also, the 5-percentile and 95-percentile values (i.e. including the majority of patients) have increased with a similar number of years. But also, younger children have been accepted; the youngest ever started PD in 2011 at age two days. Four children below 16 years started RRT in 2022; transplantation (n=2), HD (n=1) and PD (n=1), as compared to 10 in 2020 and five in 2021.

Figure 26:

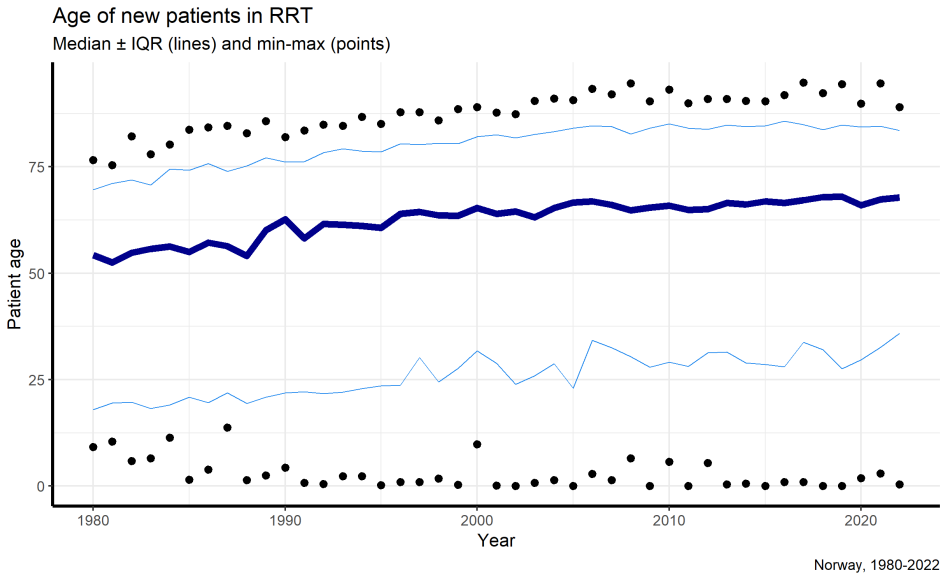


Table 16. Primary renal disease at start of RRT

	1980-89	1990-99	2000-04	2005-09	2010-14	2015-19	2020-22
Glomerulonephritis	35%	27%	18%	18%	16%	15%	16%
Pyelo/interstitial nephr.	15%	11%	11%	10%	9%	8%	7%
Polycystic diseases	10%	9%	9%	8%	7%	9%	10%
Diabetic nephropathy	13%	11%	15%	16%	17%	17%	17%
Amyloidosis	6%	5%	3%	2%	3%	2%	2%
Vascular/hypertensive	7%	21%	28%	31%	32%	32%	32%
Immune/systemic	5%	5%	4%	4%	4%	4%	4%
Kidney tumor	1%	1%	1%	2%	1%	1%	1%
Myelomatosis	2%	2%	3%	3%	2%	2%	1%
Other defined	4%	4%	3%	4%	7%	7%	7%
Unknown	3%	3%	4%	4%	2%	3%	4%
N:	2018	3234	2151	2557	2570	2801	1610

The main change over time has been an increase of vascular/hypertensive nephropathy and a relative reduction of glomerulonephritis. Whether this only reflects changed coding practice or a true shift is not known.

Diabetic nephropathy has stabilized on a higher levels as primary diagnosis cause for renal disease the last decade. In 2022, 30% of these were registered as having Type I diabetes mellitus in relation to 26% in 2020 and 17% in 2021. Also including patients with other primary diagnoses of renal disease a total of 184 patients were recorded as having diabetes mellitus at start of RRT (16% Type I), thus 34 % of new patients in RRT were diabetics.

The time from onset of diabetes to start of RRT differed considerably. For the patients with Type I diabetes the median time was 32 years, while for the patients with Type II diabetic nephropathy the median time was 17 years. Similar as the year before.

Cardiovascular disease is often present at start of RRT. Coronary heart disease was reported in 28% and 23% had anamnestic heart failure. Echo-verified left ventricular hypertrophy was reported in 25%. Cerebrovascular disease was reported in 14% and peripheral atherosclerotic disease in 12% while 10% had chronic obstructive lung disease.

Prevalence data CKD5 without RRT by December 31st 2022.

The national coverage of CKD5 patients not in RRT is in the range of 60% to 85%. The registry is currently in queue for a coverage analysis in cooperation with the Norwegian Patient Registry (NPR). The reported data on CKD5 patients not in RRT should hence be interpreted with caution.

There were 563 CKD5 patients in the registry that did not receive renal replacement therapy by the end of 2022 (538 in 2021). In CKD5 patients starting RRT in 2022, the median time to starting RRT was 11months, ranging from 0.1 to 66 months. In total 302 of the 539 (56%) starting RRT during 2022 had not been included in the registry before RRT start; 64% of those starting in HD, 43% of those starting in PD and 38% of those being preemptively transplanted. This underlines that there is a significant underreporting of patients to the registry when they enter in CKD5.

Prevalence data RRT by December 31st 2022.

By the end of 2022, 5427 patients in Norway received renal replacement therapy, i.e. 988.9 per million inhabitants. This represents a decrease of 1.1% from 2021, in contrast to an increase of 0.6% from 2020-2021.

Median age by the end of the year was 62.3 years, mean 60.4 years and range 1.0 to 95.8 years. A total of 64.8 % of the RRT population at the end of 2022 were male.

Table 17. Age distribution in prevalent patients by December 31st 2022

	Total (n:5424)	HD (n:1399)	PD (n:400)	Tx (n:3624)
Age (mean) [years]	60.4	66.6	65.2	57.5
Age (median) [years]	62.3	69.0	67.7	59.2
Age (minimum) [years]	1.0	1.0	8.7	3.9
Age (maximum) [years]	95.8	95.8	92.5	93.8

Figures 27 and 28 show prevalence per treatment modality, development over time and by center in 2022

Figure 27:

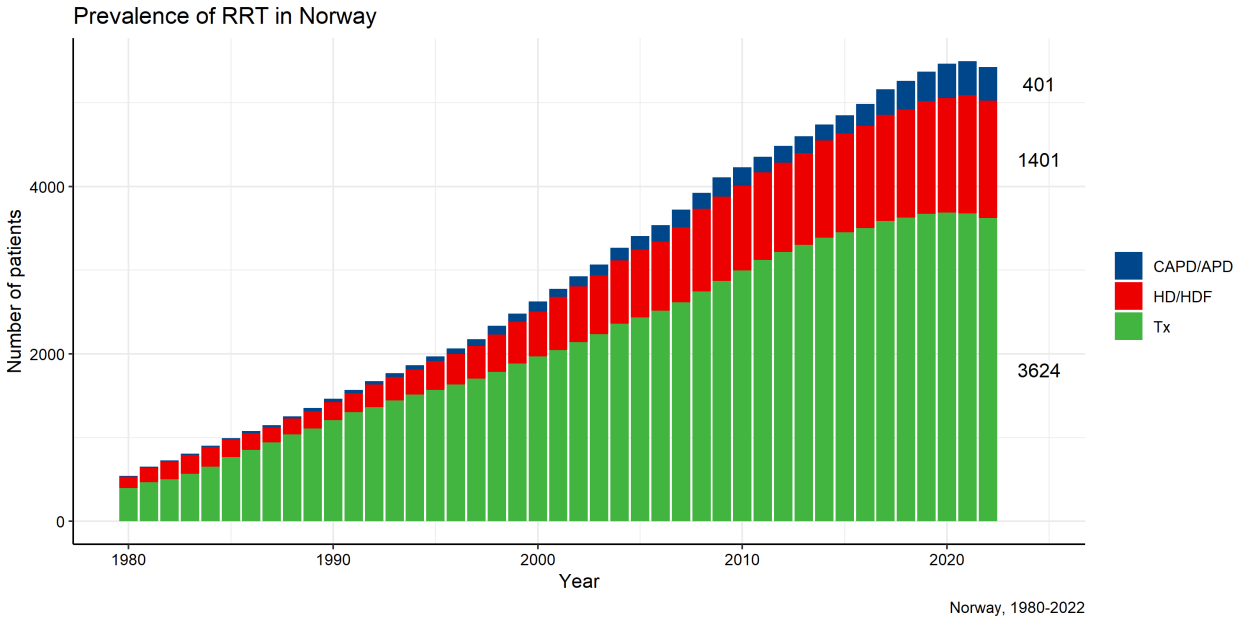
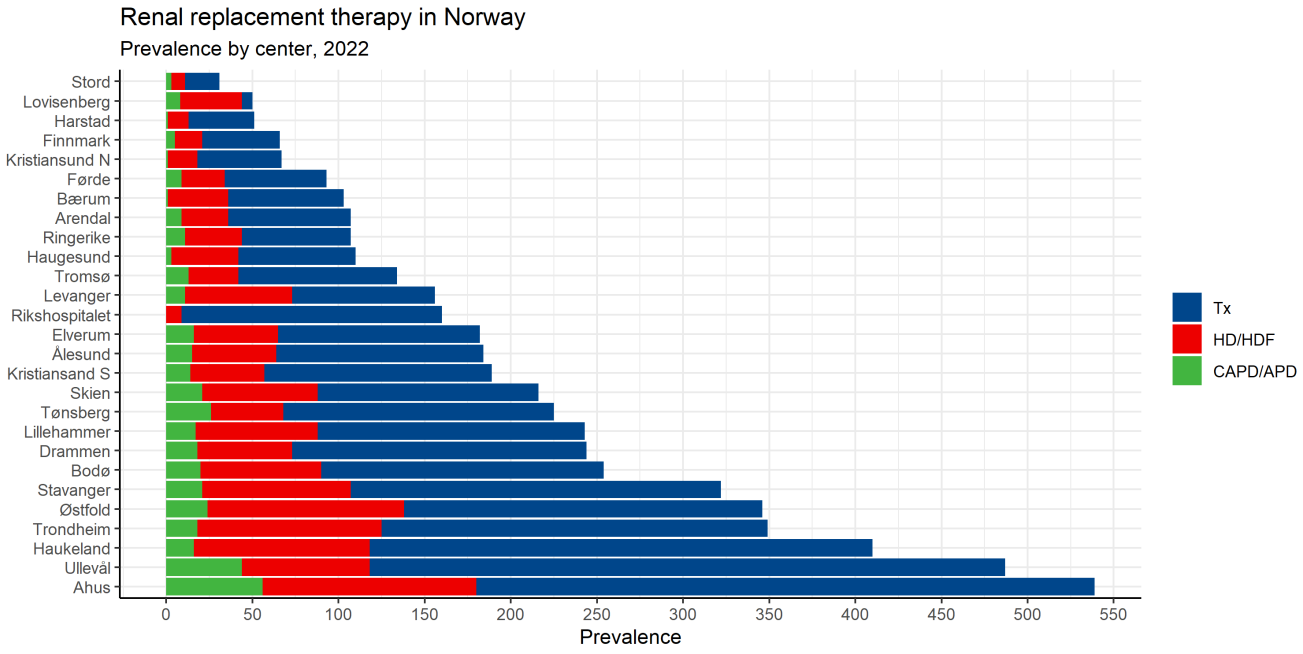


Figure 28:



SARS-CoV-2 IgG status, a new annual variable in the registry:

Information about SARS-CoV-2 IgG status was included in the capture of annual data 2021 and data on COVID-19 has been reported to the registry during the entire pandemic. Kidney transplant patients are at higher risk of serious outcomes from COVID-19 and in 2022 57 transplant patients, 10 dialysis patients and 3 CKD5 patients not on RRT died from COVID-19. (respective figures for 2023 up to October is 3, 2, 0). Over 90% of the transplant recipients have sent SARS-CoV-2 IgG samples to OUS-Rikshospitalet for analysis of vaccine response and per October 2023 there are still 20% without serologic vaccine response, despite up to 10 vaccine doses (between 3-4% have not been vaccinated). About one third have what is assumed to be a relevant protective vaccine response. The situation for dialysis patients is overall a bit better.

Transplantations:

A total of 229 renal transplantations were performed in Norway in 2022, i.e. 41.7 per million inhabitants, 21% were retransplantations and 19% were living donor transplants (**Figures 29-31**). Preemptive transplantation was performed in 34% of all first transplantations in 2022, an increase by 8%-points from the year before (26%) (**Figure 32**). 139 non-preemptive, first transplant recipients had been in dialysis for a median of 2.2 years (mean 2.7 years), ranging from 17 days to 17.1 years. An increase from 2021.

In principle, transplantation is offered to all patients considered to profit from it, with no strict upper or lower age limit. The age of the 146 first-DD-graft recipients in 2022 ranged from 9 to 81 years, with a median age of 56 years. Out of these, 34% were above the age of 65 and 6% were 75 or older. The 38 recipients of a first-LD-graft were from 3.5 to 78 years, with a median age of 42 years. Regraft recipients, LD and DD (n=45), were from 24 to 72 years, median 54 years.

Figure 29:

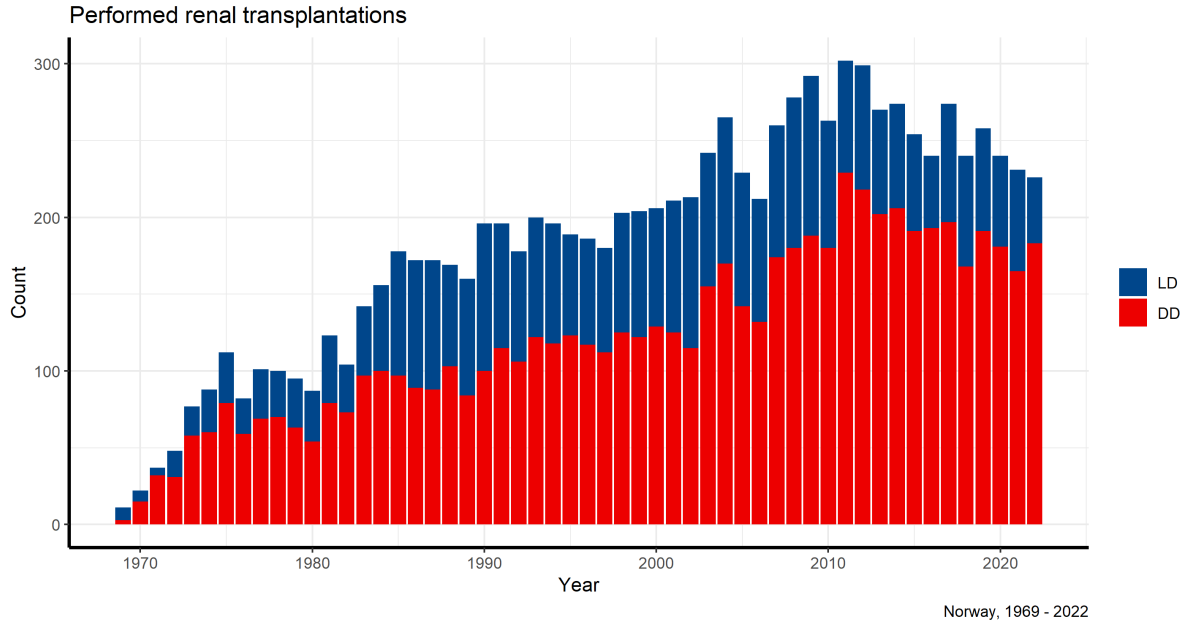


Figure 30:

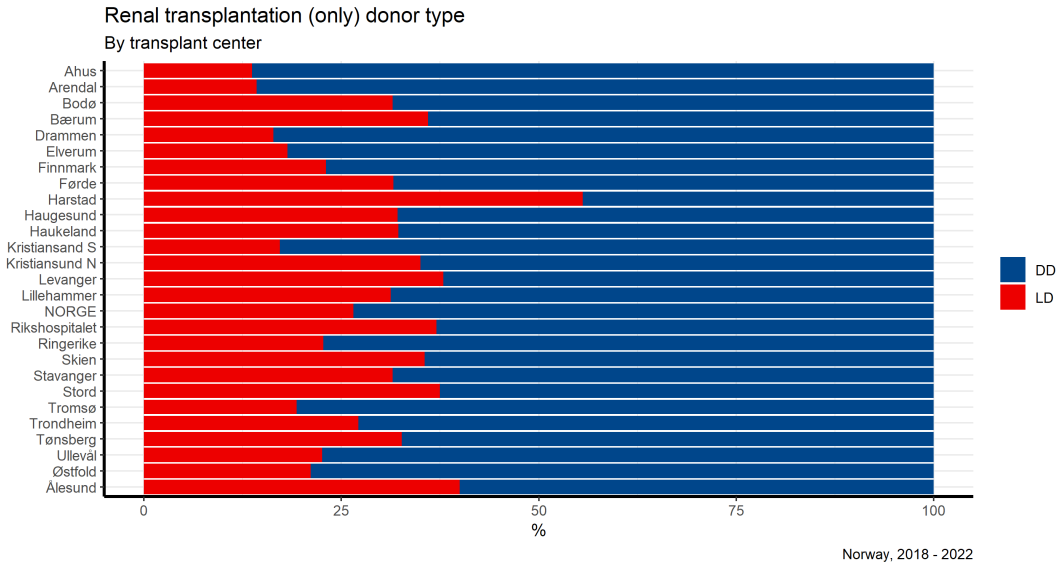


Figure 31:

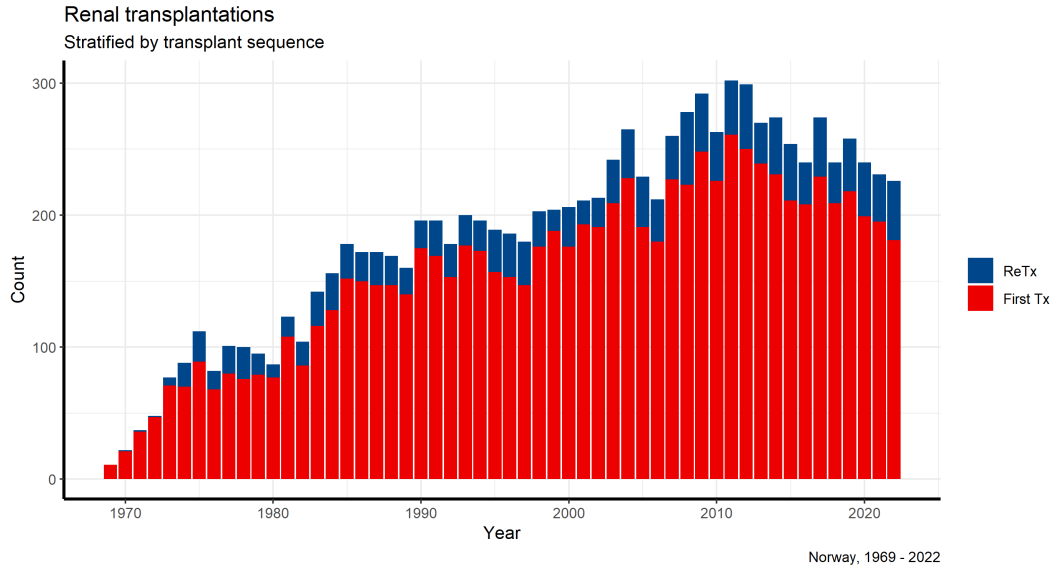
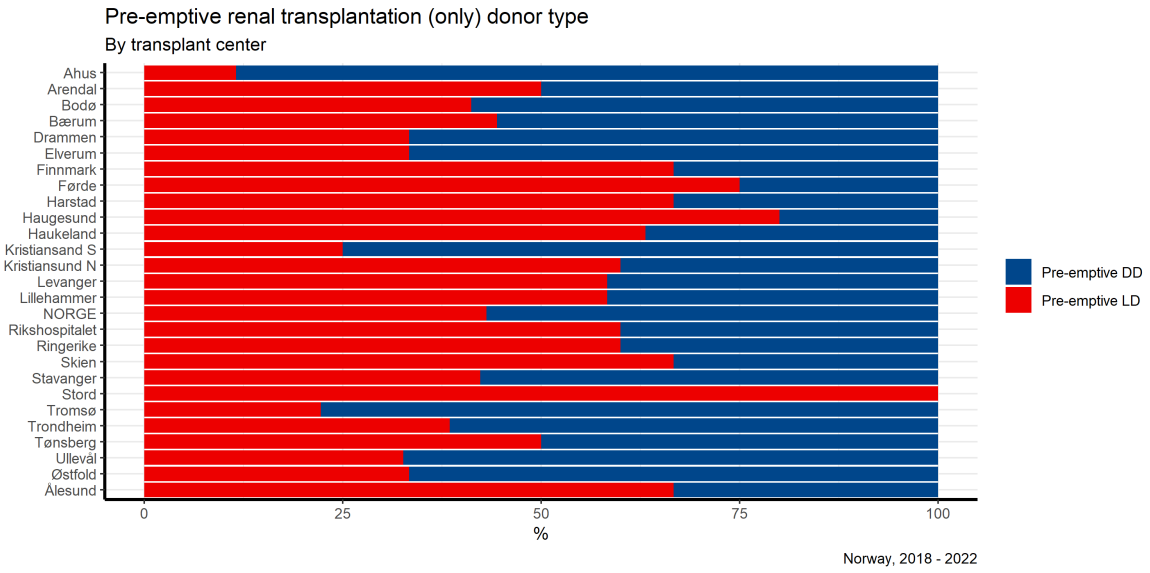


Figure 32:



Distribution of relation between recipient and donor in living donor transplantation is presented in **Figures 33 and 34**. Simultaneous pancreas and kidney (SPK) transplantation was performed in 3 patients and simultaneous liver and kidney transplantation in 2.

Figure 33:

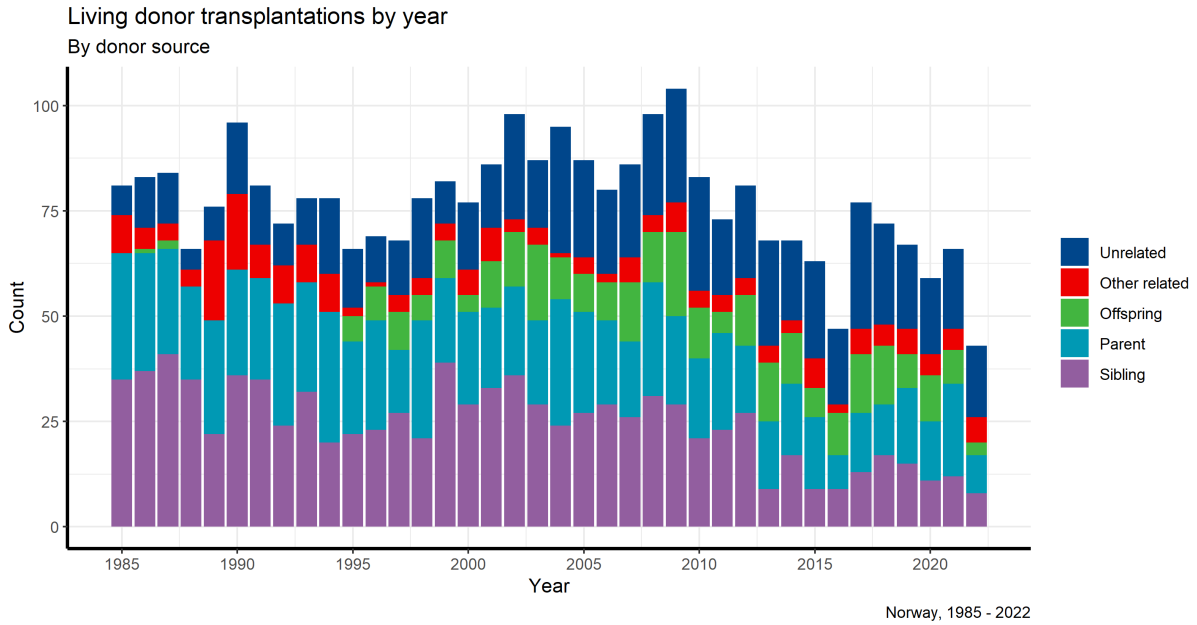
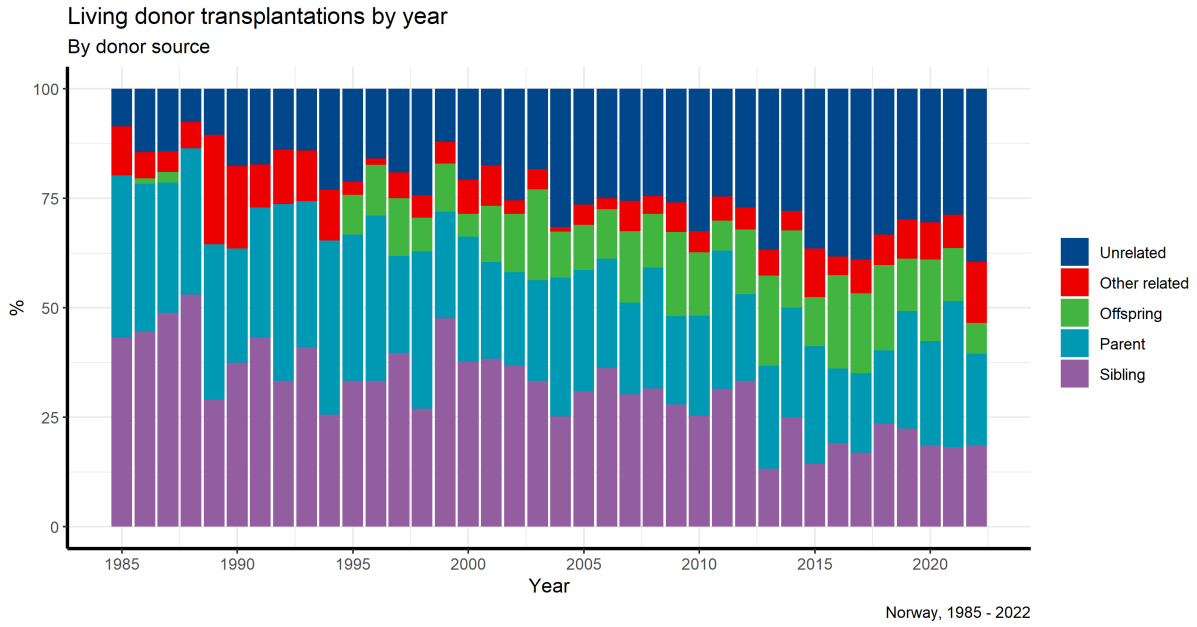


Figure 34:



Fun-facts Transplantation (by 31.12.2022):

The oldest kidney transplant recipient ever was 84.1 year at time of transplantation (youngest 9.5 months). In total 1,038 recipients have been transplanted at an age older than 70 years, 48 older than 80 years. The oldest kidney transplant recipient ever is 93.8 years and she is still living. In total 15 patients have become older than 90 years (2 now living) and 682 reached an age over 80 years (153 now living).

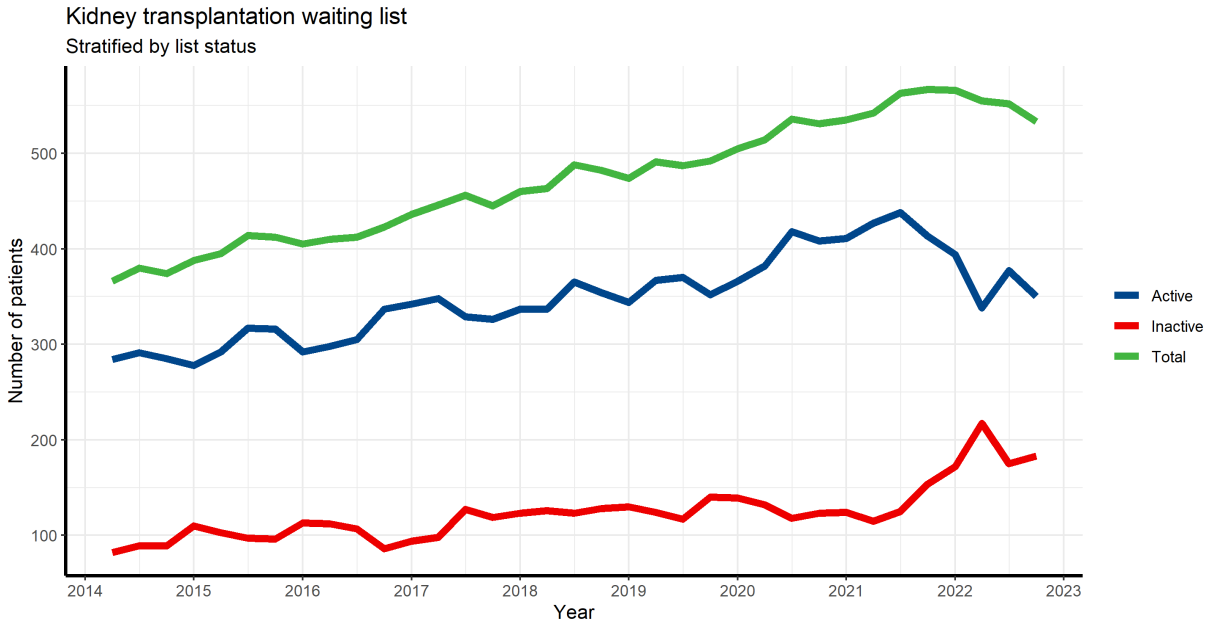
The longest graft survival is 53.1 years, and still functioning. In total 54 (28 still working) grafts have functioned in a new body for over 40 years. The oldest transplanted kidney ever is 112.2 years and the oldest still working is 106.0 years. In total 12 (4 still working) transplanted kidneys have reached a total age of over 100 years and 100 (39) over 90 years.

Patients listed for transplantation:

The list of patients actively waiting for a kidney transplant at entry into 2022 consisted of 391 patients and at the end of 2022 it has decreased to 326 patients (59.4 per mill.) due to a larger part off patients being temporarily off the list compared to what was common before the pandemic (**Figure 35**). Including those temporarily not on the list, the total number waiting for a kidney at the end of 2022 was 537 patients (97.8 per mill.), a decrease from 565 by end of 2021 and similar to the 535 by end of 2020 (459 end of 2017).

Among those actively waiting by December 31st 2022, median time on the list was 14 months for a first transplant, 43 % had waited less than one year and 31 % more than two years, a slight increase from the year before. Recipients transplanted with a DD-graft in 2022 had a median waiting time of 21 months for a first transplant and 12 months for a retransplant and a maximum of 60 months at the time of grafting.

Figure 35:



Patient and graft survival:

Below selected Kaplan-Meier analyses are presented on patient survival in RRT and graft (not death censored) survival after transplantation, crude plots only. Changes in baseline characteristics should be taken into consideration, for example that median age when starting RRT is increasing by the year. More Kaplan-Meier analyses, including patient- and death censored graft survivals, are presented in the Appendix.

Patient survival in RRT:

Figure 36:

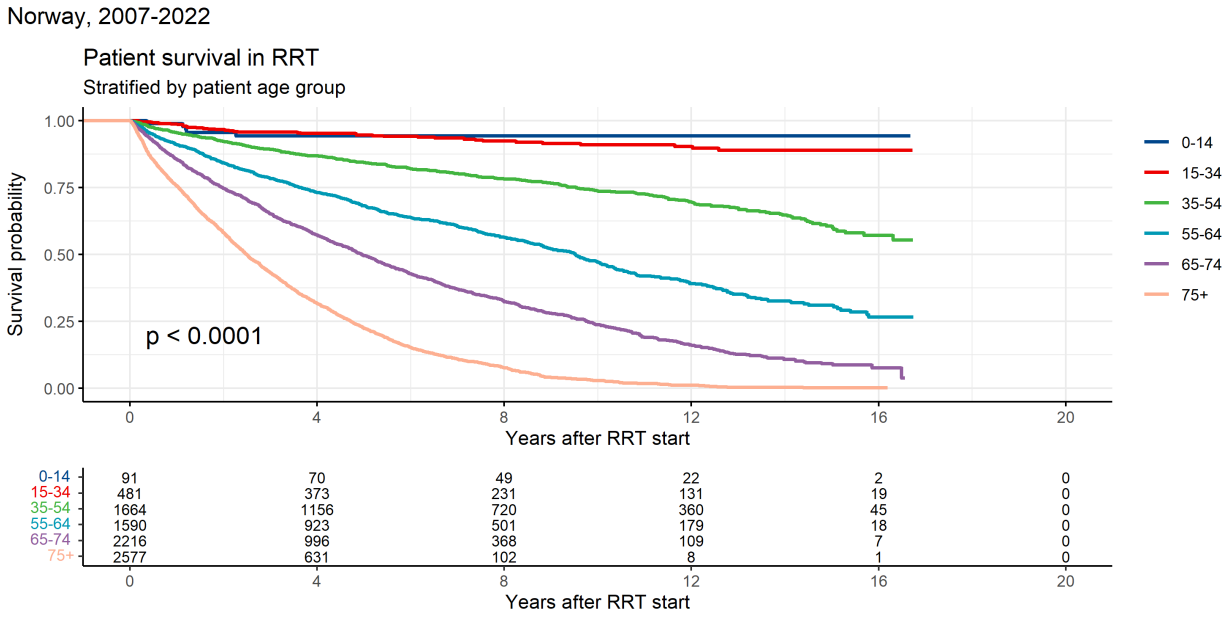
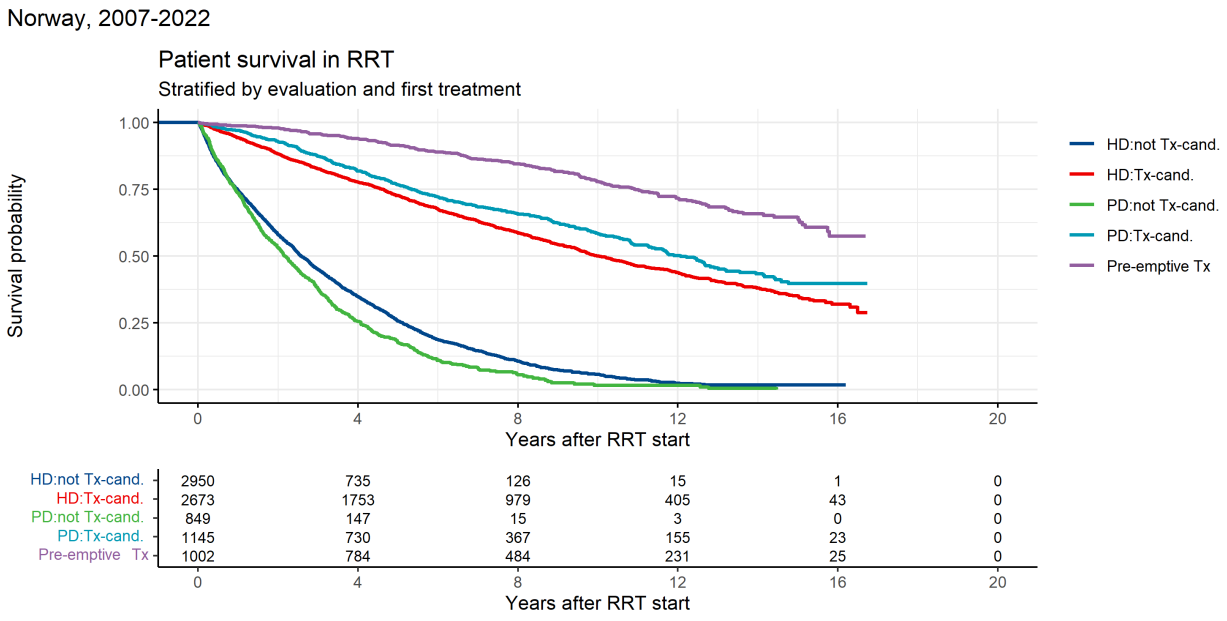


Figure 37:



Graft survival after transplantation:

Figure 38:

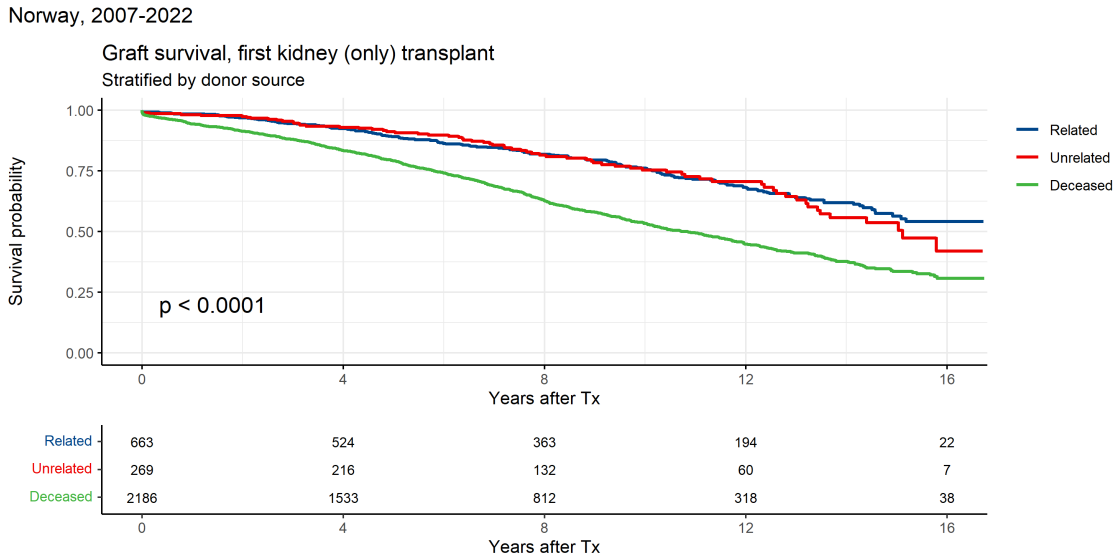


Figure 39:

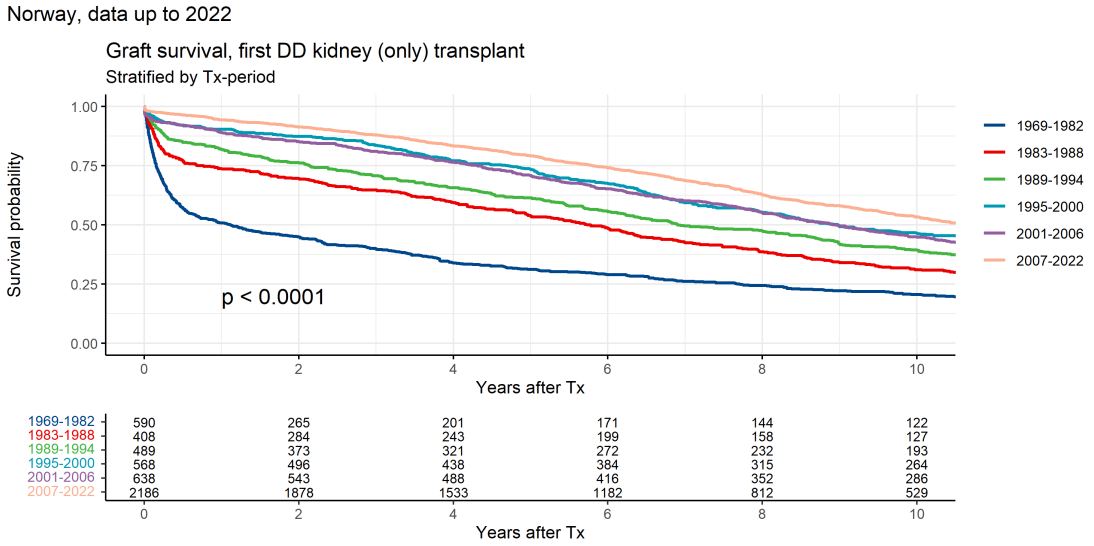


Figure 40:

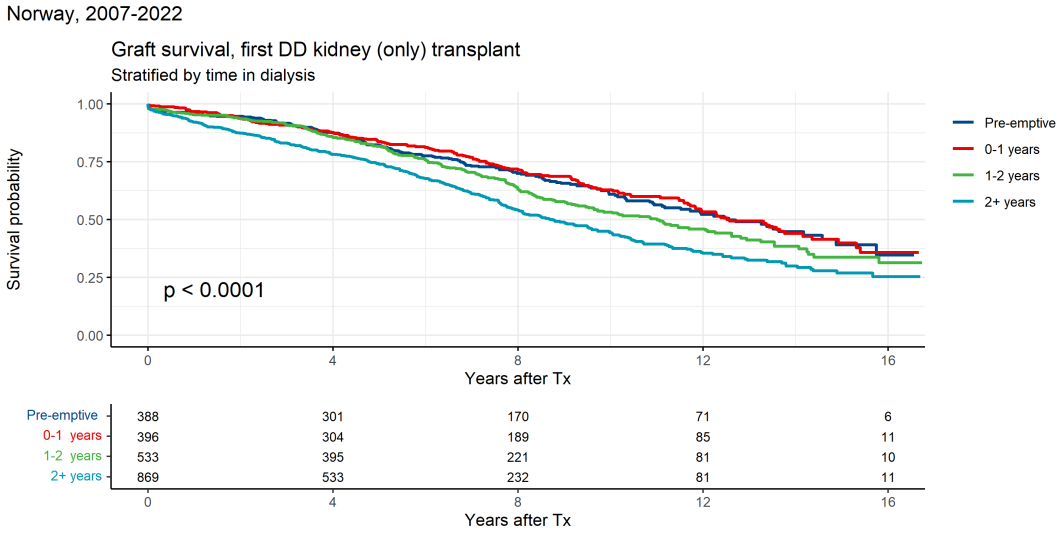


Figure 41:

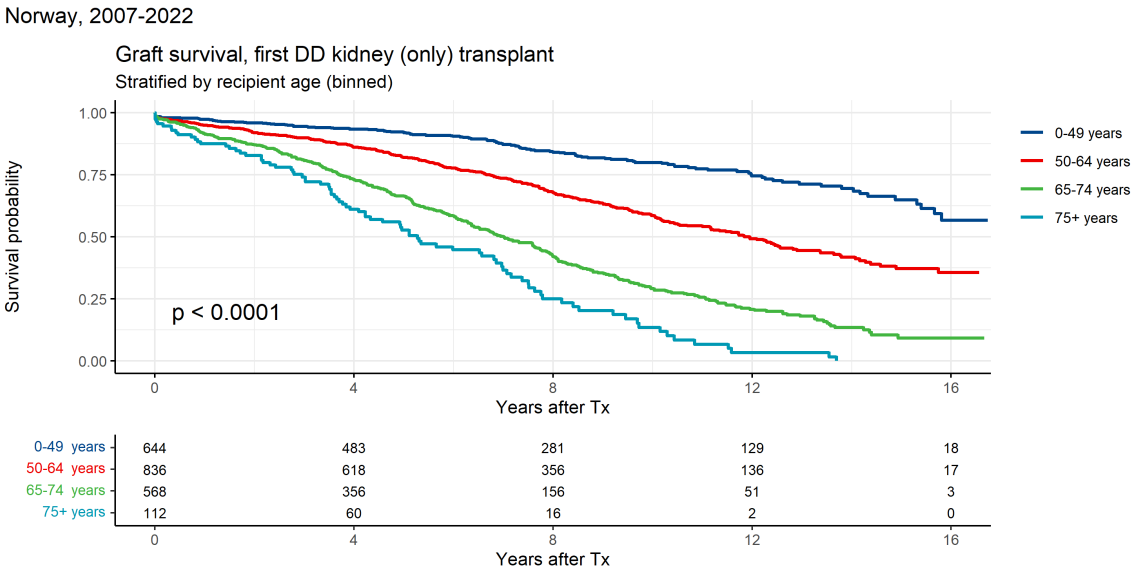


Figure 42:

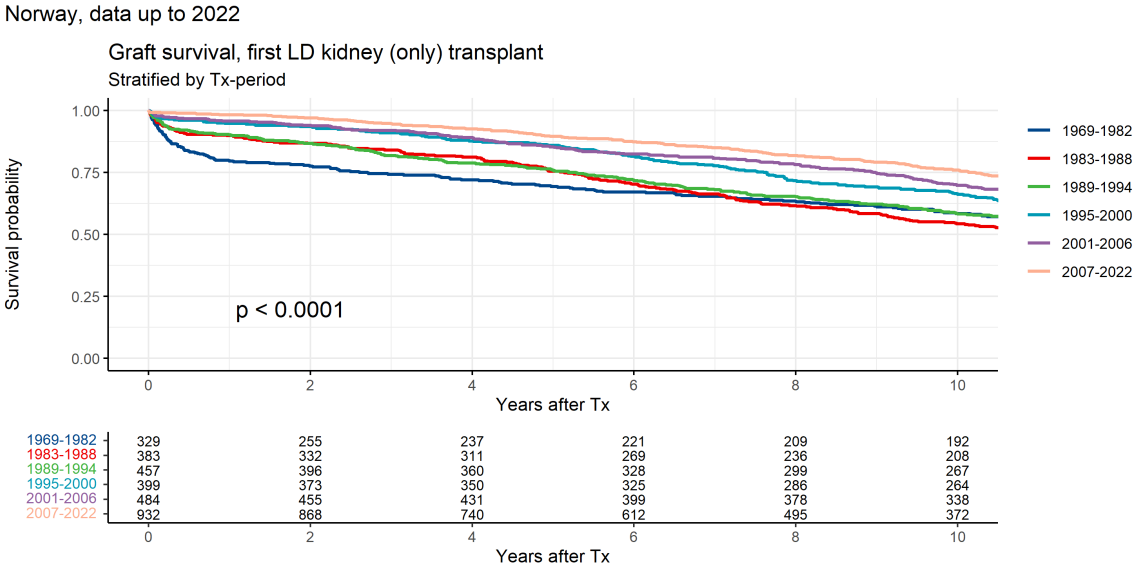


Figure 43:

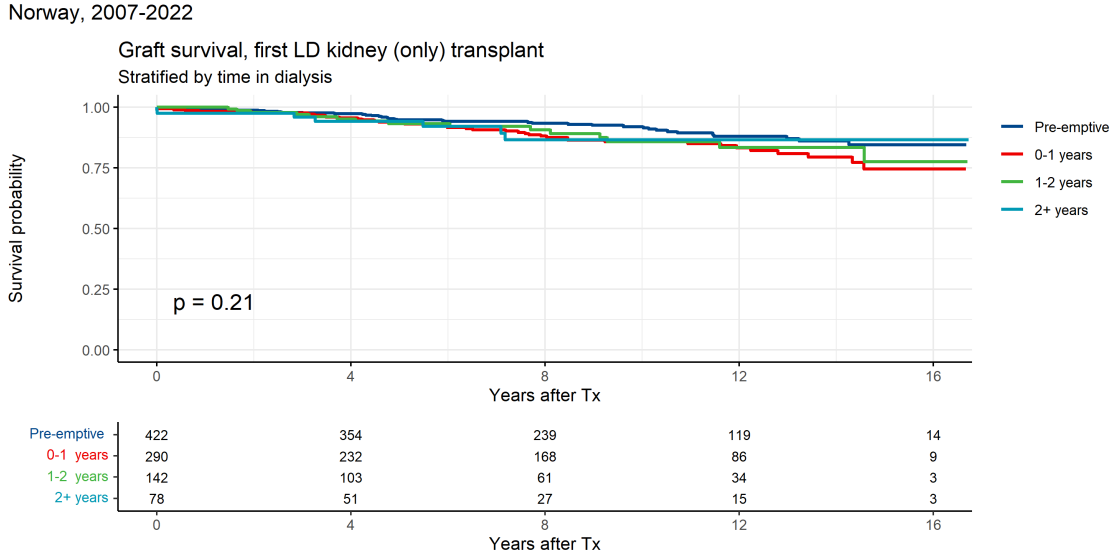
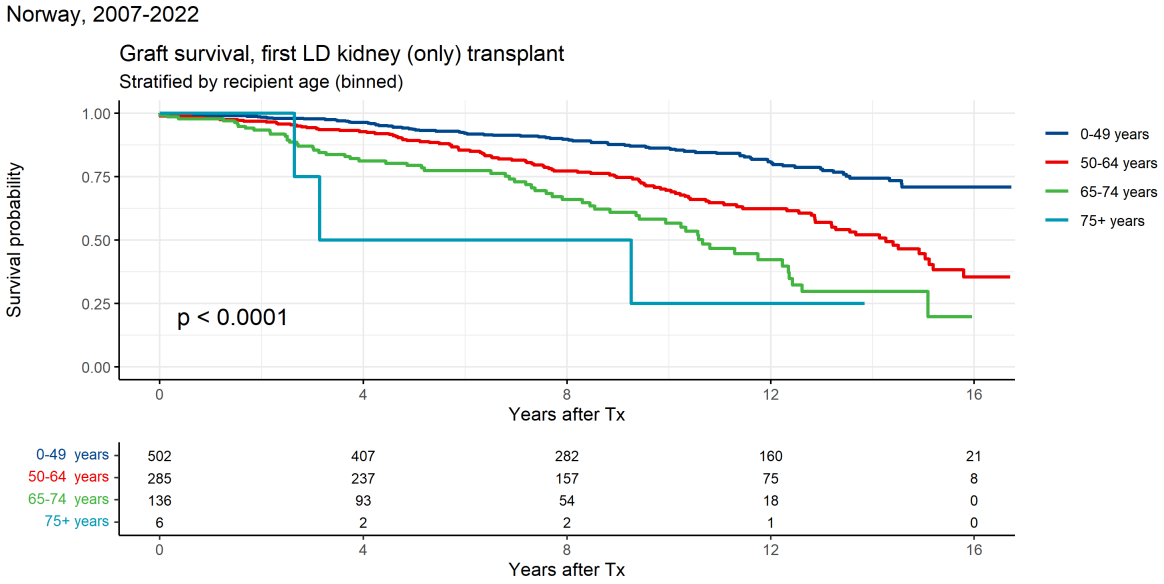


Figure 44:



Death in CKD5:

A total of 664 patients in CKD5 died during 2022. The majority of these were patients in hemodialysis (n = 284), followed by transplanted patients (n = 223). Many of the deaths were due to COVID-19 in 2022; 7 in HD, 3 in PD, 57 in transplantation and 3 in patients not in RRT.

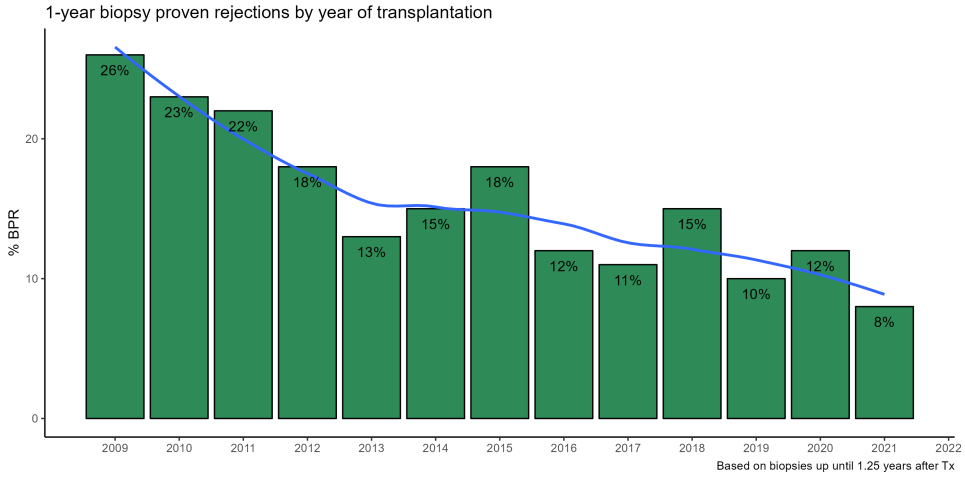
Median age at death was 76 years (mean 74 years), ranging from 8 to 97 years. Median time from start of RRT until death was 5.5 years (mean 9.3 years), ranging from 8 days to 48.7 years.

Infections and cardiac complications were the most frequent causes of death, followed malignant tumors.

Biopsy-proven rejections:

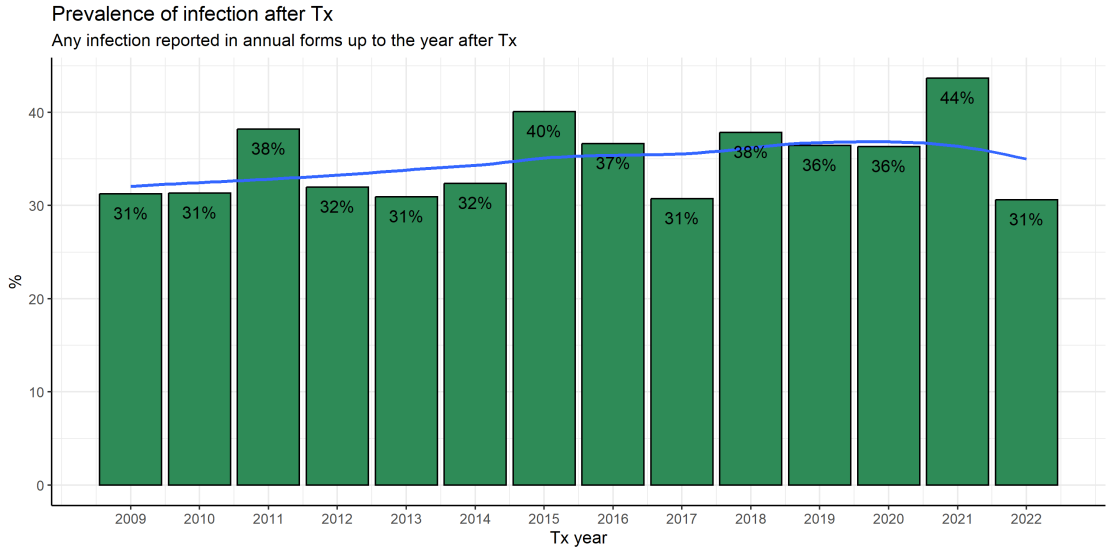
Recently the registry was able to obtain historic kidney biopsy results from the Department of Pathology. Additionally, we now receive biopsy records from Rikshospitalet every third month. This allows us to perform more granular analysis on the incidence of biopsy-proven rejections. **Figure 45** shows the rate of 1-year biopsy proven rejections by year of transplantation. The last three years the approximate acute rejection rate the first year after transplantation was in the range of 8% to 12%, a figure that has seen a steady decline over the last 10-year period, with intermittent spikes up to 14-18%.

Figure 45:



The prevalence of infections (bacterial, fungal, or viral) requiring hospital treatment the first two years after transplantation, in the same period as the decrease in acute rejection is seen, has remained steady around 30%, with intermittent up to 40% (**Figure 46**). This indicates that the decrease in acute rejection episodes presented above is not primarily due to higher degree of immunosuppression in the period.

Figure 46:



Quality indicators:

The registry has implemented 22 quality indicators (see appendix) that will be followed year by year to assure the quality of the treatment the patients included in the registry is subjected to. These data are presented interactively at this site (https://www.kvalitetsregistre.no/registers/464/resultater) and the national quality indicator of part in home dialysis is presented three times per year here (https://www.helsedirektoratet.no/statistikk/kvalitetsindikatorer/behandling-av-sykdom-og-overlevelse/andel-dialysepasienter-som-har-hjemmedialyse). Only a short summary of the results is presented as figures in this report for completeness (**see Appendix**) and is based on a reporting coverage as shown in **Figure 59** below.

Data on part of the patients on the waiting list for a kidney transplant that has been in dialysis for more than 2 years (first kidney transplant only, excluding immunized patients, counting also time during temporary withdrawals) is not relevant to present on a center level. In the period 2017-2020 the rate ranged between 28%-30%. In 2021 it was increased to 37% for patients actively on the transplantation list, and this level is stable also for 2022 (37%). During COVID-19 a higher proportion of the patients on the transplantation list has however been temporarily off, which may have biased the quality indicator part actively on the list with a longer time in dialysis.
In the figures below the indicator line represent the target percentage.

Figure 47:

Quality projects

In 2022 data on COVID-19 incidence and vaccine response from the registry have been important for both health authorities and the general understanding on how to best treat these patients when they become infected with SARS-CoV-2. Data from the registry have also been important for development of international guidelines.

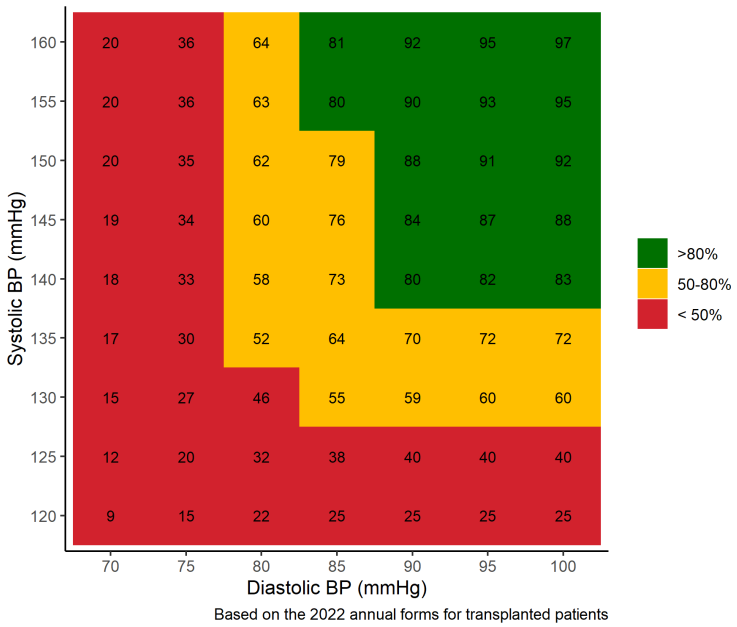
The scientific group for non-neoplastic kidney pathology has since year 2020 worked with the standardization on how to report non-neoplastic kidney biopsies. The specialist group has drawn up a specification for a standardized and structured response report for non-neoplastic kidney biopsies. The specification contains a structured data set that defines mandatory and optional content in each pathology report. Data from the registry has been central in this work. The specification has then been used to create the data set for the new MRS database for the register.

Blood pressure in kidney transplant recipients:

Results from the data collection in 2020 [Onsøien MO et al. Transplantation 2021: 105(10): e150] indicates that a target figure between 75-80% is possible to achieve. Based on these results, the research group at OUS-Rikshospitalet has initiated a randomized clinical trial to investigate whether self-measured blood pressure at home with the possibility of self-adjustment of dosage can lead to better goal attainment. At the same time, the registry has expanded the collection of annual data with the type of blood pressure measurement that was carried out on each patient.

Figure 48 below show blood pressure target attainment for different levels of systolic- and diastolic blood pressure. In order to fulfill the quality indicators target of 80% with a well-controlled blood pressure the limits need to be either 155/85 mmHg or 140/90 mmHg.

Figure 48:



Blood access when starting hemodialysis:

The register collected information on reasons for not starting hemodialysis with AV-fistula as blood access and got a good overview of the reasons why not. The data clearly indicate that the target figure is set too high. In consultation with the renal community, work has continued to adjust the quality indicator to better describe the quality of the health care provided. The Faculty Council will continue to work on this work in 2023.

CMV preventive strategies in kidney transplantation:

In the treatment population, several safety variables are collected annually from all patients. Most of these are expected events in a population treated with immunosuppressive drugs with known complications such as a high infection pressure. The variables are; infections, acute rejections, strokes, heart attacks, graft loss, death. The register has this year particularly followed up on CMV infections. CMV is a viral infection that causes illness in transplant patients due to immunosuppression. CMV disease occurs both as primary infection and reactivation. It is known that CMV disease can cause significant morbidity. With data from registry, one has investigated the preventive strategies to avoid CMV

infection following kidney transplant [Blom KB et al. Transplantation 2023; 107(8): 1846-1853].

COVID-19 in patients on renal replacement therapy

In 2020 the registry started to collect data on renal replacement patients with COVID-19. The registry also reported data to the European collaboration initiative ERACODA, coordinated by ERA-EDTA. In cooperation with researchers at OUS-Rikshospitalet and all the local contact persons at the 27 nephrology units in Norway a national screening of SARS-CoV-2 IgG antibodies was also initiated, inviting all kidney transplant recipients in the registry, to see how many of the patients that had been infected with the virus, also covering subclinical infections. In 2021 this national screening was extended to also investigate immunological response to the SARS-CoV-2 vaccines, in both dialysis and kidney transplant patients, which was rolled out during the first quarter of 2021,

By the end of 2022, 1,425kidney transplant (39%) and 455 dialysis (25%) patients have been reported to the registry with COVID-19. Respectively 87 (6.1%) and 12 (2.6%) later died due to COVID-19. In the national screening of SARS CoV-2 antibodies we have received samples from over 90% of all dialysis kidney transplant patients. Most vaccinated dialysis patients have achieved a vaccine response, but not all have shown high IgG titers and have therefore limited protection against severe COVID-19. For the transplant cohort about one fifth still have no measureable humoral vaccine response, even after up to 10 vaccine doses, and only about 40% have a more or less protective response. In **Table 18** and **19** monthly data in 2022 is presented (during the omicron era).

Table 18. Monthly and overall incidence of SARS-CoV-2 infection and severity in Dialysis patients in Norway.

Mnd-ÅR	syke	innlagt	meanDgr	innlagt%	ICU	AS-beh	mangler FU	død	mors-rate	kum%syke
Nov-21	7	5	3.3	71.4	1	0	0	1	14.29	3.78
Dec-21	11	4	18.30	36.4	2	1	0	1	9.09	4.39
Jan-22	41	13	15.20	31.7	3	6	0	0	0.00	6.78
Feb-22	78	21	6.50	26.9	0	10	0	3	3.85	11.17
Mar-22	94	18	8.42	19.1	3	8	0	1	1.06	16.56
Apr-22	18	6	6.83	33.3	0	2	0	2	11.11	17.56
May-22	13	4	6.75	30.8	0	0	0	0	0.00	18.28
Jun-22	21	3	5.00	14.3	0	0	0	0	0.00	19.72
Jul-22	19	3	7.00	15.8	0	1	0	0	0.00	20.83
Aug-22	26	7	4.40	26.9	0	4	1	0	0.00	22.28
Sep-22	4	1	8.00	25.0	0	0	0	0	0.00	22.50
Oct-22	4	1	1.00	25.0	0	0	0	0	0.00	22.72
Nov-22	13	7	2.50	53.8	1	2	0	0	0.00	23.44
Dec-22	33	9	4.13	27.3	1	2	0	4	12.12	25.28
Jan-23	14	5	5.80	35.7	1	0	0	0	0.00	26.06
Feb-23	1	0	0.00	0.0	0	0	0	0	0.00	26.11
Mar-23	5	3	8.00	60.0	0	0	0	1	20.00	26.39
Apr-23	4	2	2.50	50.0	0	1	0	1	25.00	26.61
May-23	4	2	2.50	50.0	0	0	0	0	0.00	26.83
Jun-23	2	0		0.0	0	0	0	0	0.00	26.94
Jul-23	0	0			0	0	0	0		26.94
Aug-23	4	2	2.50	50.0	0	0	0	0	0.00	27.17
Totalt	**489**	**158**	**8.34**	**32.3**	**20**	**40**	**1**	**19**	**3.89**	**27.17**

Table 19. Monthly and overall incidence of SARS-CoV-2 infection and severity in Kidney transplant patients in Norway

Mnd-ÅR	syke	innlagt	meanDgr	innlagt%	ICU	AS-beh	mangler FU	død	mors-rate	kum%syke
Nov-21	35	26	25.7	74.3	11	9	0	7	20.00	4.22
Dec-21	54	27	10.42	50.0	6	13	2	5	9.26	5.68
Jan-22	107	29	6.54	27.1	1	30	0	1	0.93	8.57
Feb-22	364	75	4.90	20.6	11	77	5	13	3.57	18.41
Mar-22	290	48	6.97	16.6	6	77	2	11	3.79	26.24
Apr-22	53	12	8.50	22.6	3	10	2	7	13.21	27.68
May-22	36	8	2.71	22.2	1	3	0	3	8.33	28.65
Jun-22	82	20	6.54	24.4	2	12	1	3	3.66	30.86
Jul-22	80	19	5.60	23.8	5	12	6	5	6.25	33.03
Aug-22	33	10	5.50	30.3	3	9	1	3	9.09	33.92
Sep-22	23	9	3.60	39.1	2	8	1	2	8.70	34.54
Oct-22	33	10	7.00	30.3	1	8	2	0	0.00	35.43
Nov-22	45	15	7.00	33.3	3	11	0	4	8.89	36.65
Dec-22	69	29	7.25	42.0	4	9	1	5	7.25	38.51
Jan-23	12	2	2.00	16.7	0	0	0	0	0.00	38.84
Feb-23	9	1	0.20	11.1	0	1	1	0	0.00	39.08
Mar-23	12	8	1.25	66.7	1	2	3	2	16.67	39.41
Apr-23	17	7	3.87	41.2	0	0	1	1	5.88	39.86
May-23	12	5	2.20	41.7	0	1	1	0	0.00	40.19
Jun-23	2	1		50.0	0	0	1	0	0.00	40.24
Jul-23	1	0		0.0	0	0	0	0	0.00	40.27
Aug-23	5	1		20.0	0	0	4	0	0.00	40.41
Totalt	**1495**	**432**	**9.1**	**28.9**	**85**	**311**	**34**	**90**	**6.02**	**40.41**

Concluding remarks:

The reporting of patients in CKD5 without RRT is very variable between centers and needs to come up to the coverage level of the rest of the registry. The prevalence has flattened out during the recent years. Despite the increased age in patients starting RRT the survival is increasing. The registry has been quite busy working with the transition to a new database (MRS) during the year. There is still a way to go but we are convinced that this will have a positive impact on the overall patient coverage on all levels and also increase the data quality. With the new system each center will have their own local registry where they can have a good overview of their population and make center-specific analyses.

An area of improvement is the completeness of the pathology reports submitted to the registry. As shown in **Figures 16 and 17** there are areas where a definite diagnosis is not possible to determine due to this.

A worrying trend is the continued increasing waiting list for kidney transplantation. Action has been taken to increase the number of living donors with a good result, but there is still need for more available organs for transplantation to meet the demand. During the COVID-19 pandemic more patient on the transplant list has been temporarily withdrawn. Numbers for both active and temporarily withdrawn patients must be considered when analyzing changes in the transplant list.

During the years as a combined registry (since 2016) some of the quality indicators that the registry has been focusing on has shown important improvements, e.g. “CKD5 patients completed *Nyreskole* (Kidney School)”, “part of patients in home-dialysis” and “KidneyTx patients with at least 4 controls/year”. There are still room for improvement on other focus areas however, such as “Blood pressure control in KidneyTx patients” and “first blood access in hemodialysis”.

Registry data are also regularly used by Norwegian nephrologists as basis for scientific papers, congress presentations and PhD-thesis. A list of publications is published on www.nephro.no along with the annual reports. During 2022 a total of 28 international peer reviewed papers and two PhD-theses has been based on data from the registry.

Data from the registry has also been vital for an appropriate follow-up of the patients during the COVID-19 pandemic. Data delivered to the ERA-EDTA Registry in Amsterdam are included in its reports and publications; some data are also forwarded to the USRDS-reports (the chapter of “International Comparisons”). The registry has also in 2022 been active in keeping track of vaccination against SARS-CoV-2 in RRT patients and the development of COVID-19. These data show a general low vaccination response and high death rate from COVID-19 in RRT patients.

Regardless of status, the cooperation with all Norwegian nephrologists and nephropathologists, demanding their steady efforts to keep the registry updated, has always been, and will always be, a prerequisite for keeping a complete and reliable registry. All hard work over the entire country is GREATLY acknowledged!

Report completed 21.11.2023

Appendix; misc survival curves.

More Kaplan Meier survival curves is available by contacting the registry or the local center contacts.

Patient survival in RRT:

Figure A-1:

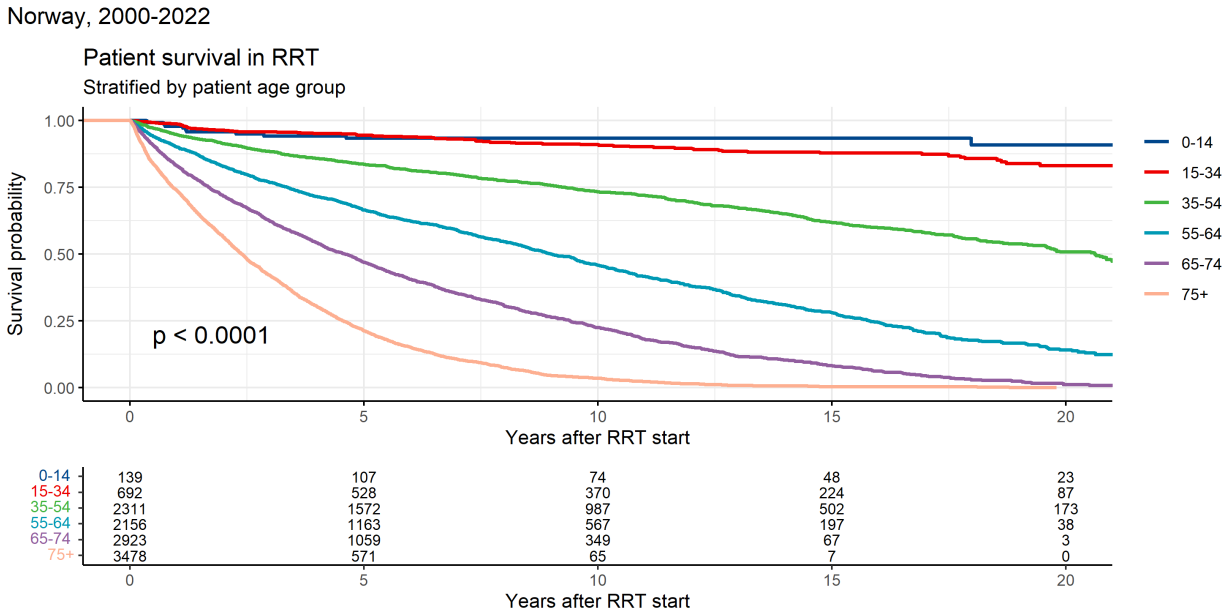
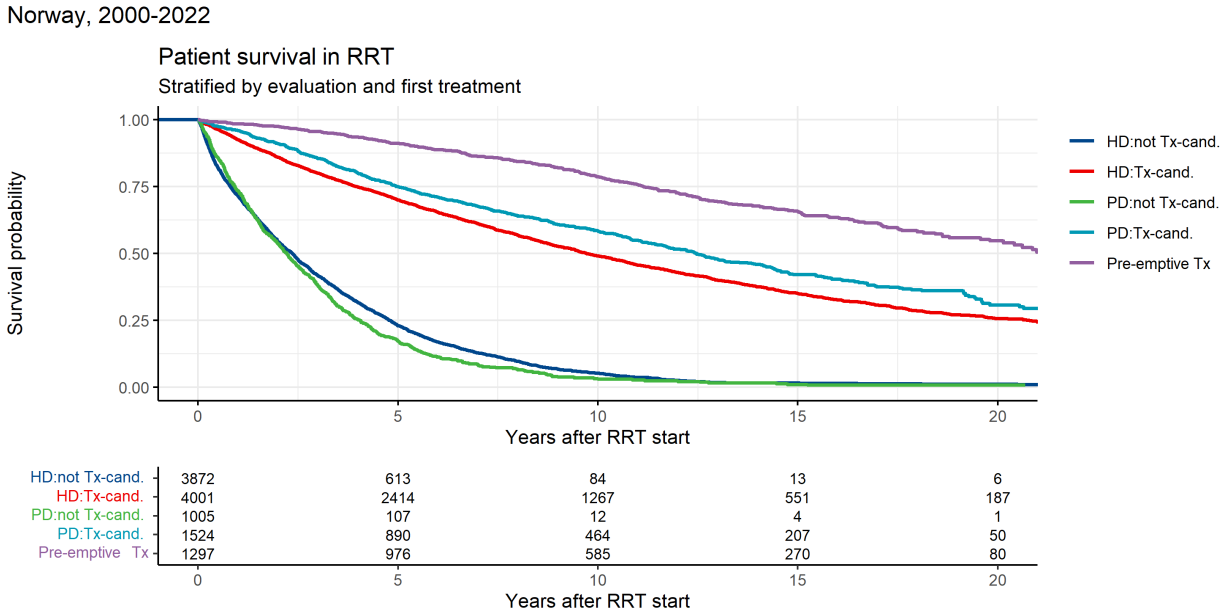


Figure A-2:



Patient survival after transplantation:

Figure A-3:

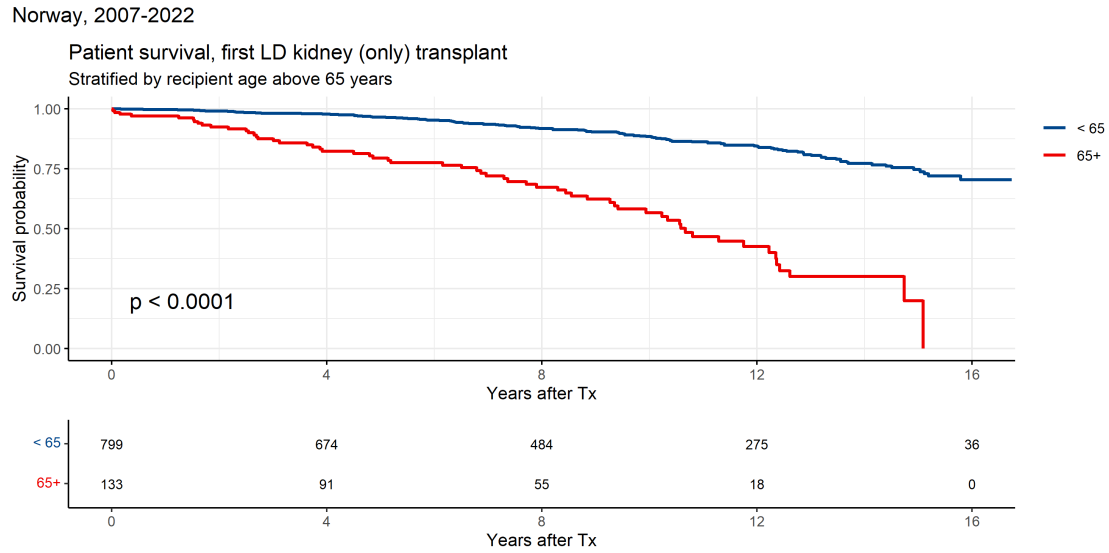


Figure A-4:

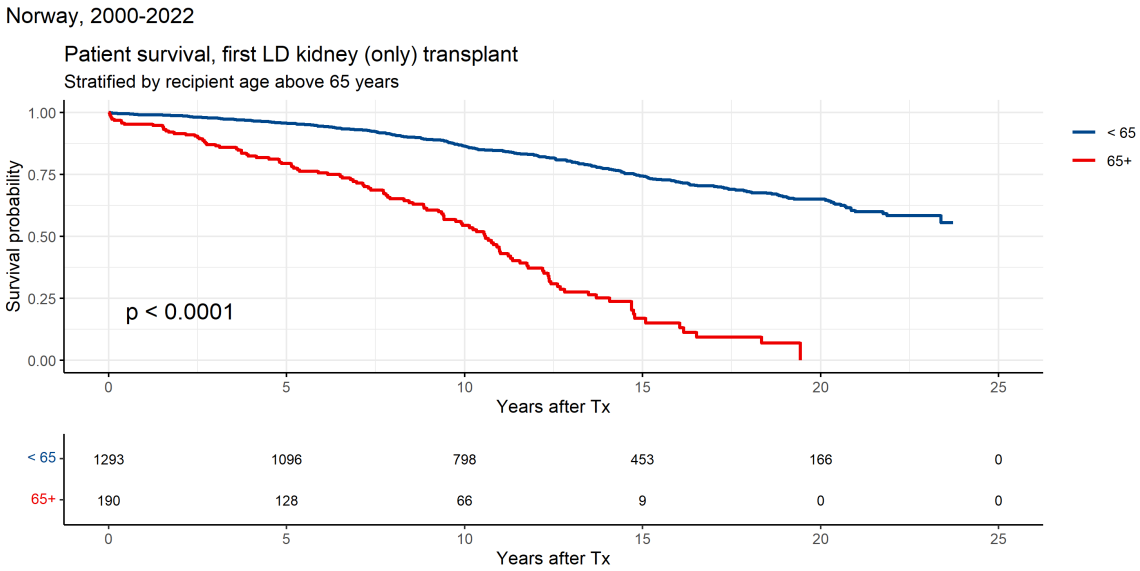


Figure A-5:

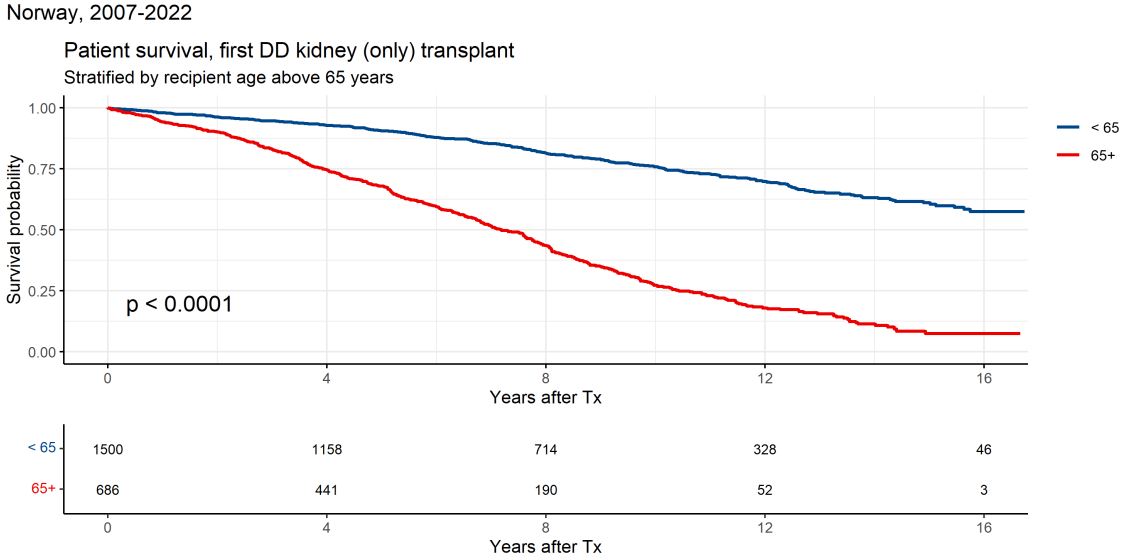


Figure A-6:

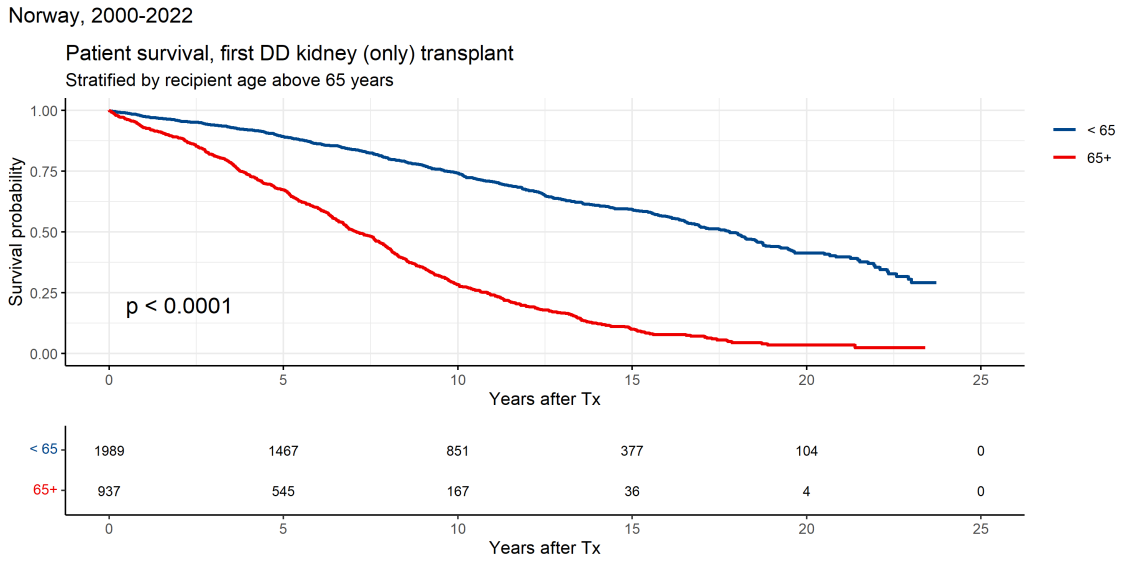


Figure A-7:

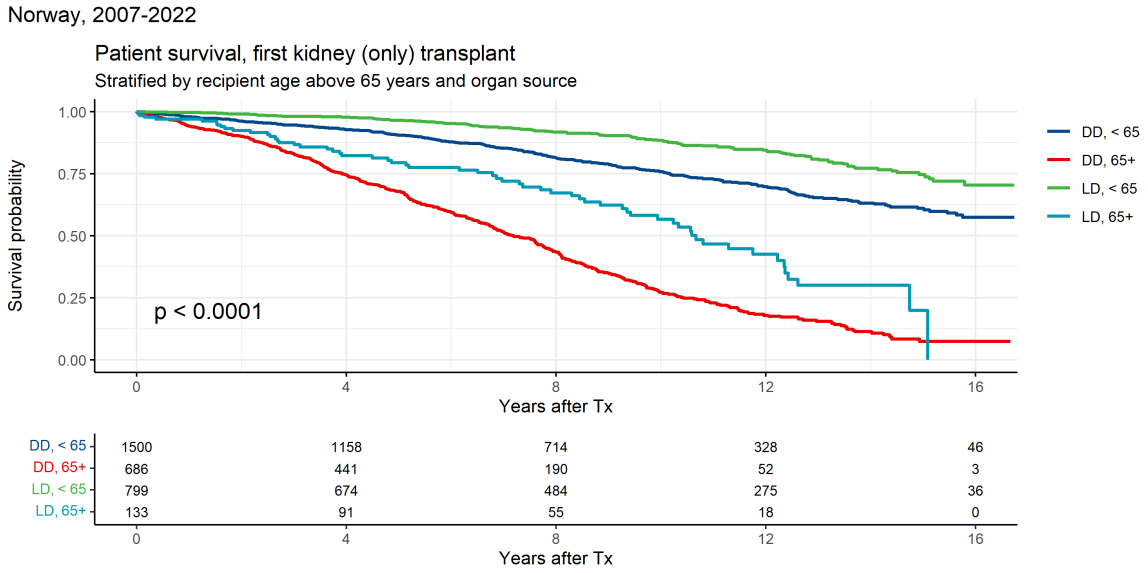
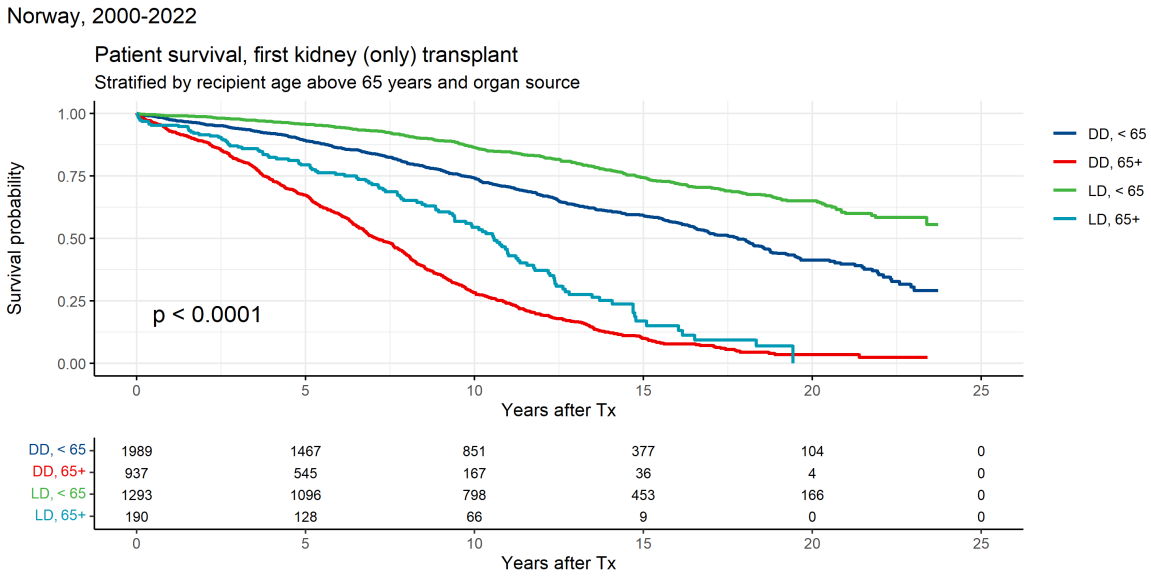


Figure A-8:



Graft survival after transplantation:

Figure A-9:

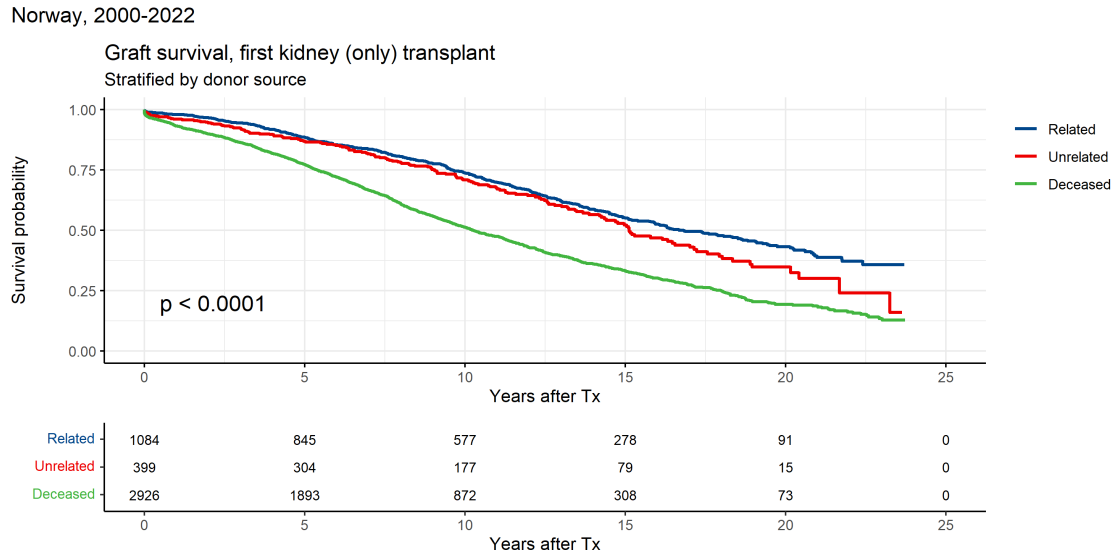


Figure A-10:

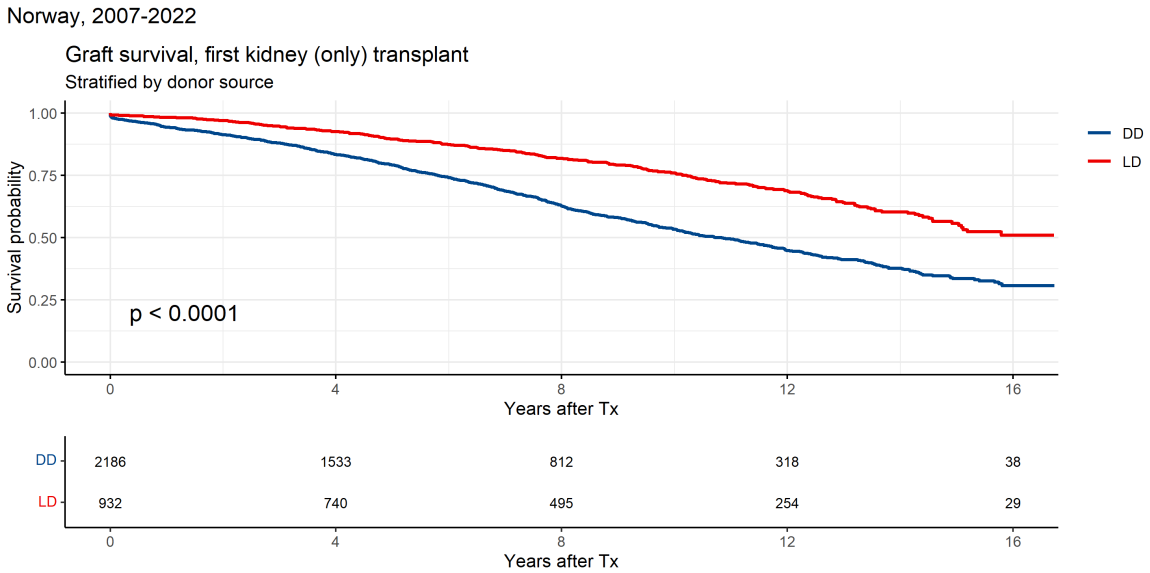


Figure A-11:

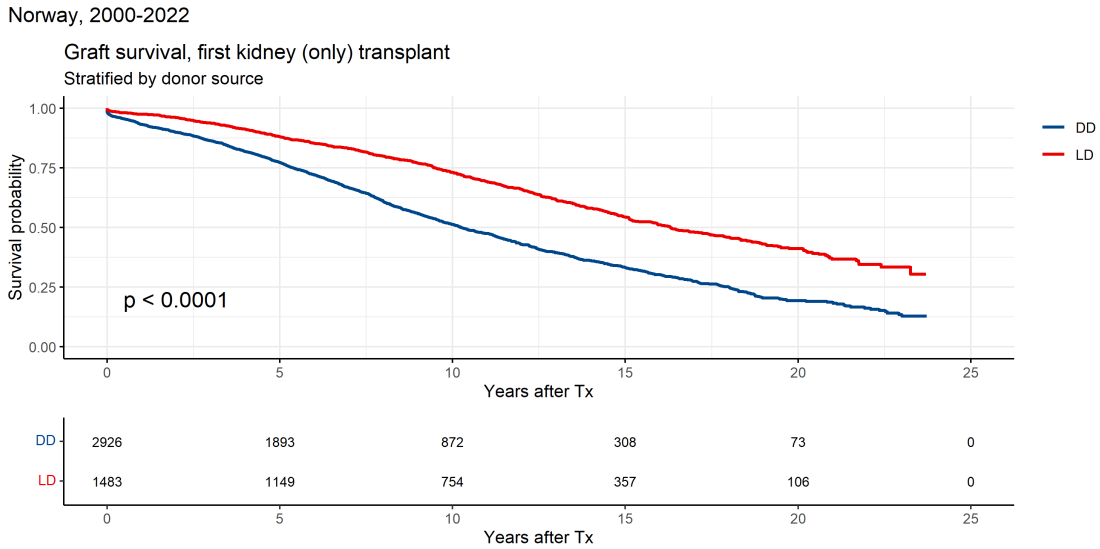


Figure A-12:

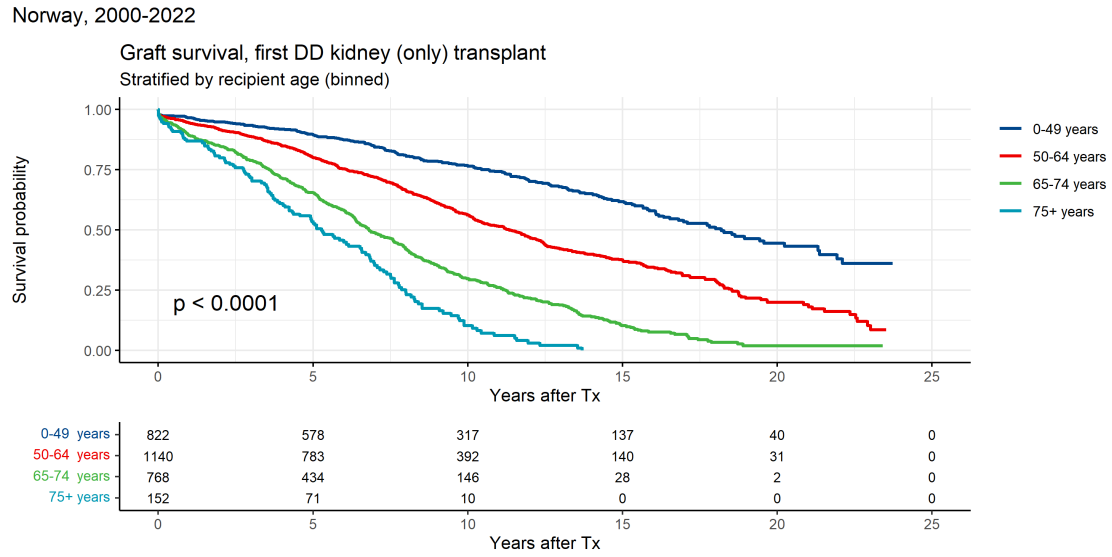


Figure A-13:

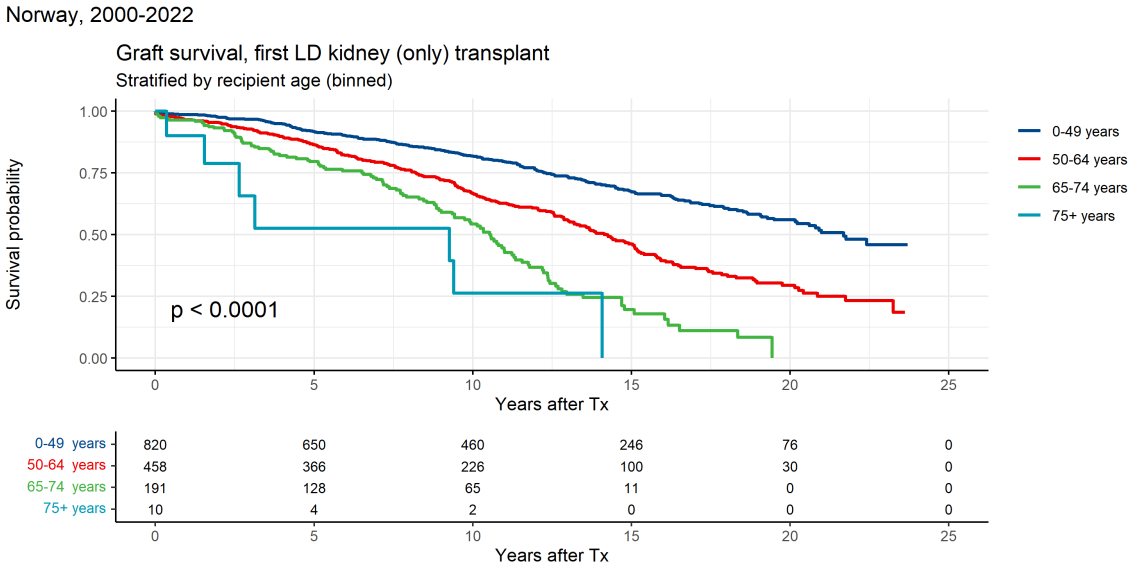


Figure A-14:

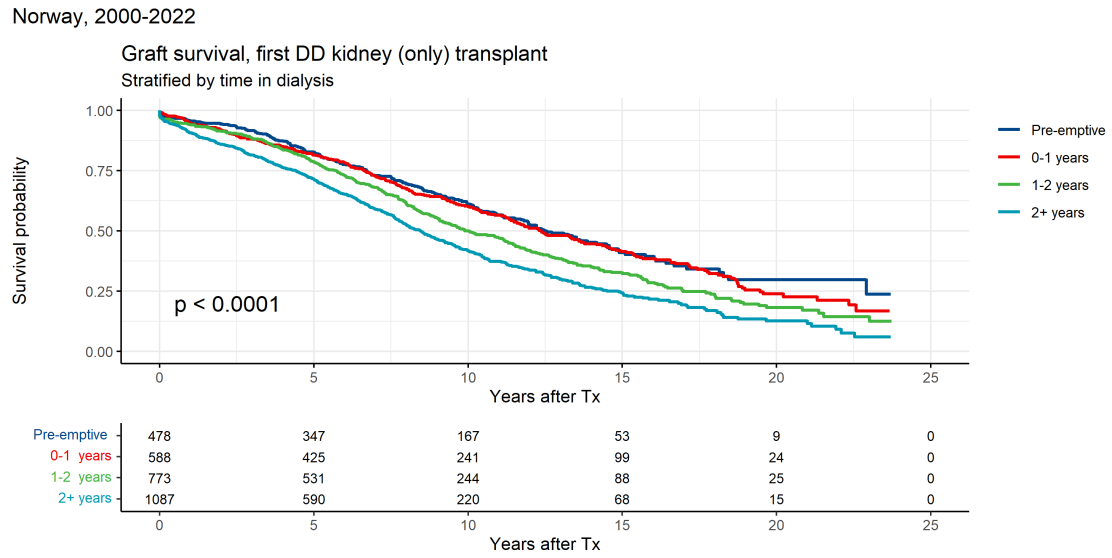


Figure A-15:

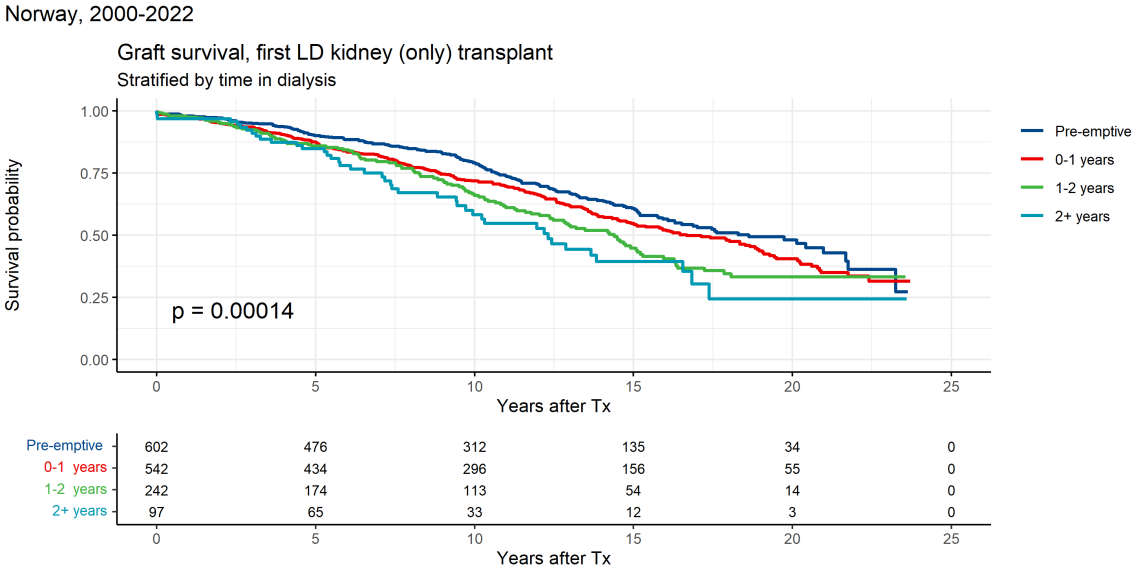


Figure A-16:

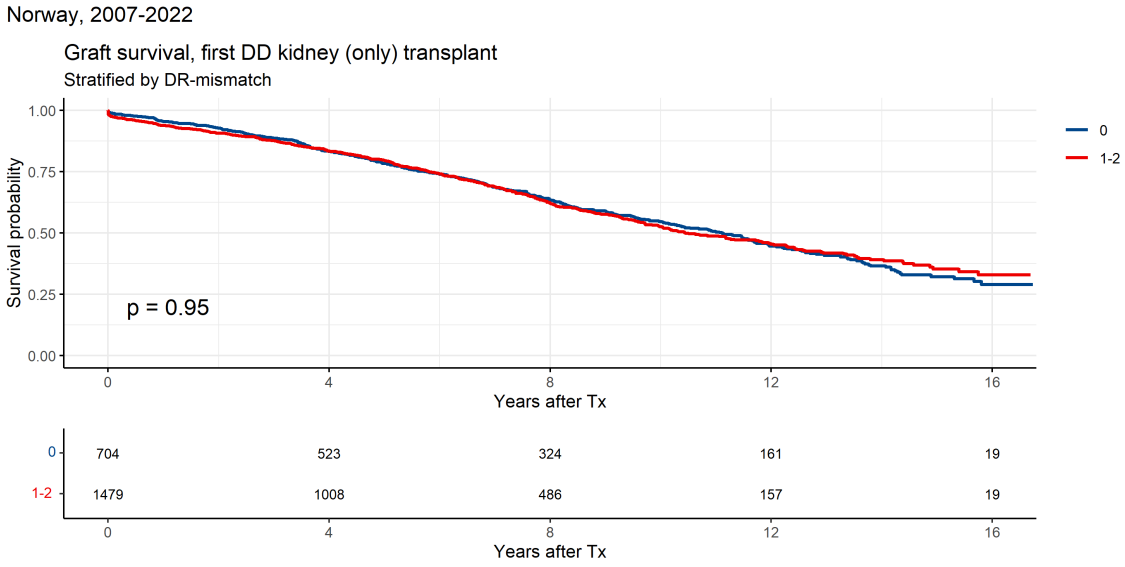


Figure A-17:

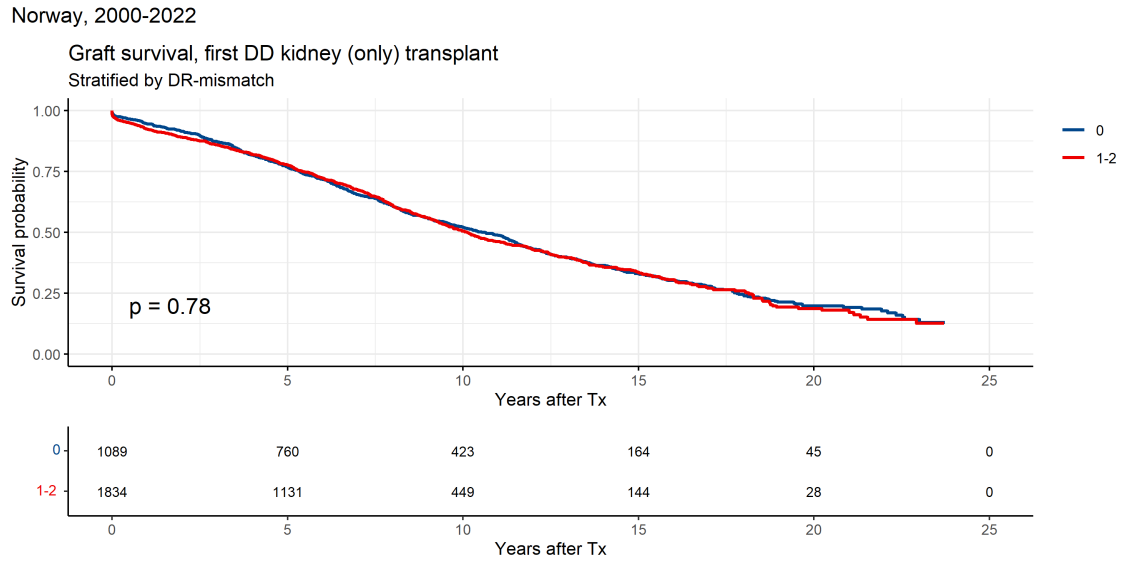


Figure A-18:

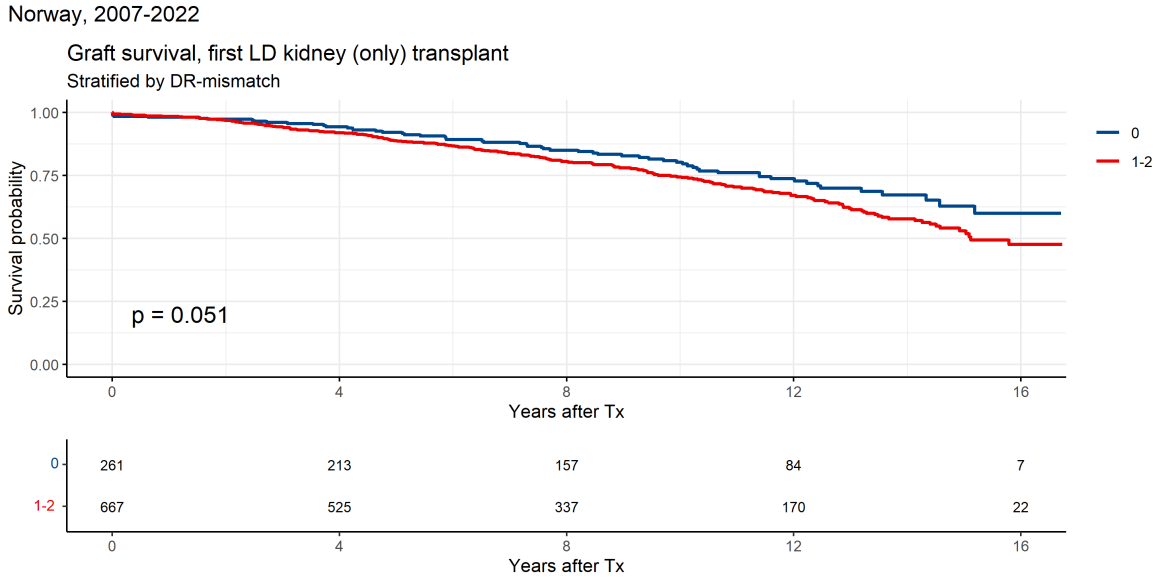


Figure A-19:

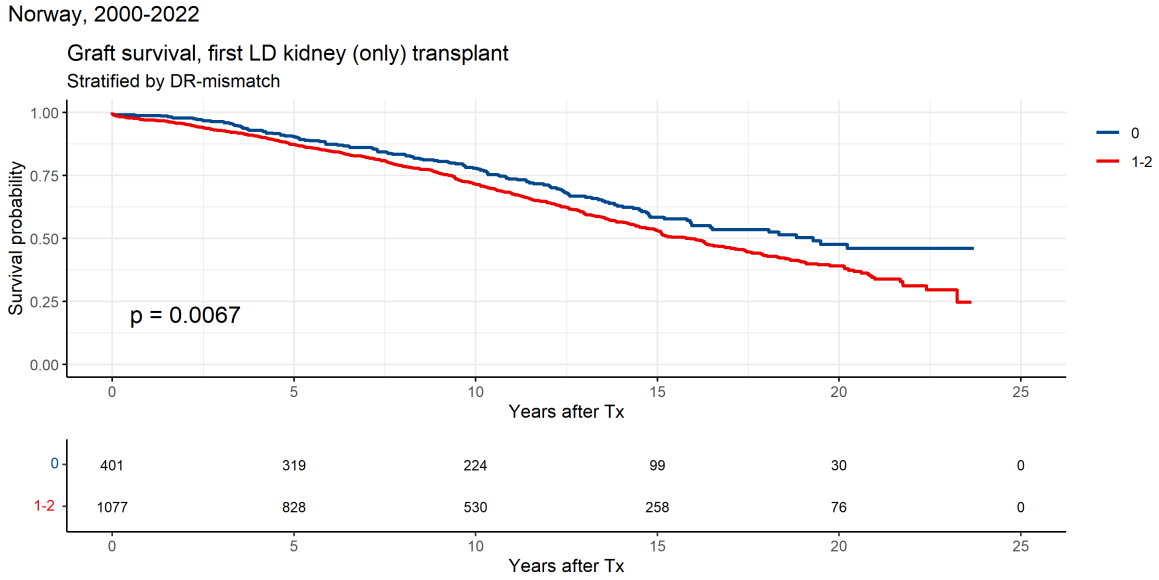
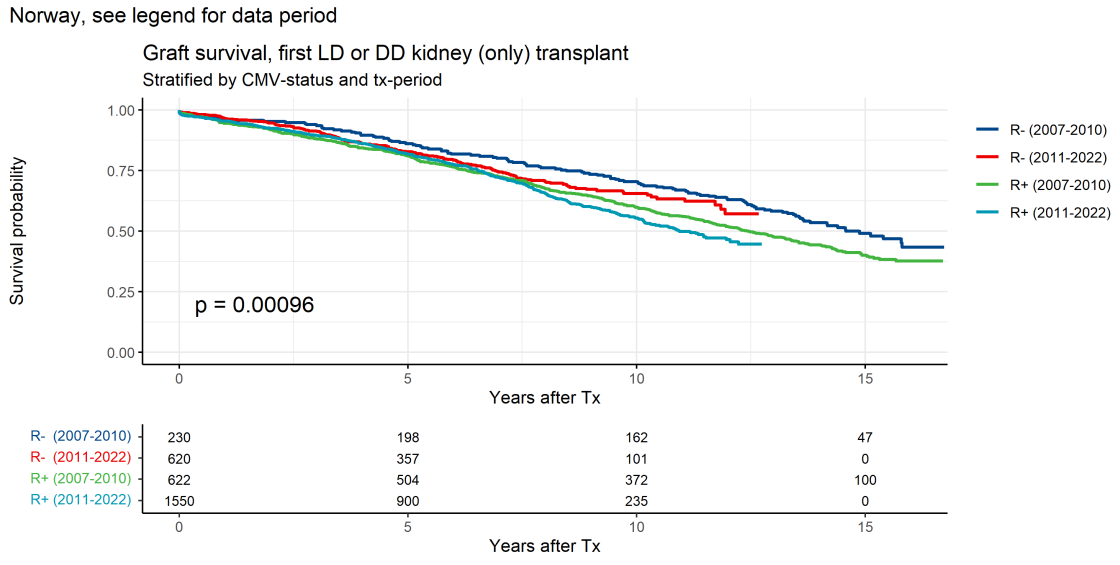


Figure A-20:



Death censored graft survival after transplantation:

Figure A-21:

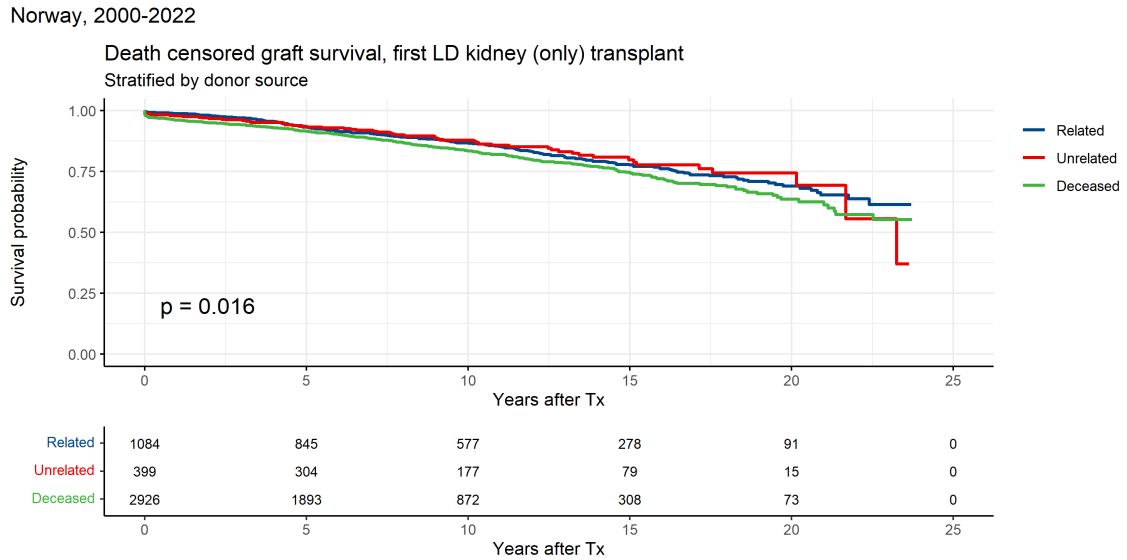


Figure A-22:

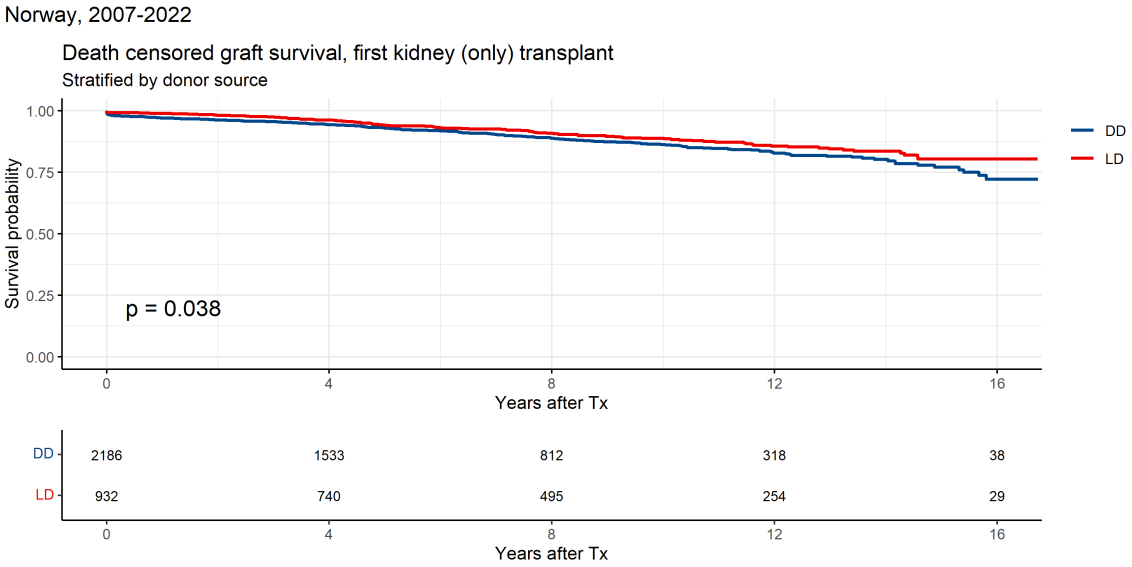


Figure A-23:

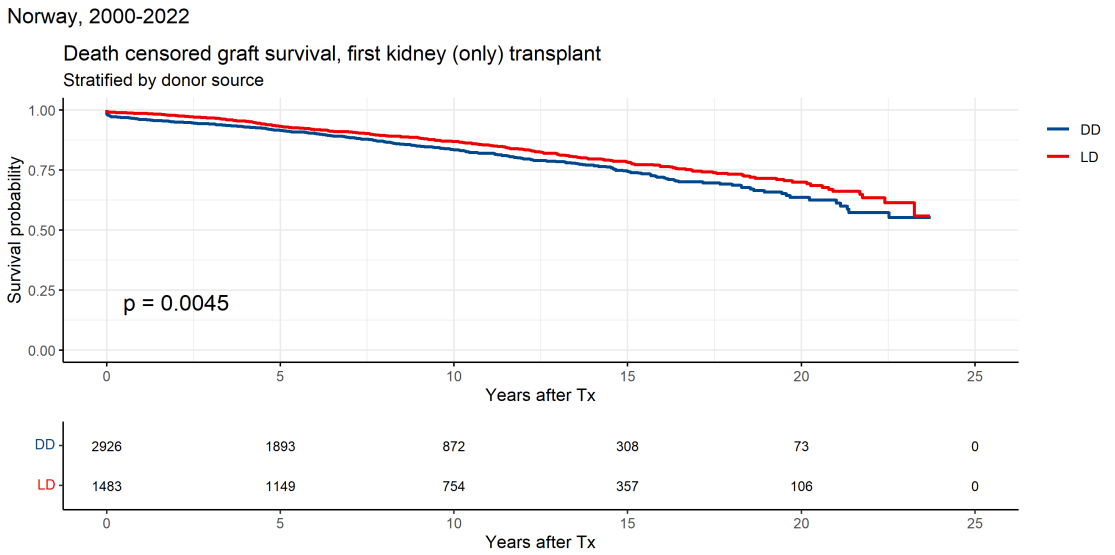


Figure A-24:

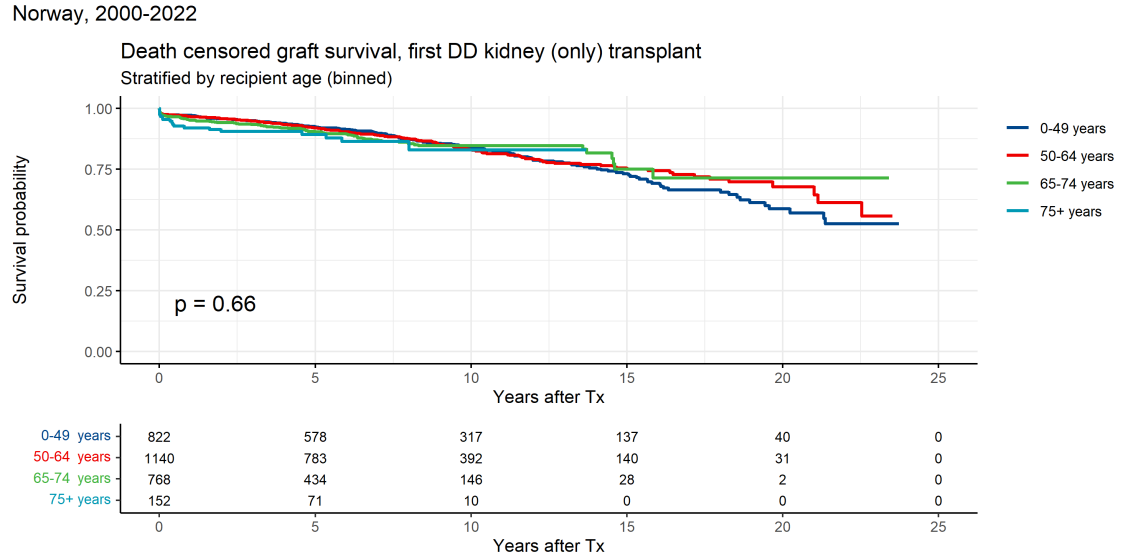


Figure A-25:

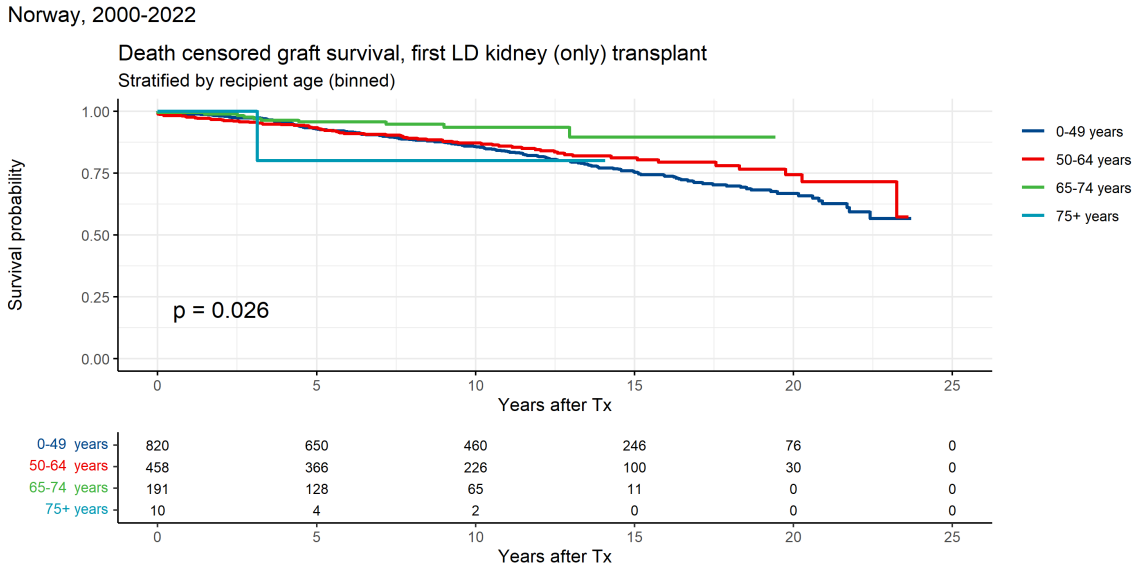


Figure A-26:

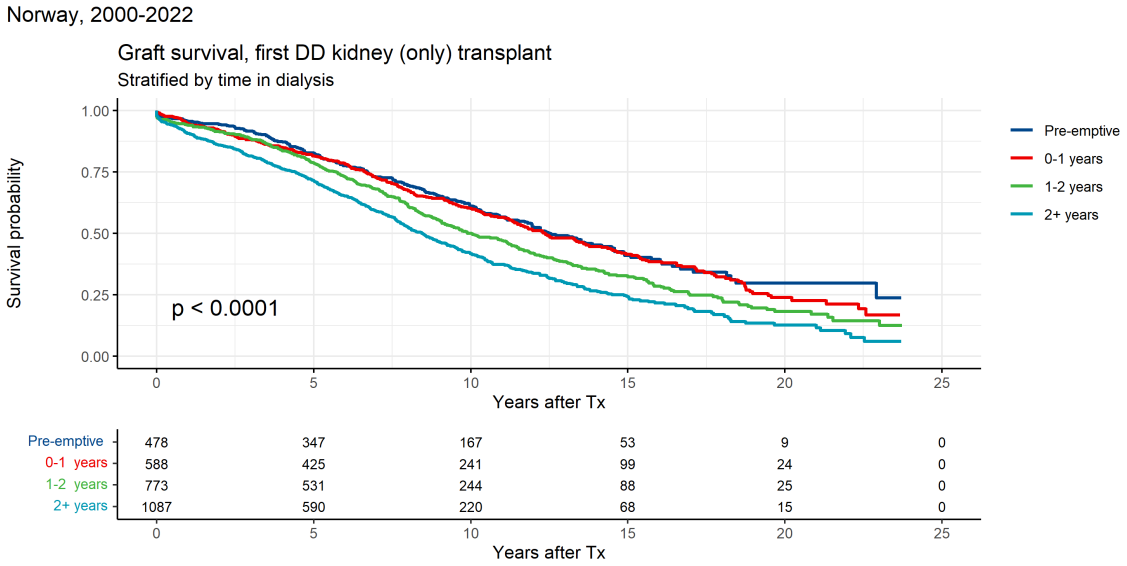


Figure A-27:

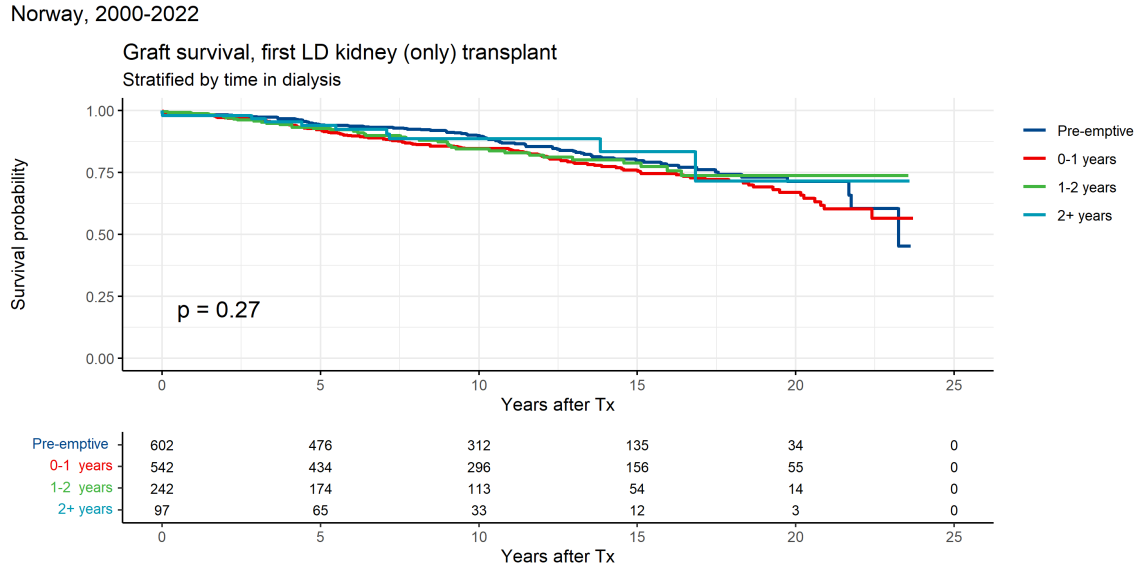


Figure A-28:

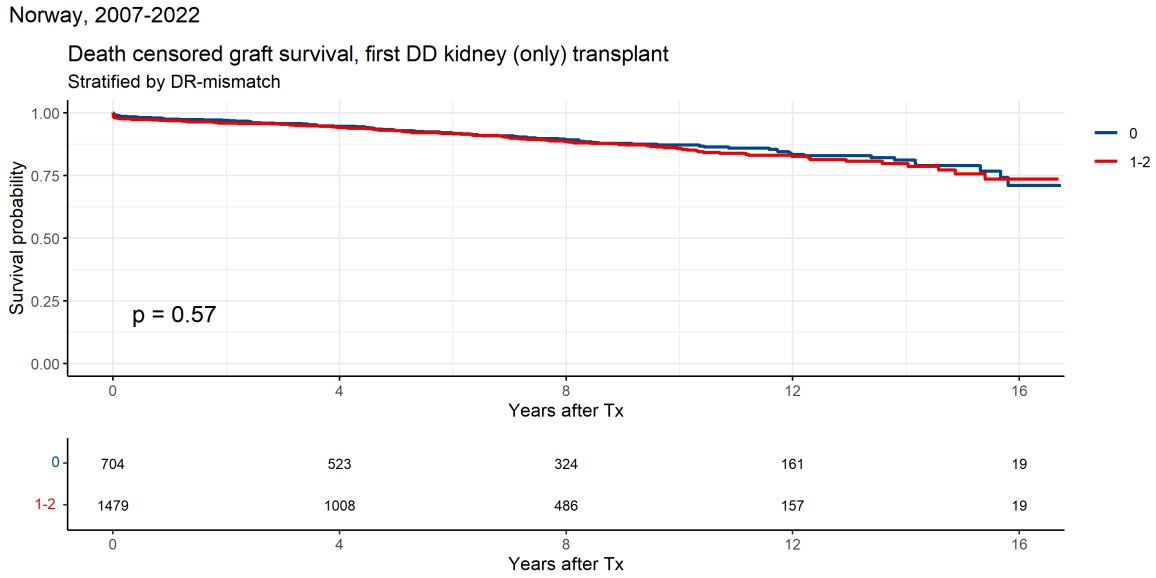


Figure A-29:

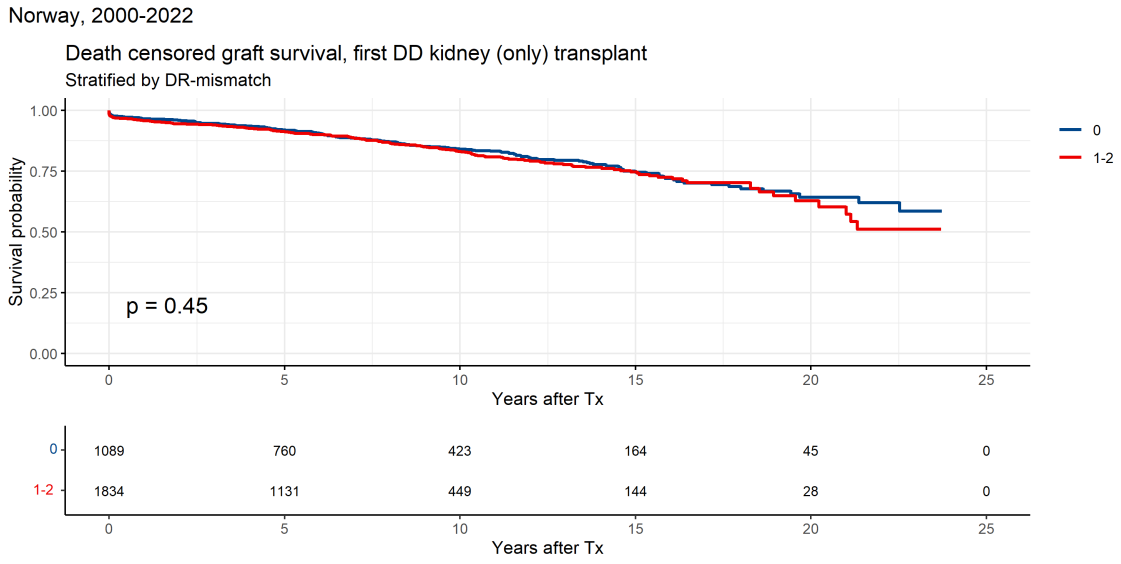


Figure A-30:

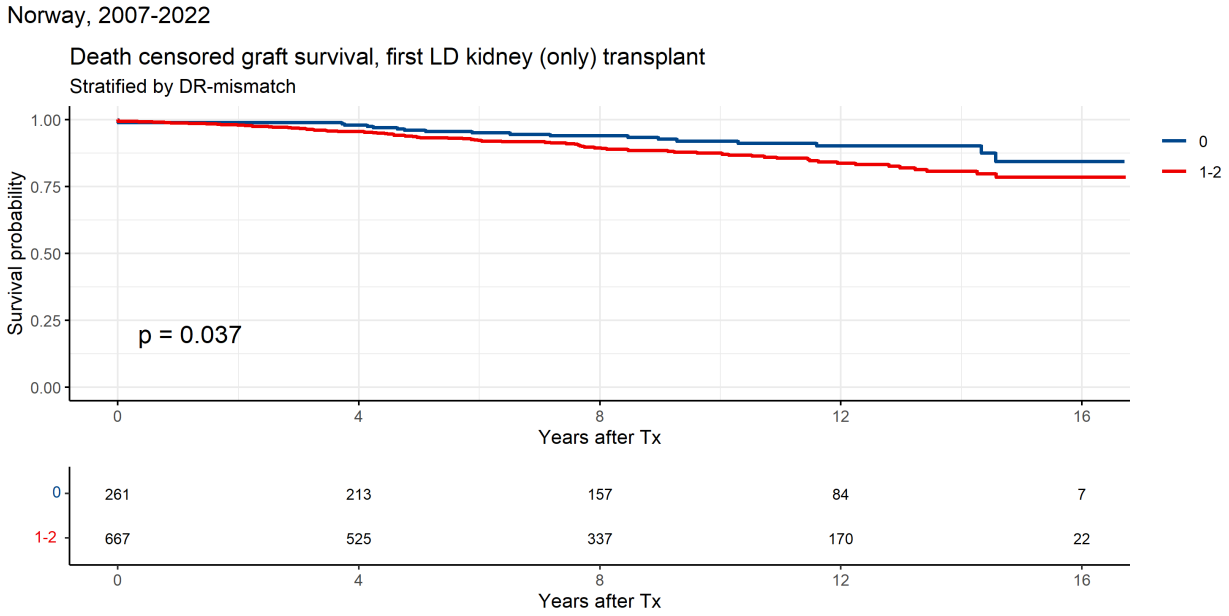
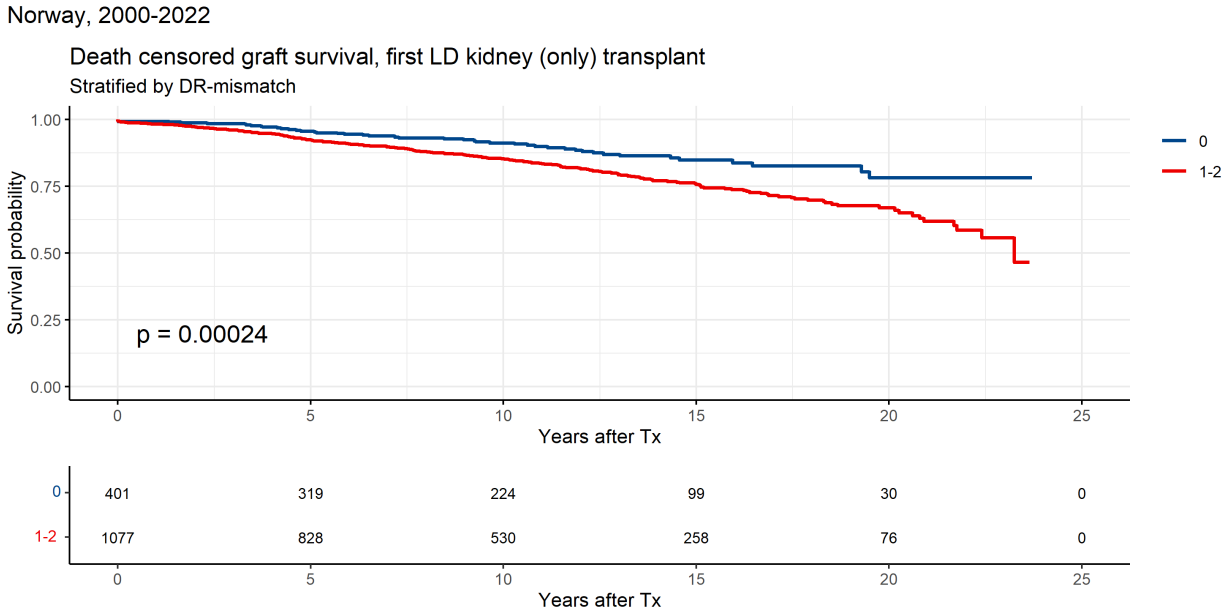


Figure A-31:



Appendix; quality indicator results.

Please note that all data on biopsies are for native kidney biopsies, not transplant biopsies! Center data is not shown when the data is based on less than 10 patients.

Figure A-32:

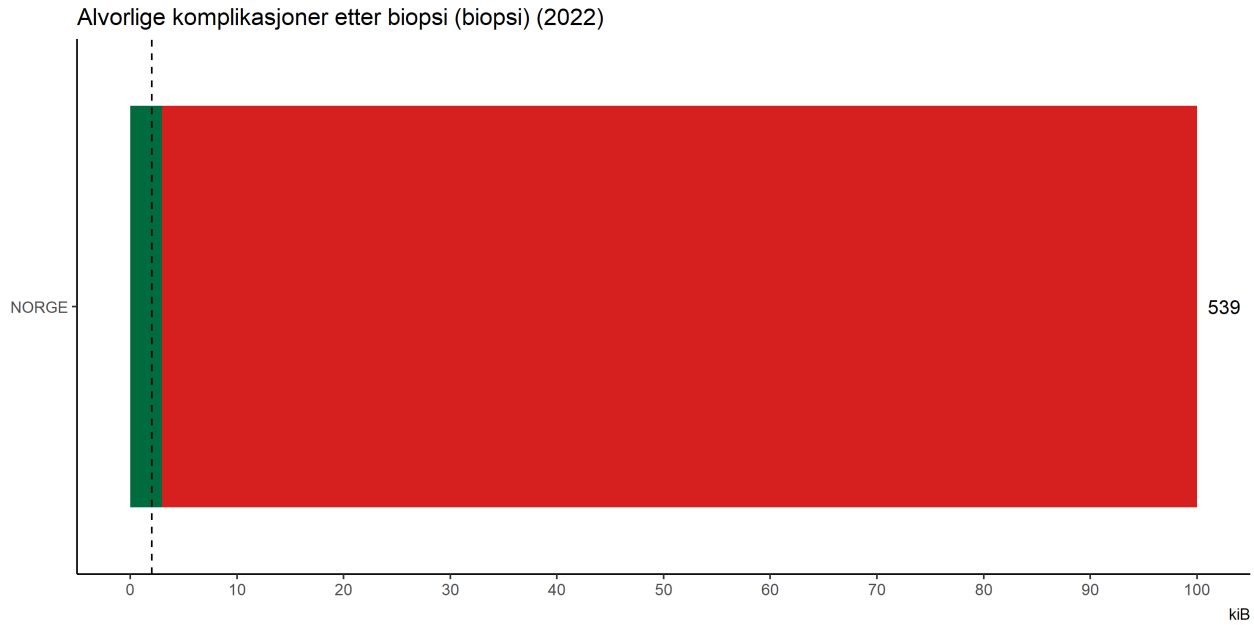


Figure A-33:

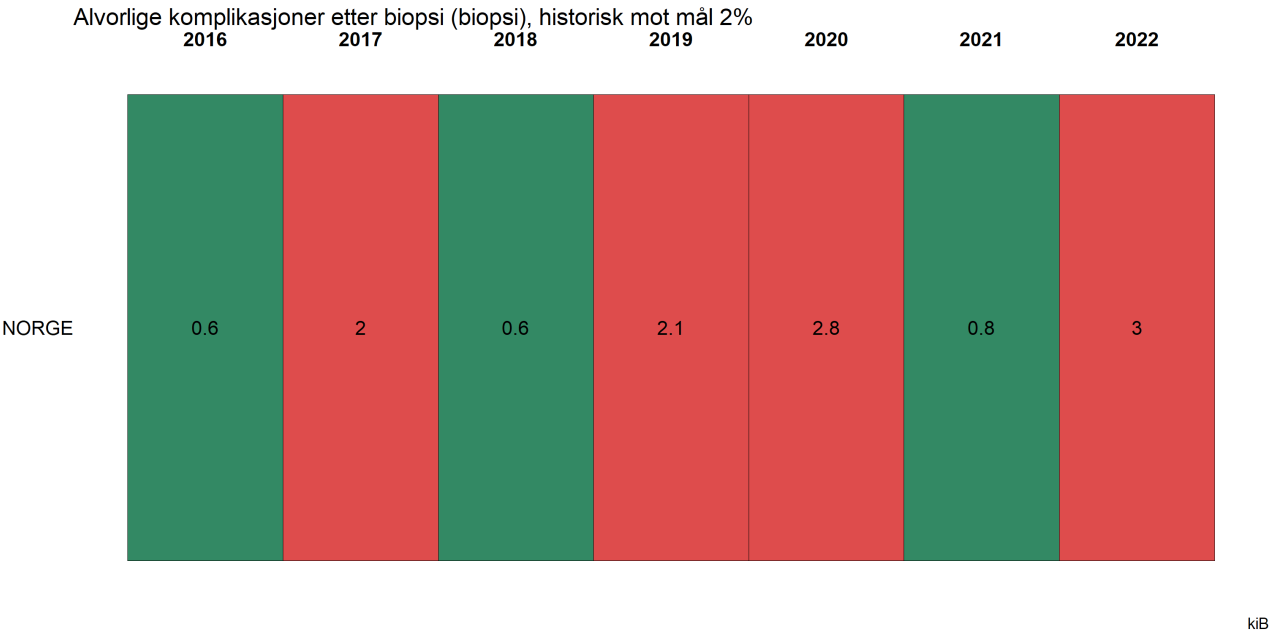


Figure A-34:

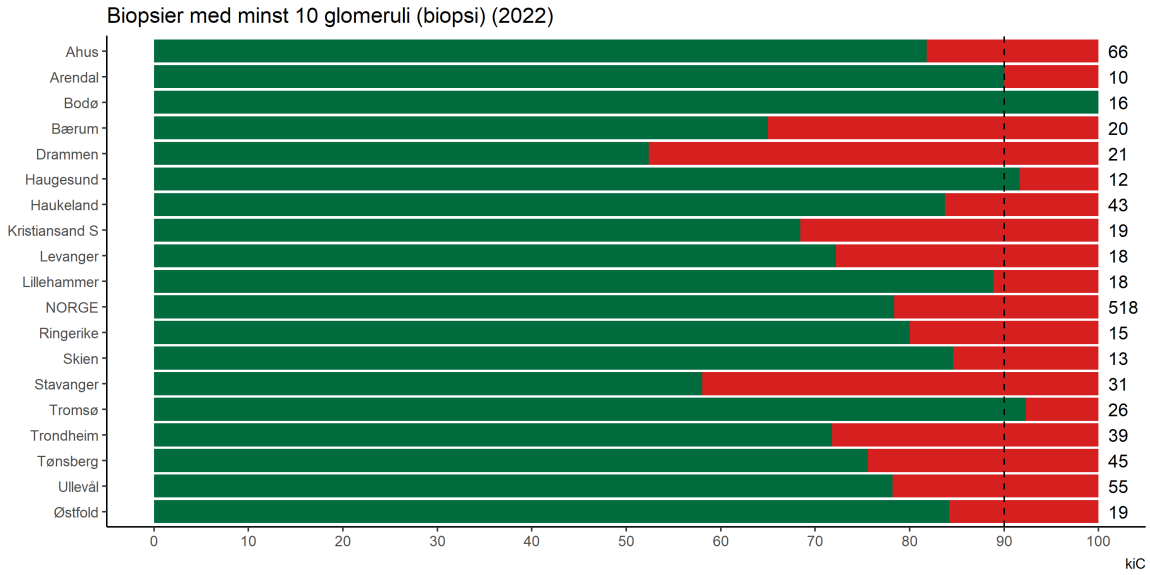


Figure A-35:

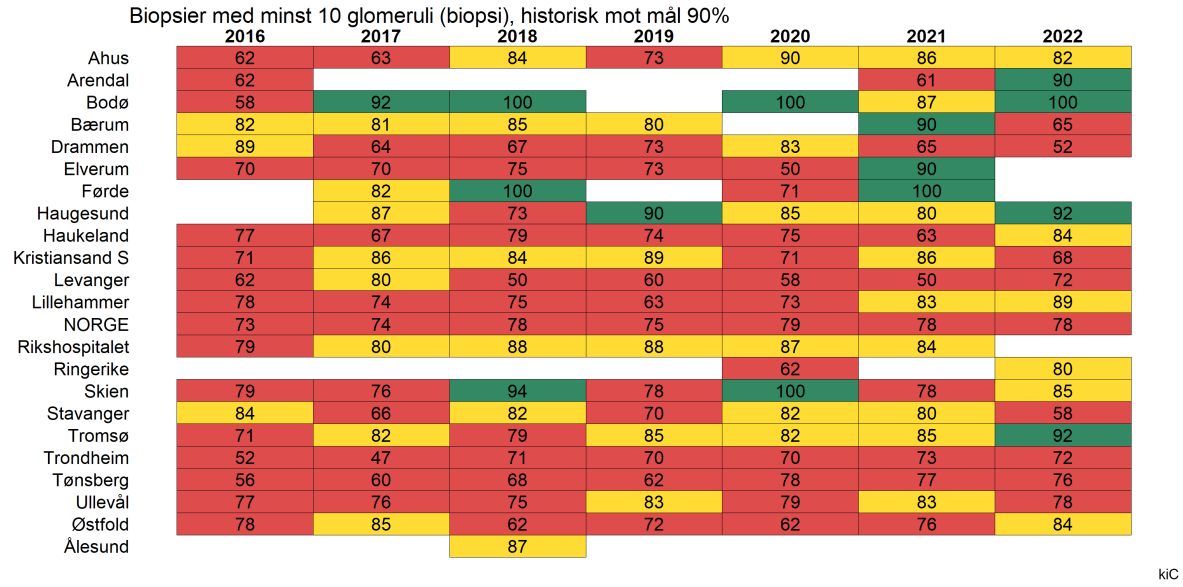


Figure A-36:

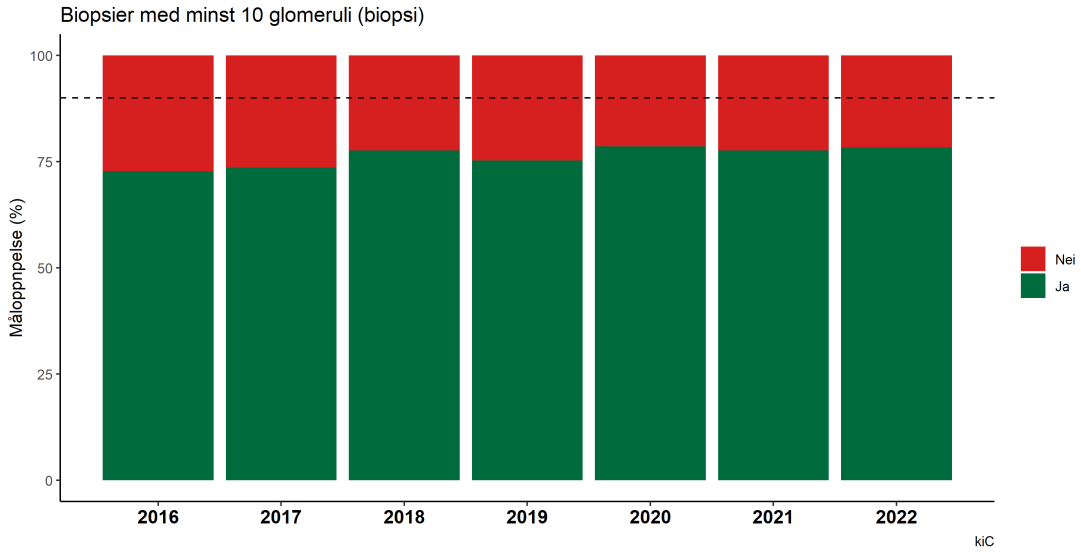


Figure A-37:

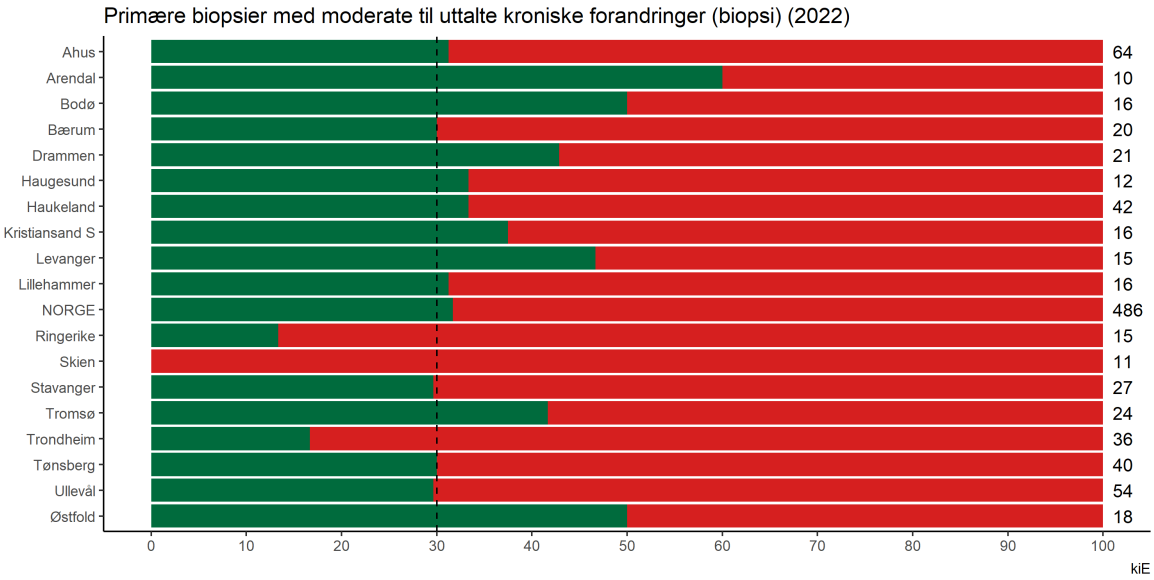


Figure A-38:

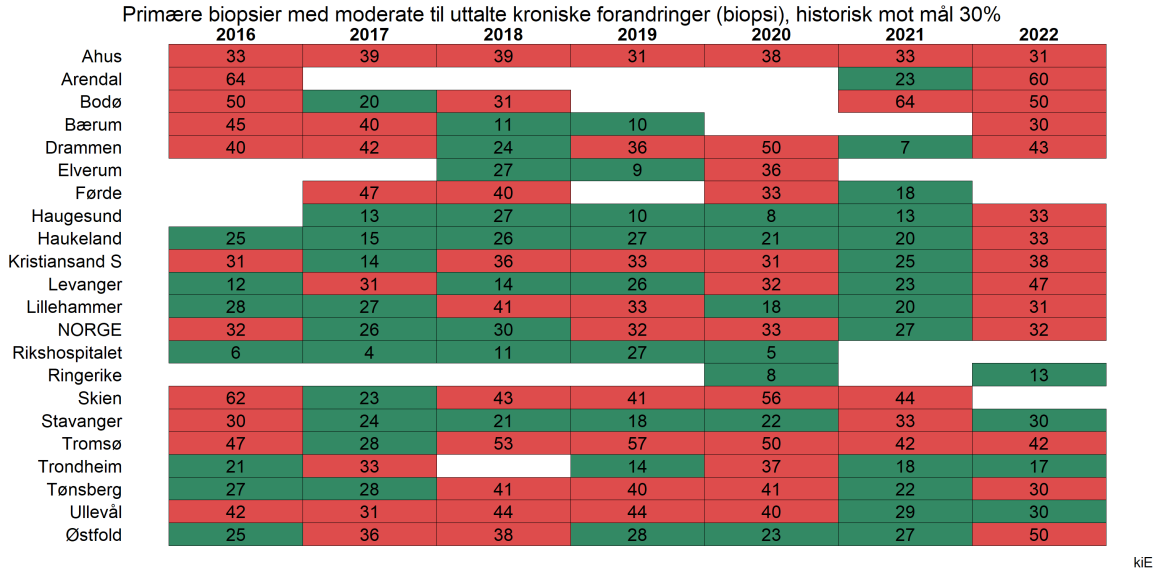


Figure A-39:

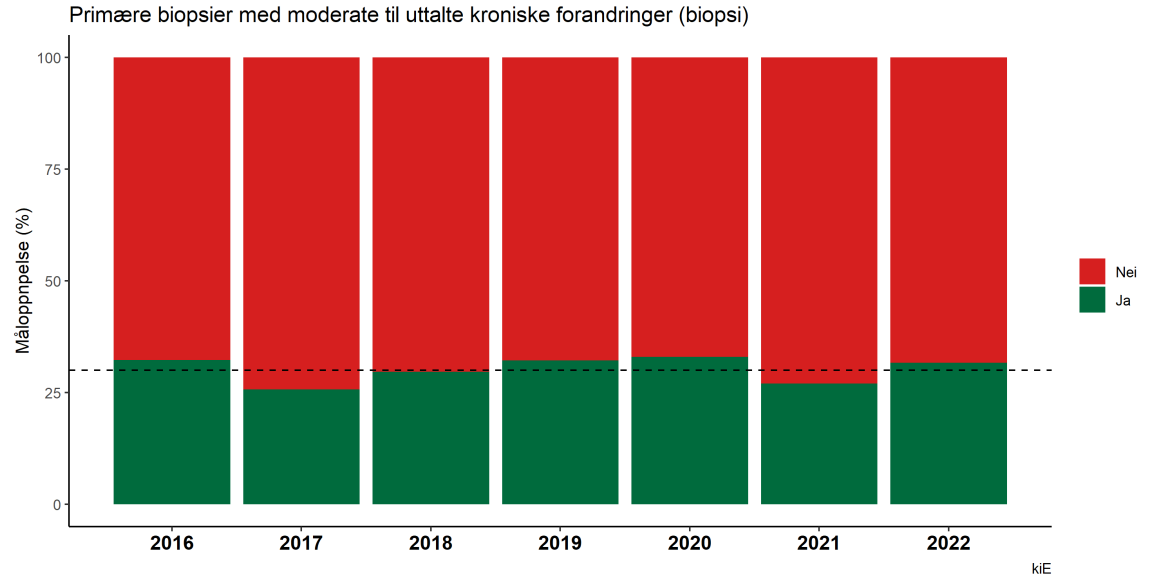


Figure A-40:

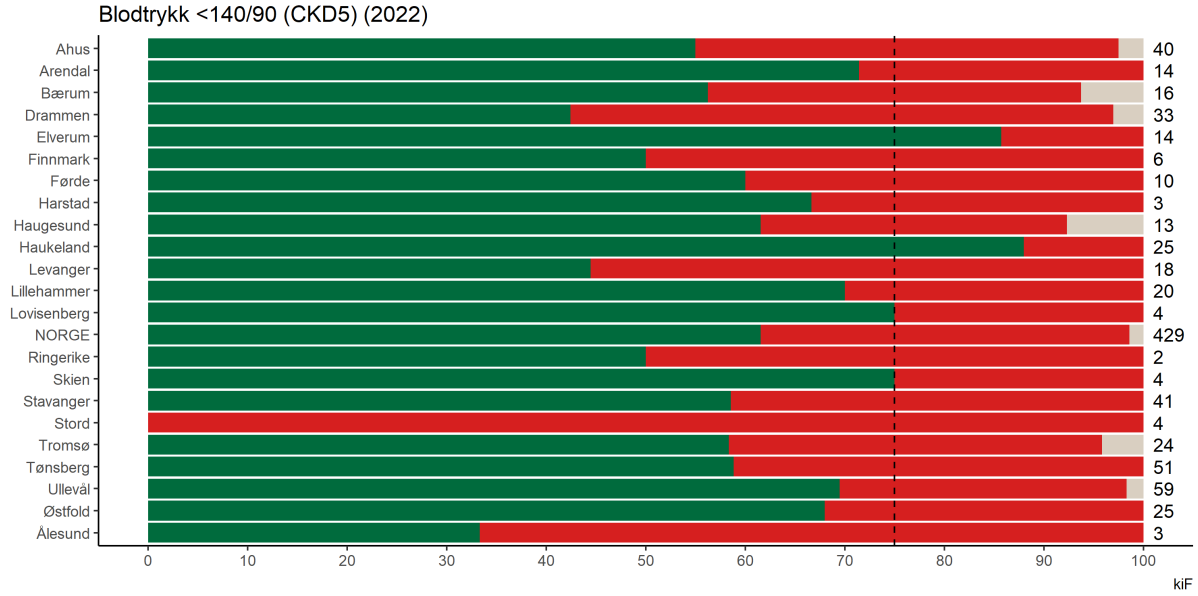


Figure A-41:

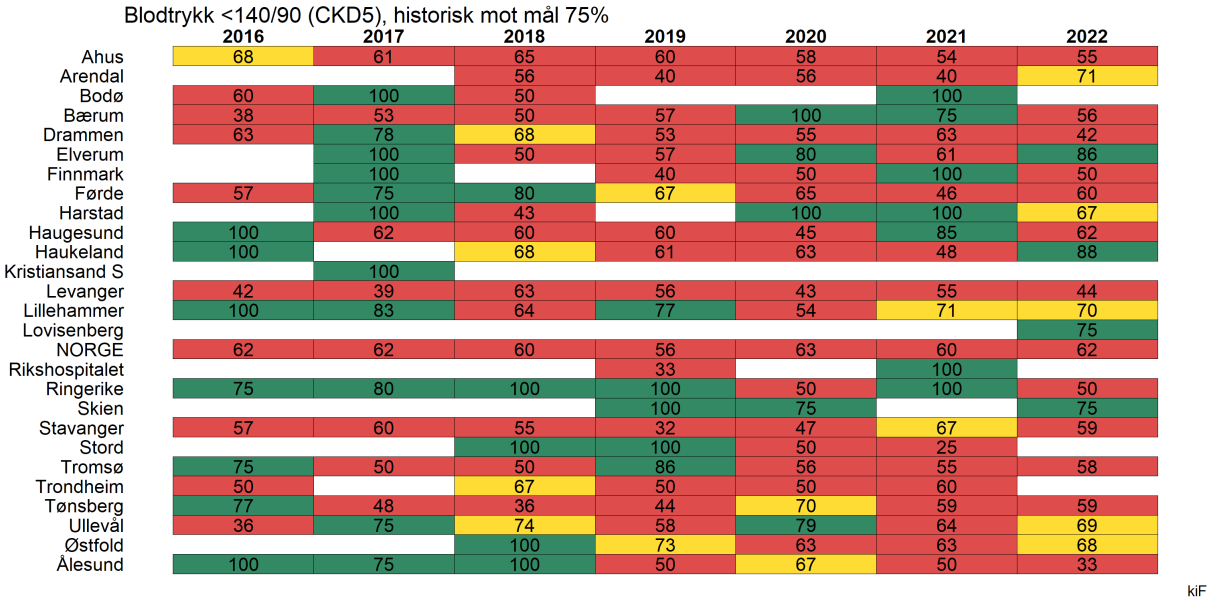


Figure A-42:

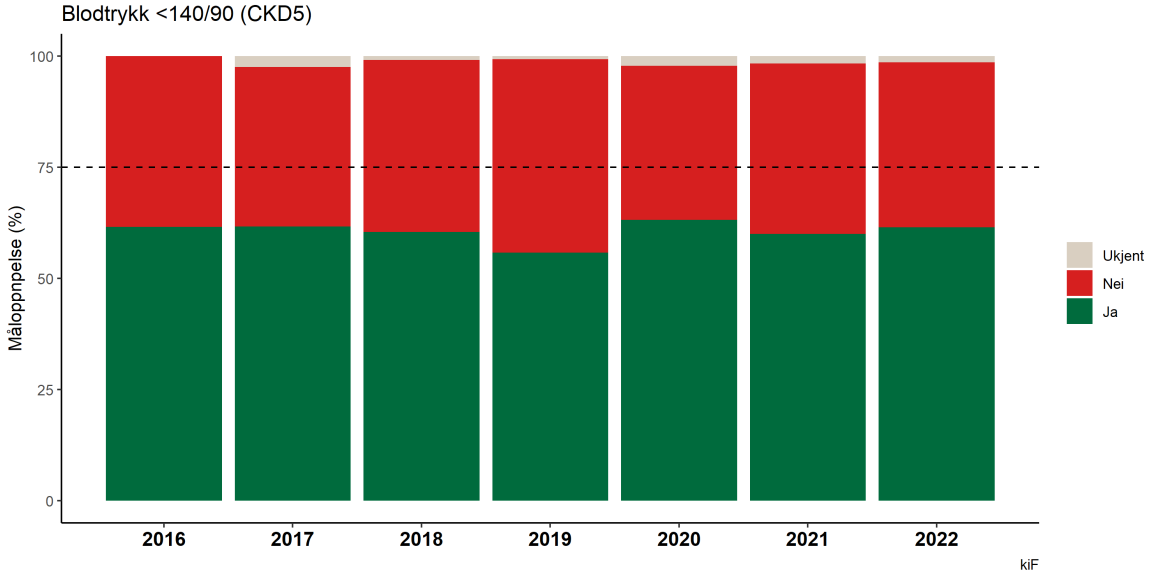


Figure A-43:

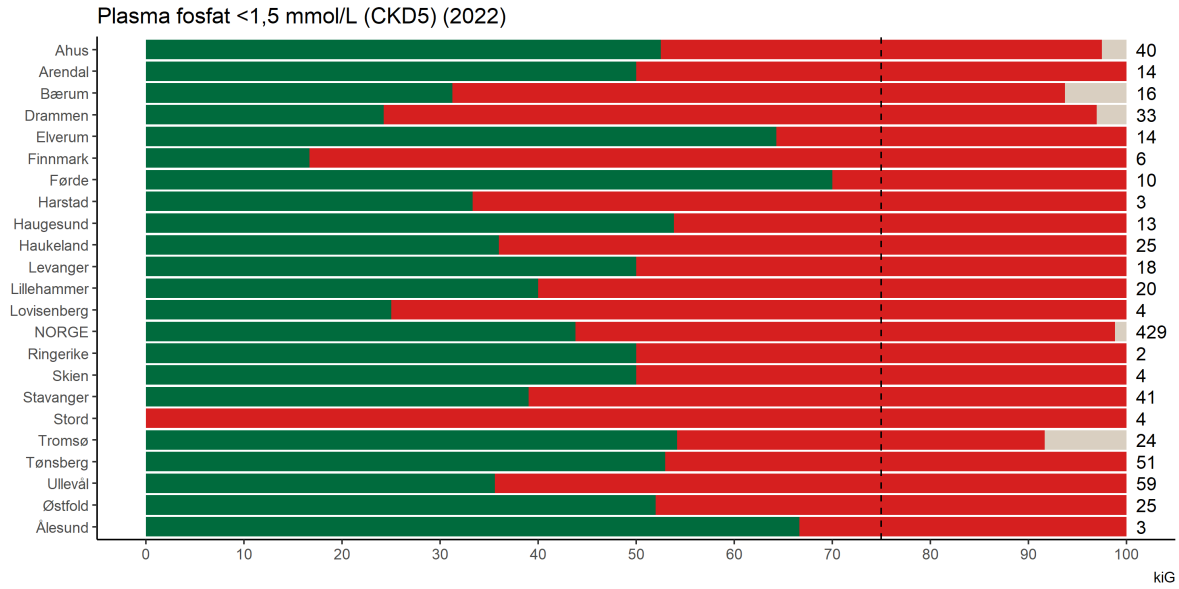


Figure A-44:

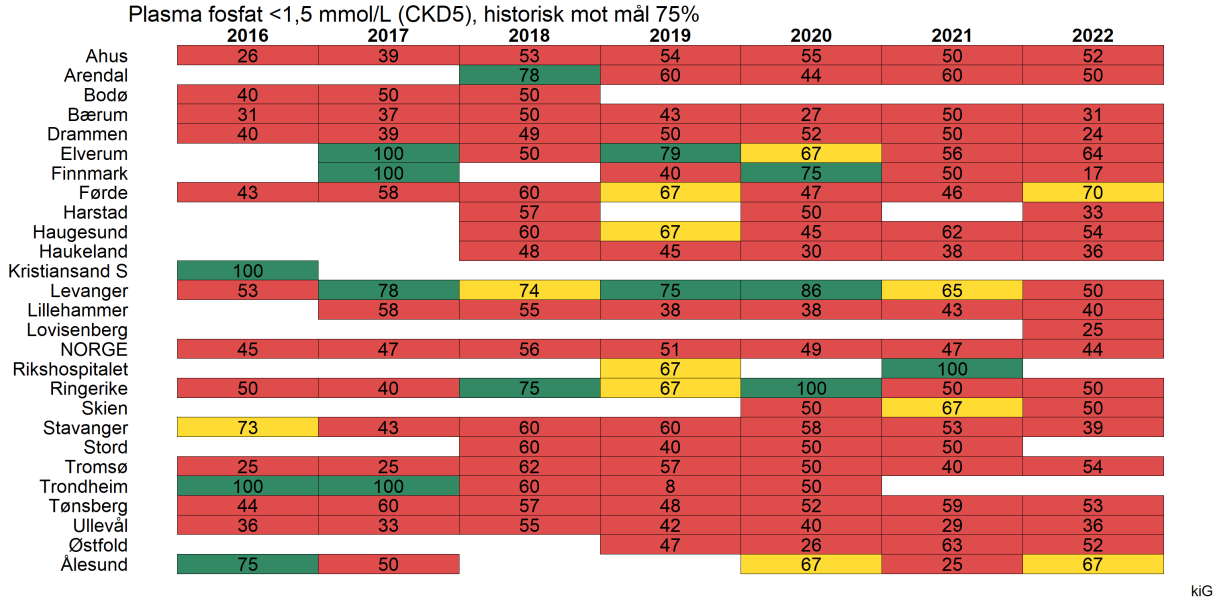


Figure A-45:

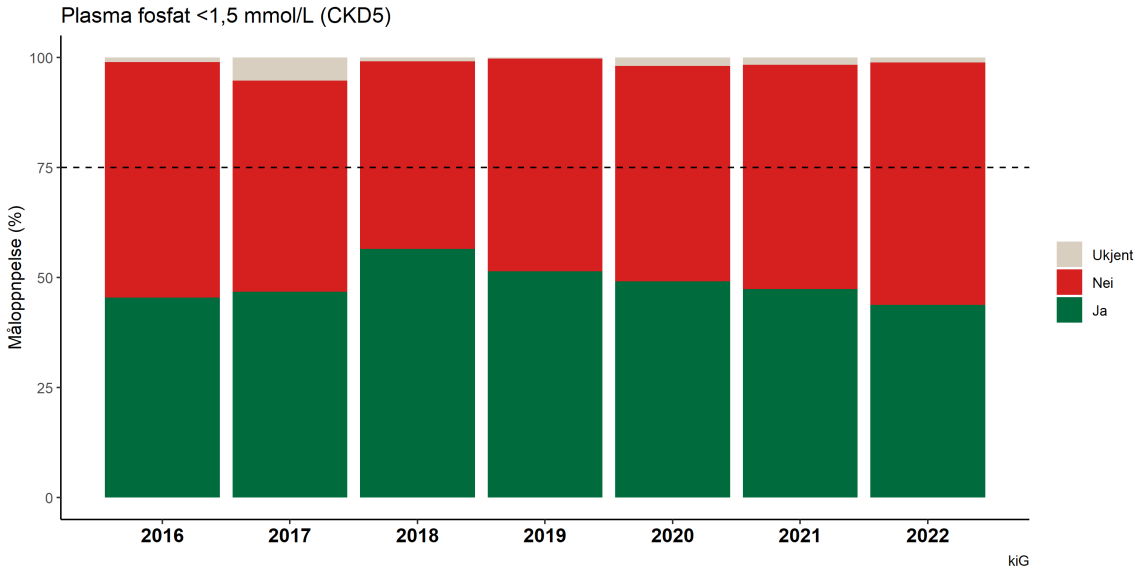


Figure A-46:

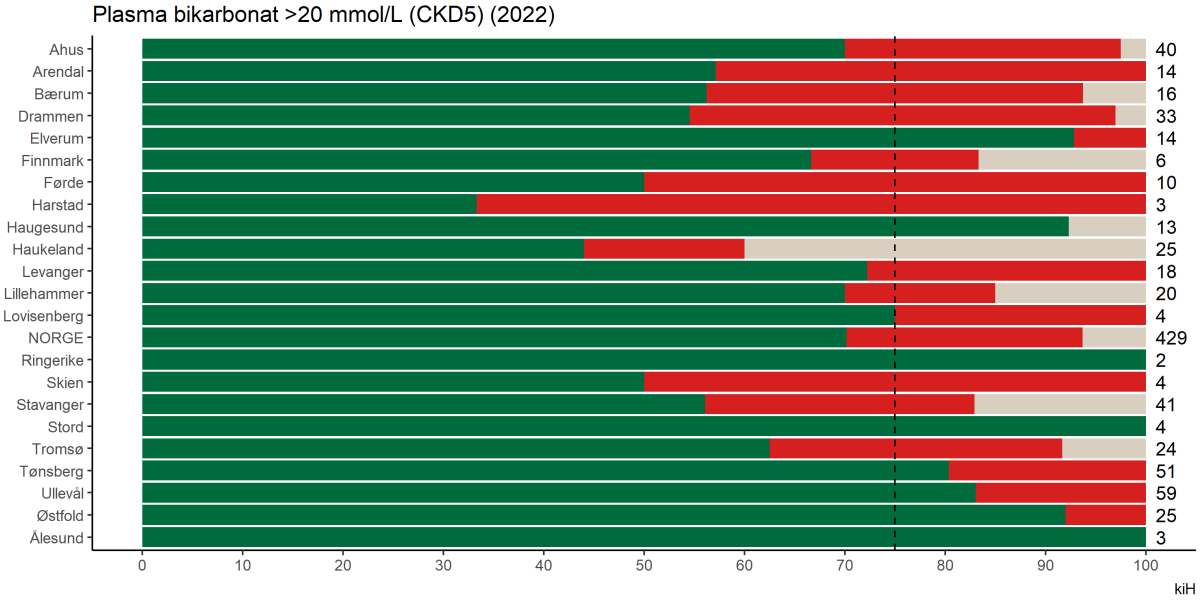


Figure A-47:

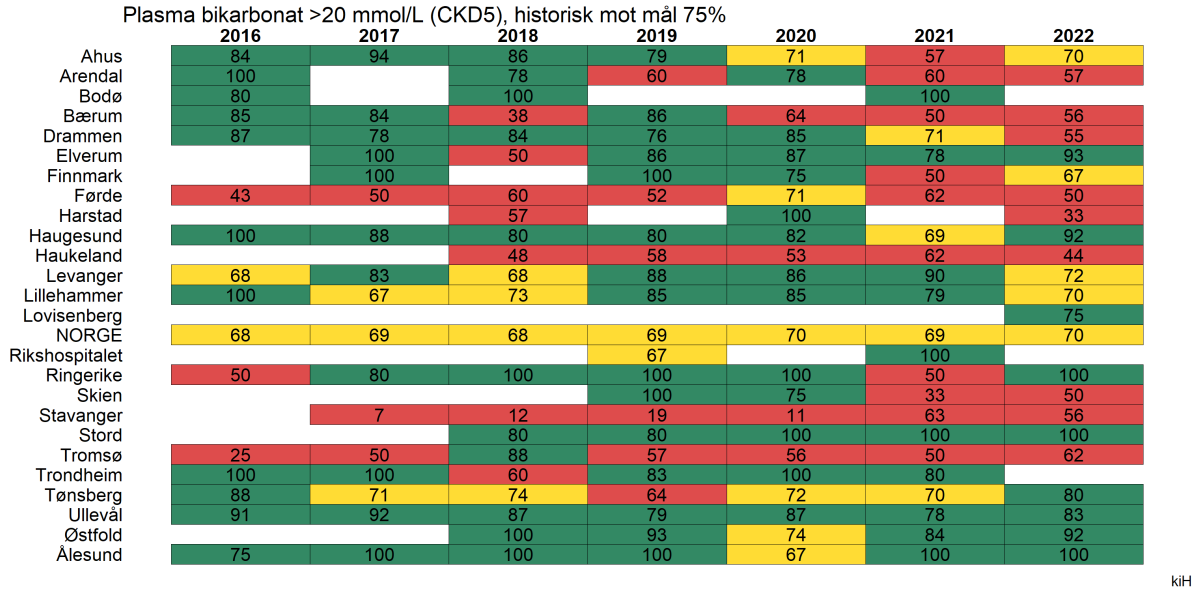


Figure A-48:

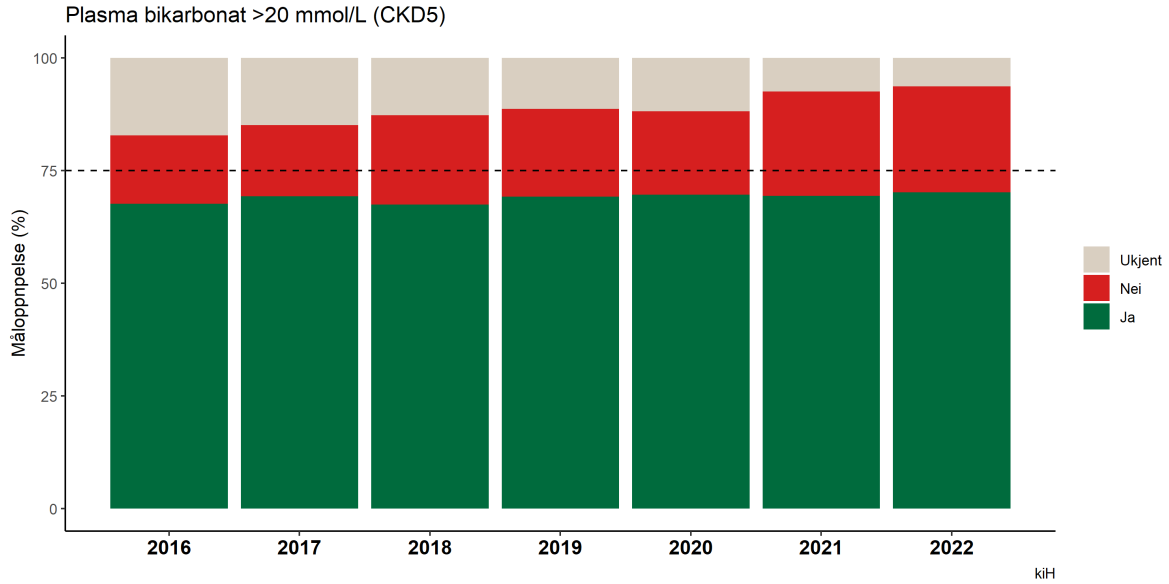


Figure A-49:

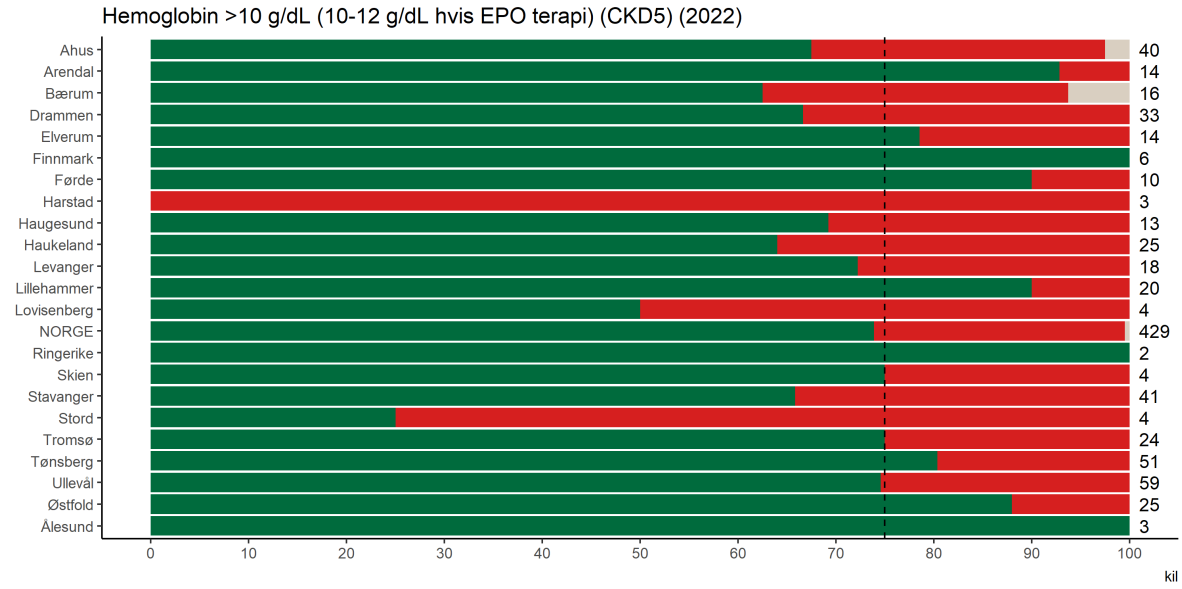


Figure A-50:

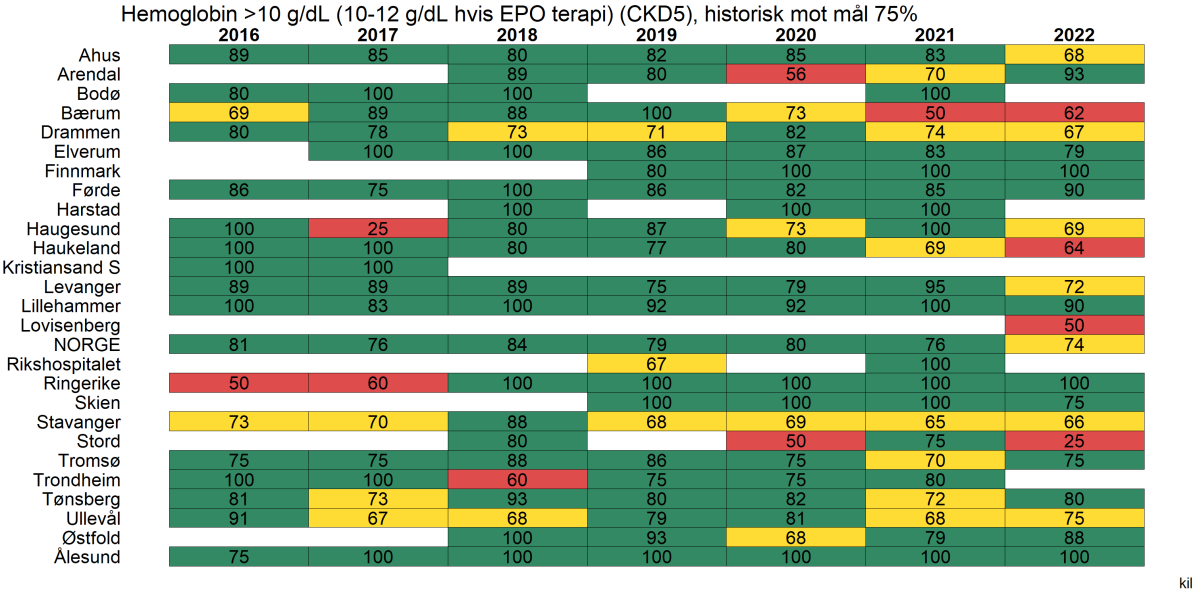


Figure A-51:

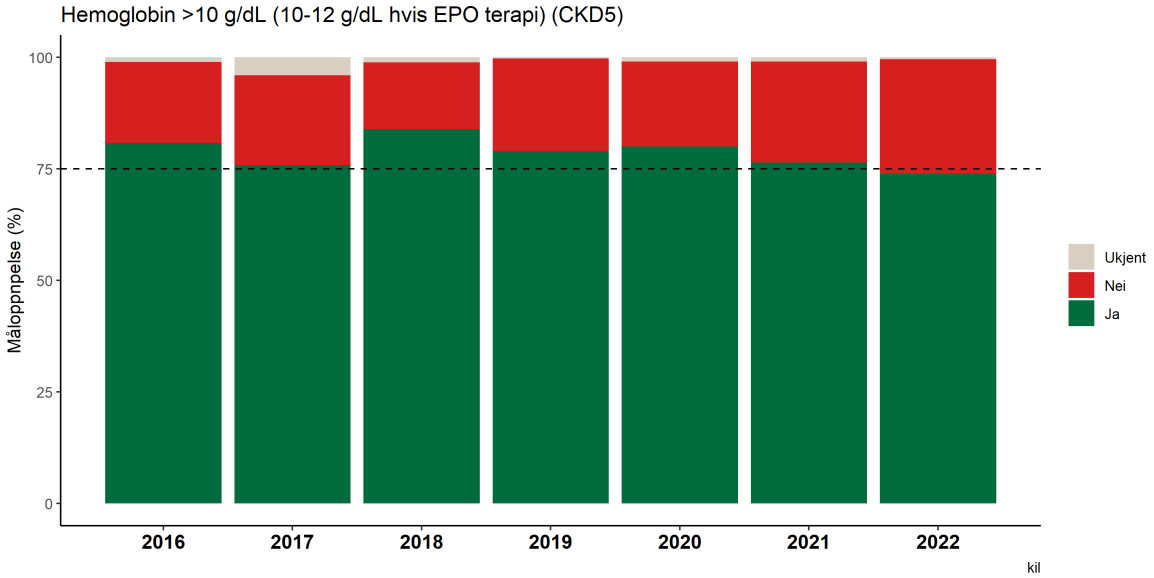


Figure A-52:

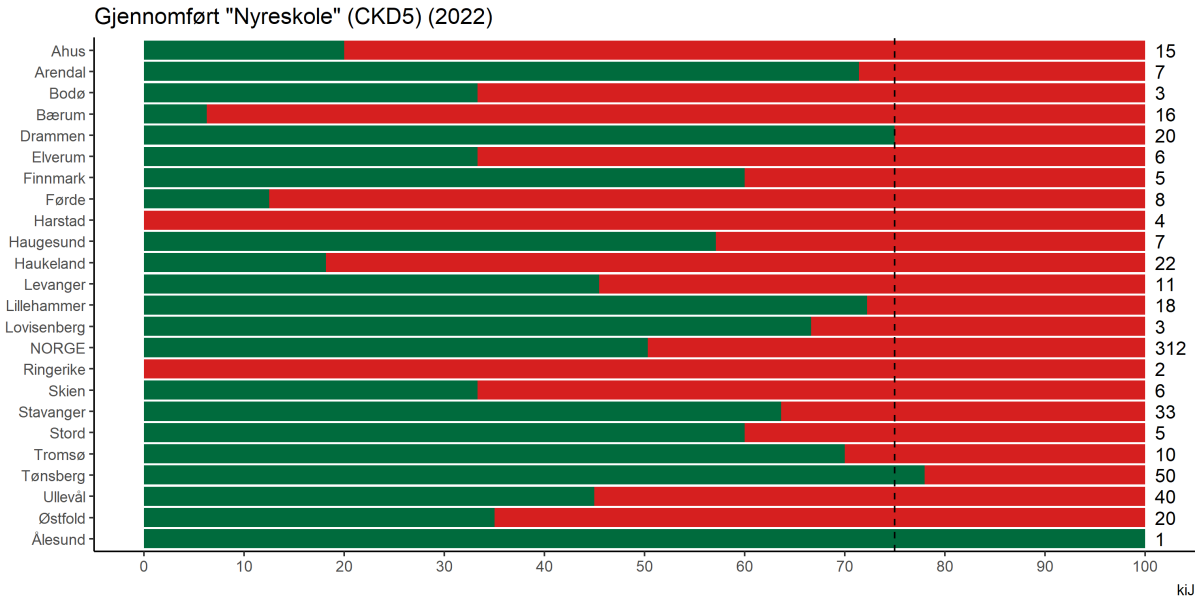


Figure A-53:

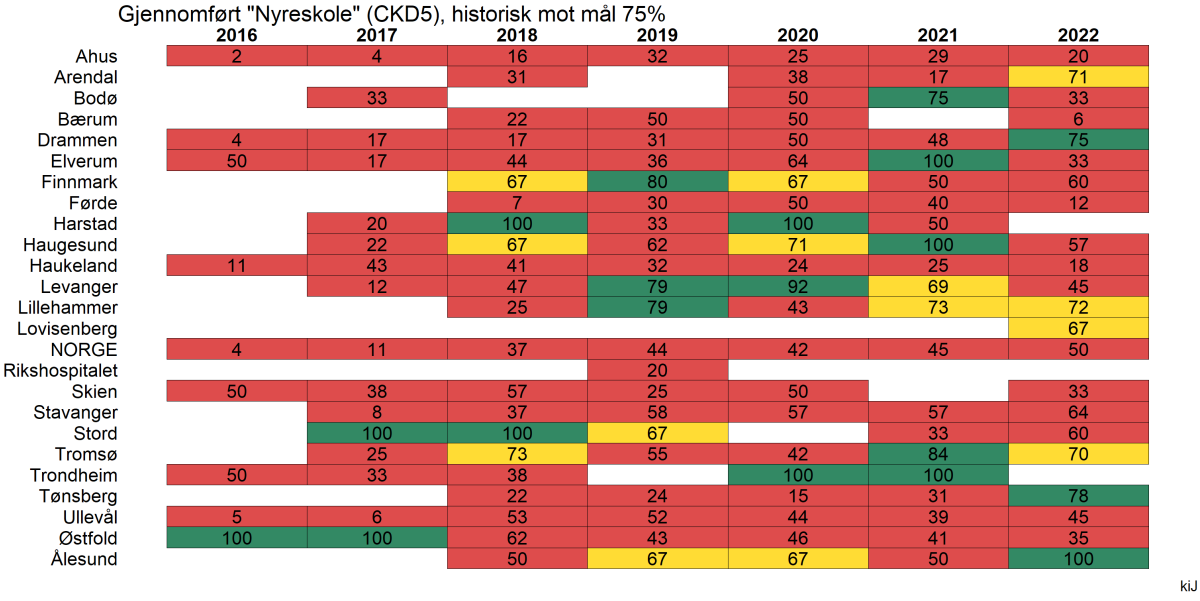


Figure A-54:

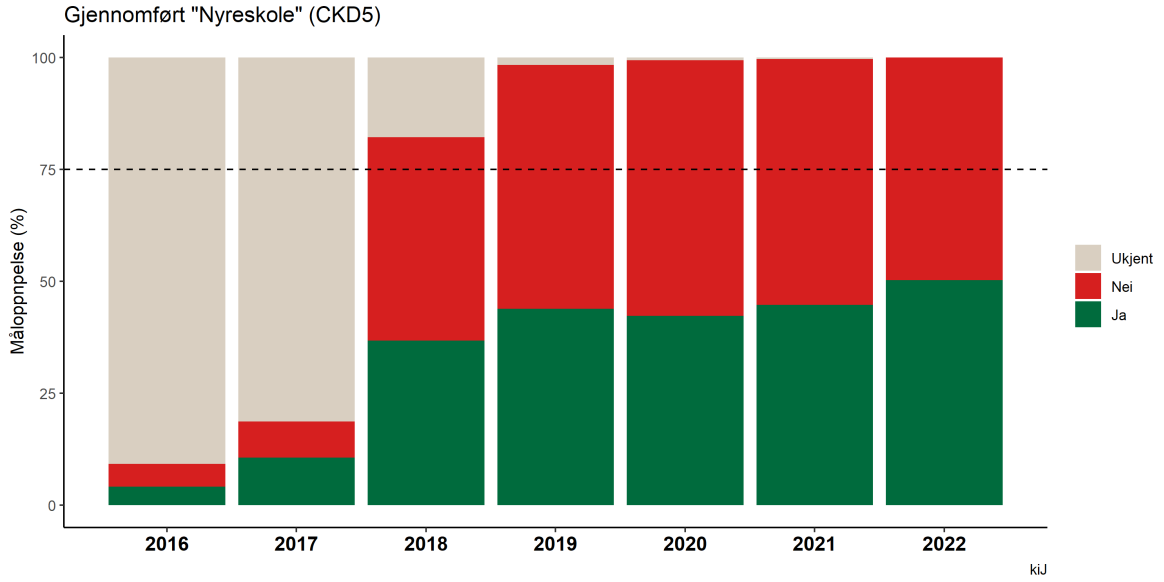


Figure A-55:

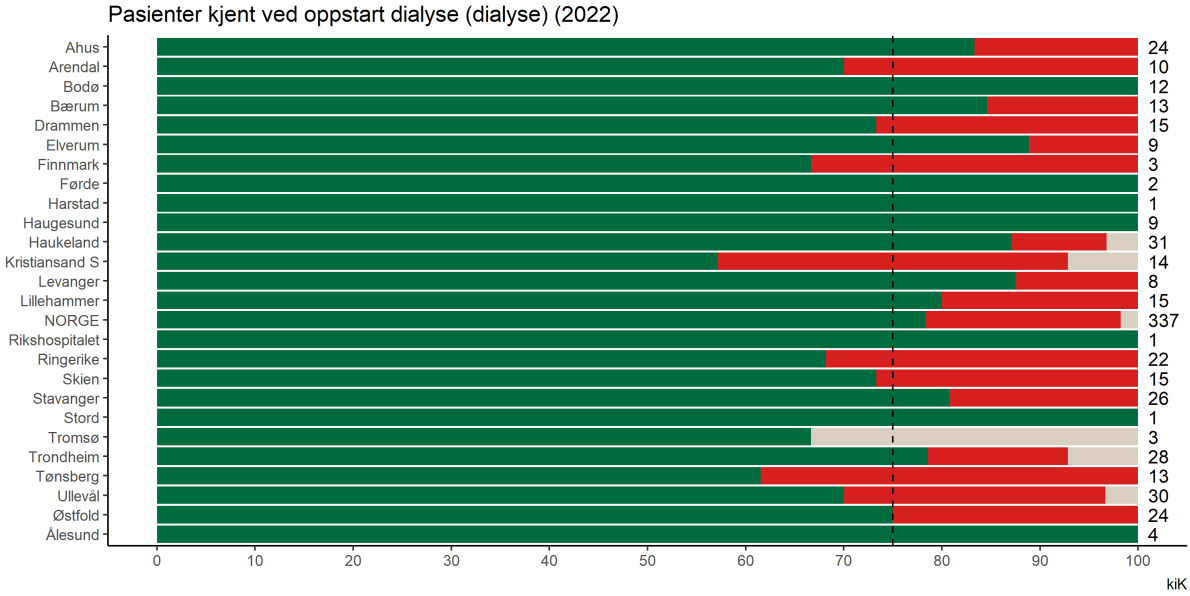


Figure A-56:

Pasienter kjent ved oppstart dialyse (dialyse), historisk mot mål 75%

	2016	2017	2018	2019	2020	2021	2022
Ahus	86	78	75	80	77	71	83
Arendal	60	62	50	78	60	80	70
Bodø	68	60	80	75	56	70	100
Bærum	80	86	100	100	67	86	85
Drammen	76	93	82	94	79	64	73
Elverum	61	91	73	76	67	78	89
Finnmark		100	100	83	89	100	67
Førde	83	58	100	67	80	80	100
Harstad	100	50	50	50		100	100
Haugesund	33	86	75	100	73	82	100
Haukeland	69	76	84	100	85	83	87
Kristiansand S	70	78	73	83	71	67	57
Kristiansund N	86	75	57	89	67	60	
Levanger	83	90	62	77	80	82	88
Lillehammer	89	79	77	78	94	88	80
NORGE	76	78	77	78	76	77	78
Rikshospitalet		67	50		80	100	100
Ringerike	79	71	71	86	82	58	68
Skien	62	79	88	69	75	67	73
Stavanger	83	82	61	83	81	78	81
Stord	67	100	100	100	100	100	100
Tromsø	71	71	73	78	55	88	67
Trondheim	100	82	72	60	83	87	79
Tønsberg	70	91	100	69	46	87	62
Ullevål	79	80	83	68	81	62	70
Østfold	69	69	77	93	79	73	75
Ålesund	73	71	82	75	100	78	100

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Figure A-57:

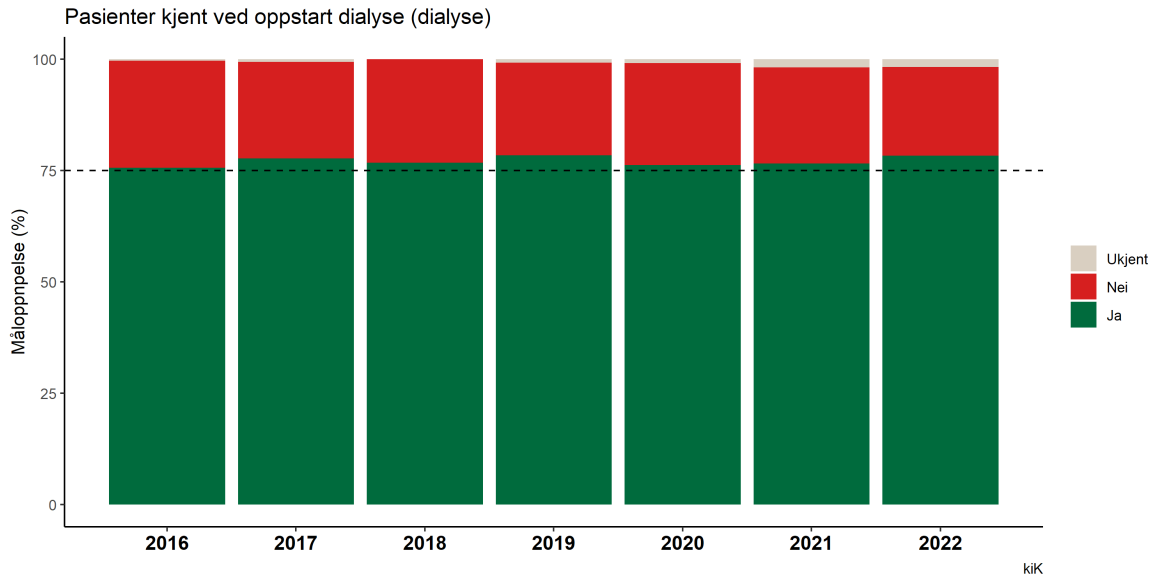

Figure A-58:

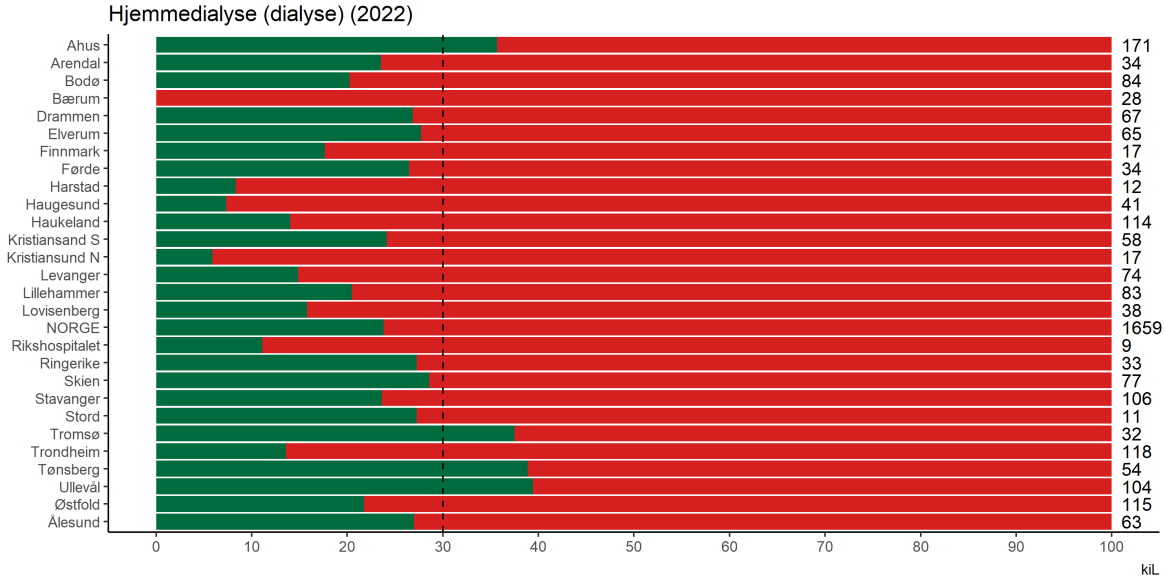

Figure A-59:

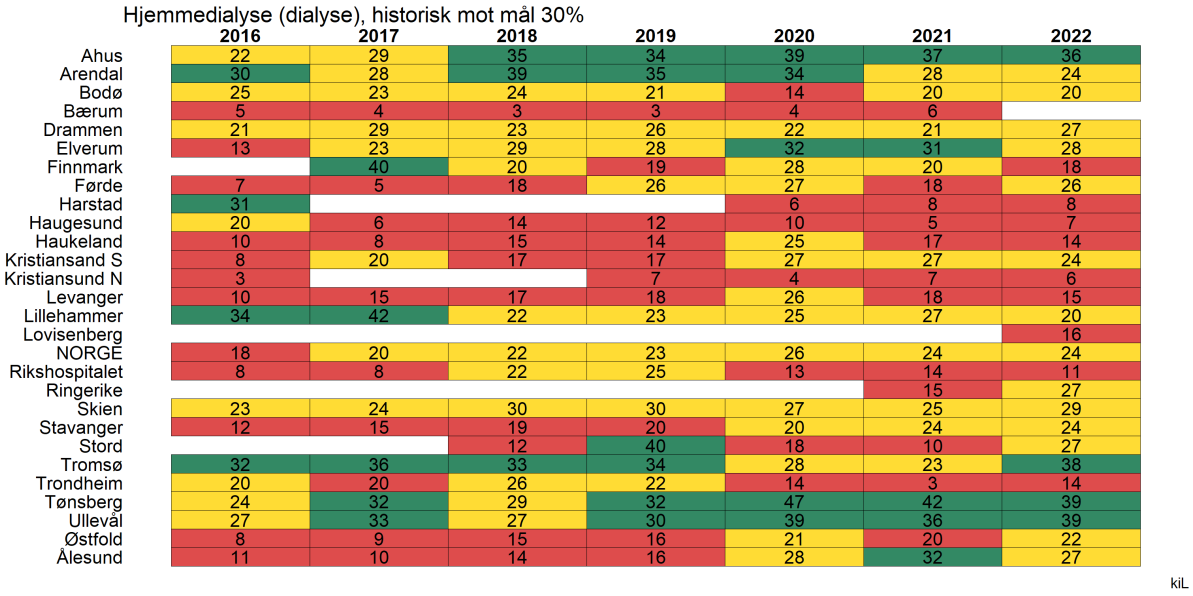

Figure A-60:

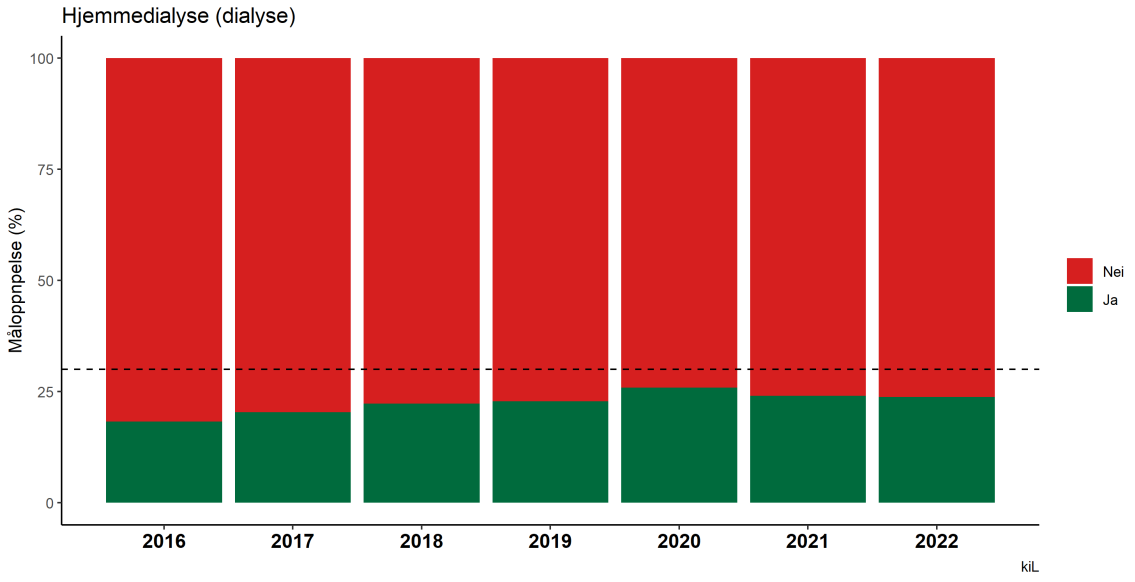

Figure A-61:

Figure A-62:

Start hemodialyse på fistel (hemodialyse), historisk mot mål 75%

	2016	2017	2018	2019	2020	2021	2022
Ahus	48	56	24	34	44	50	30
Arendal	50	20	100	29		50	43
Bodø	46	78	50	27	11	43	42
Bærum	50		45	36	25	17	45
Drammen	54	46	36	27	36	11	45
Elverum	27	25	9	31	12		
Finnmark		33	100	40	75	50	100
Førde	40	29	12	25	100	42	50
Harstad	67	100		50		50	
Haugesund		33	67	67	62	33	22
Haukeland	22	26	38	32	35	36	41
Kristiansand S	43	43	50	40	50	50	25
Kristiansund N	33	33		25		67	
Levanger	40	33	62	70	62	67	57
Lillehammer	25	27	30	29	20	29	17
NORGE	42	39	40	35	40	37	37
Ringerike	36	80	40	33	33	43	60
Skien	30	18	14	9		38	18
Stavanger	73	56	65	53	67	43	48
Stord	50			50	20		
Tromsø	70	30	50	57	17	43	50
Trondheim	38	44	44	39	42	35	27
Tønsberg	57	70	33	22	83	46	62
Ullevål	29	12	29	19	62	20	33
Østfold	27	44	41	42	30	50	28
Ålesund	62	58	71	33	40	29	75

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Figure A-63:

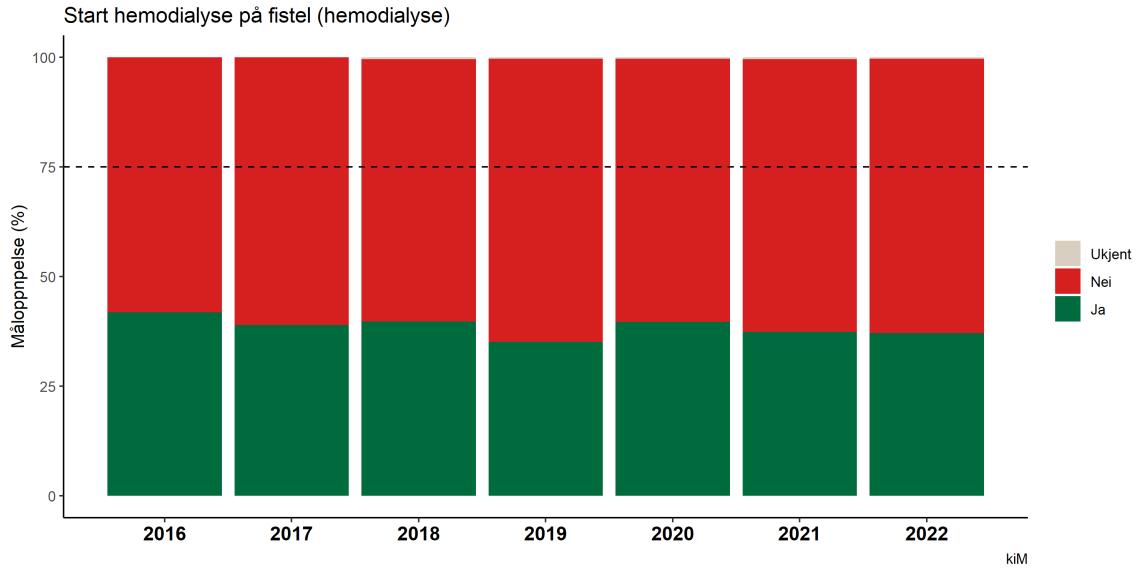

Figure A-64:

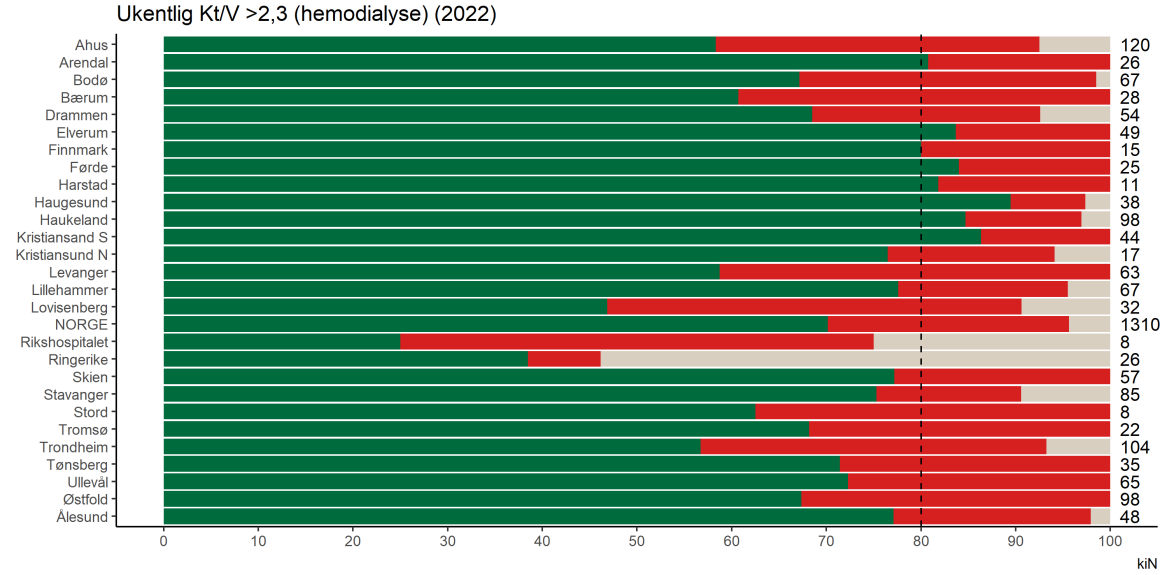

Figure A-65:

Ukentlig Kt/V >2,3 (hemodialyse), historisk mot mål 80%

	2016	2017	2018	2019	2020	2021	2022
Ahus	70	68	76	59	56	63	58
Arendal	34	59	76	63	83	78	81
Bodø	83	91	72	78	75	80	67
Bærum	14	74	83	75	67	63	61
Drammen	80	85	67	74	65	58	69
Elverum	85	76	87	81	93	93	84
Finnmark		75	85	61	89	81	80
Førde	93	77	91	96	92	93	84
Harstad	89	91	100	100	100	92	82
Haugesund	86	77	78	80	72	78	89
Haukeland	64	58	54	55	61	87	85
Kristiansand S	57	59	63	71	70	73	86
Kristiansund N	57	83	79	82	71	85	76
Levanger	89	82	80	69	79	76	59
Lillehammer	67	59	62	81	65	89	78
Lovisenberg							47
NORGE	64	72	72	71	73	75	70
Rikshospitalet	50	77	25	70	57	54	25
Ringerike	61	70	67	67	63	70	38
Skien	86	88	83	70	53	72	77
Stavanger		79	84	85	85	66	75
Stord	18	80	100	67	78	56	62
Tromsø	68	73	79	79	75	79	68
Trondheim	60	71	69	72	80	79	57
Tønsberg	72	79	88	79	86	81	71
Ullevål	69	76	82	71	75	68	72
Østfold	40	40	35	37	73	68	67
Ålesund	85	85	77	91	91	84	77

kiN

Figure A-66:

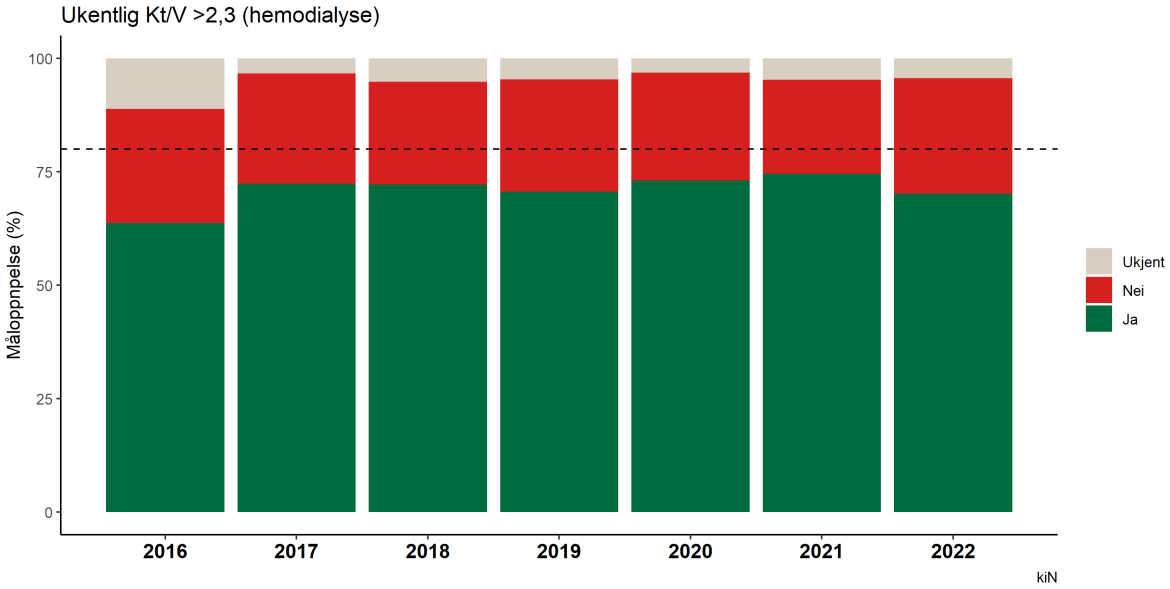

Figure A-67:

Figure A-68:

Predialytisk plasma fosfat <1,78 mmol/L (hemodialyse), historisk mot mål 75%

	2016	2017	2018	2019	2020	2021	2022
Ahus	55	53	59	57	50	50	50
Arendal	48	37	59	53	67	57	46
Bodø	65	79	75	66	60	65	69
Bærum	68	78	60	59	74	63	82
Drammen	63	59	60	62	45	51	56
Elverum	64	51	57	67	47	59	55
Finnmark		67	54	67	67	50	60
Førde	79	74	73	81	71	68	68
Harstad	56	73	55	81	56	58	55
Haugesund	61	65	66	43	31	55	66
Haukeland	52	52	44	45	31	57	60
Kristiansand S	43	39	44	47	39	43	41
Kristiansund N	77	78	79	82	57	69	76
Levanger	60	71	65	63	60	69	73
Lillehammer	72	64	73	62	43	56	66
Lovisenberg							34
NORGE	59	62	63	60	52	57	57
Rikshospitalet	50	46	38	70	36	38	38
Ringerike	48	50	60	54	63	43	54
Skien	61	66	55	48	47	46	54
Stavanger	60	79	86	73	63	68	74
Stord	45	60	43	67	56	56	50
Tromsø	58	67	68	58	56	58	55
Trondheim	63	74	57	64	64	63	45
Tønsberg	53	57	64	59	54	50	43
Ullevål	55	54	57	47	42	48	46
Østfold	52	52	63	59	44	56	47
Ålesund	85	85	75	81	75	74	73

kiO

Figure A-69:

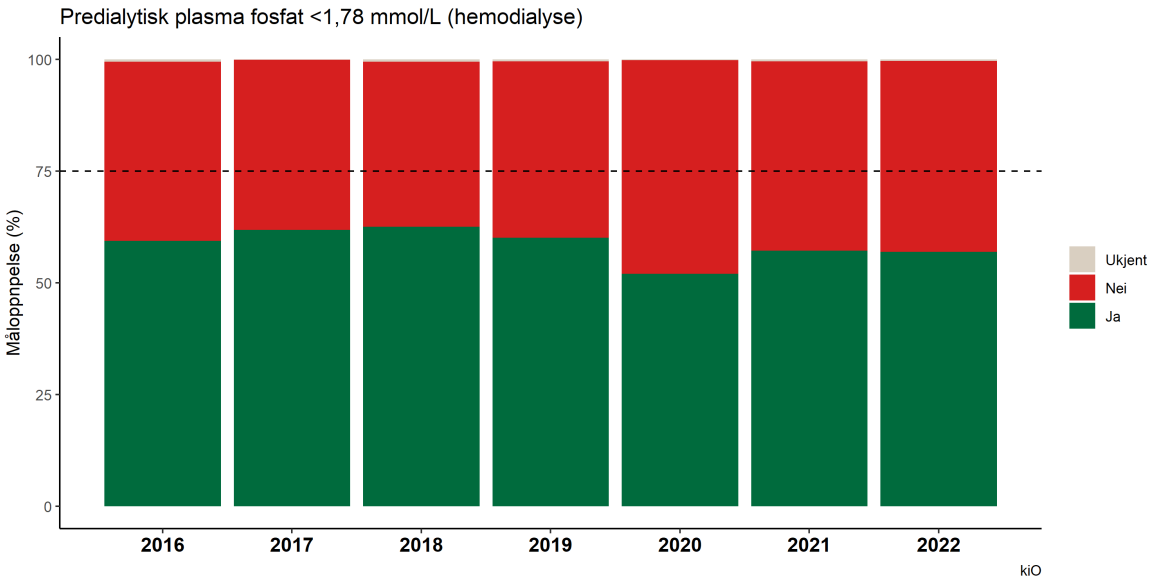

Figure A-70:

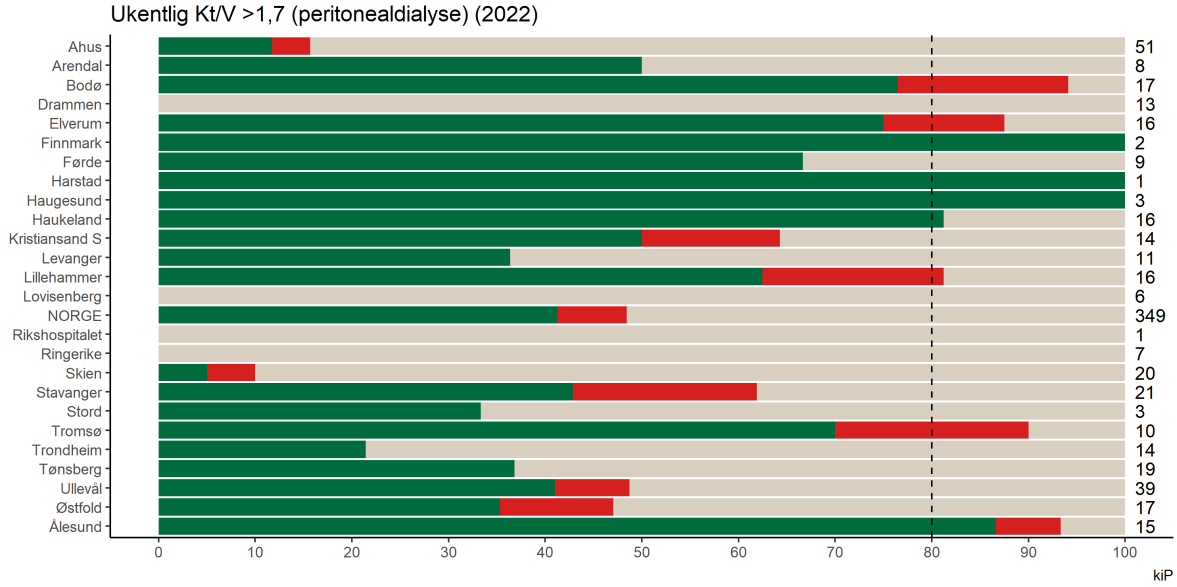

Figure A-71:

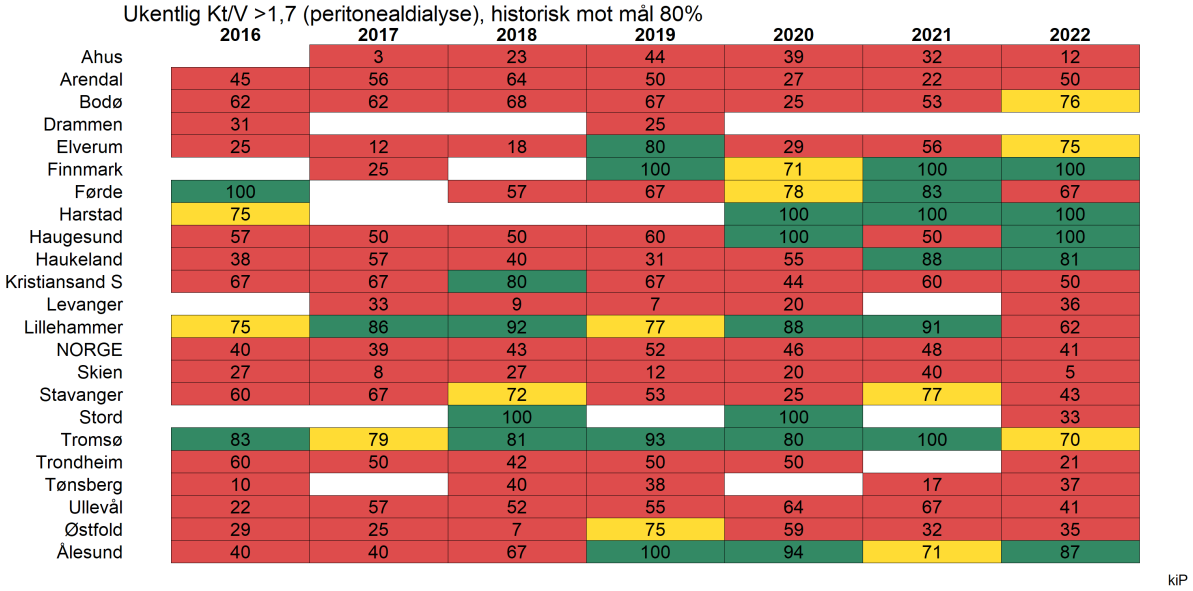

Figure A-72:

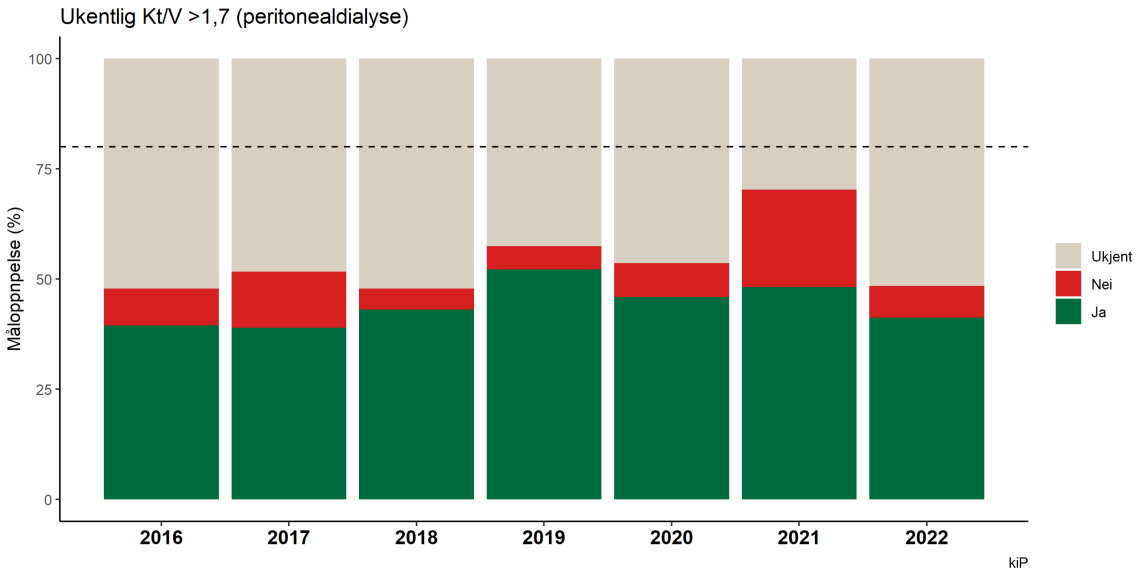

Figure A-73:

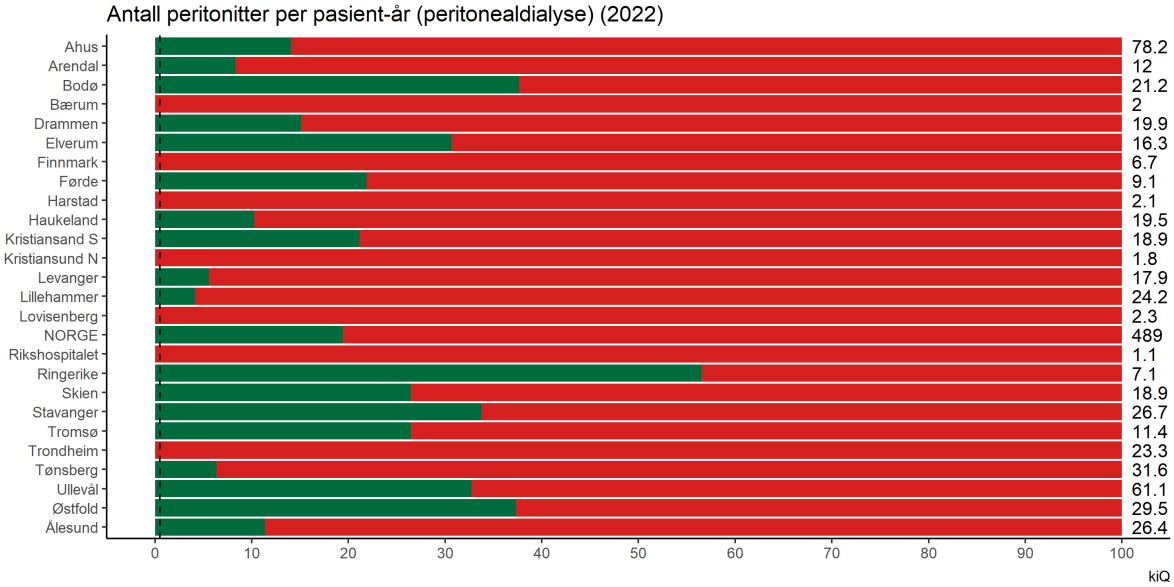

Figure A-74:

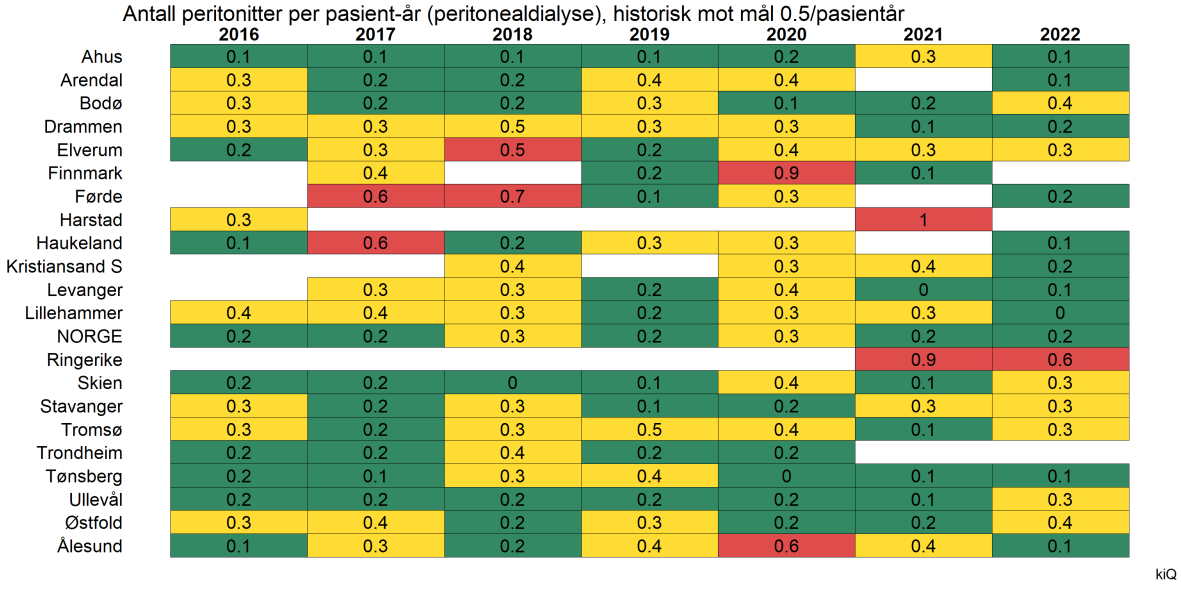

Figure A-75:

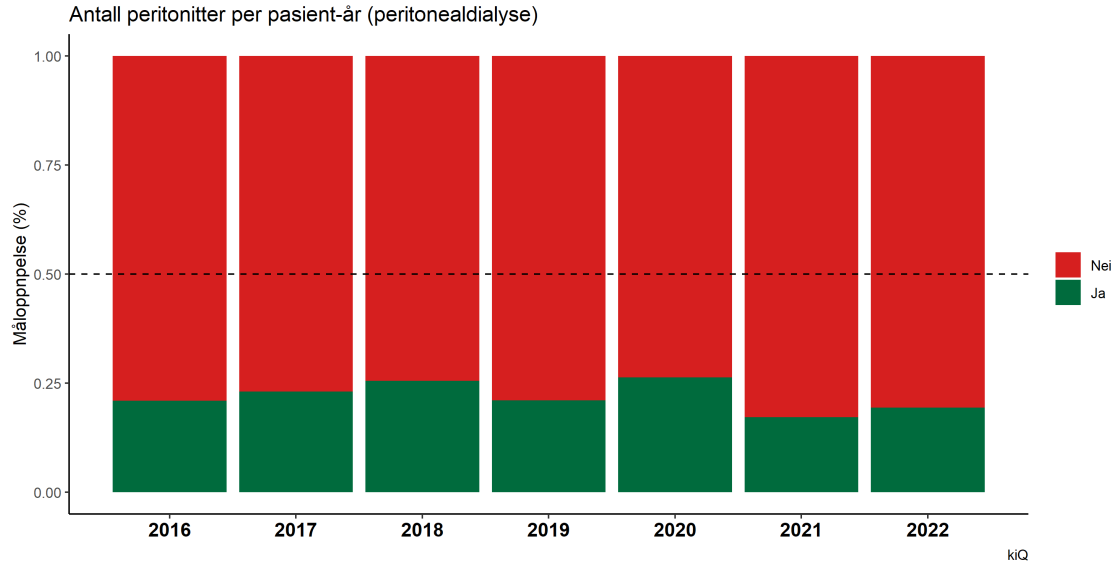

Figure A-76:

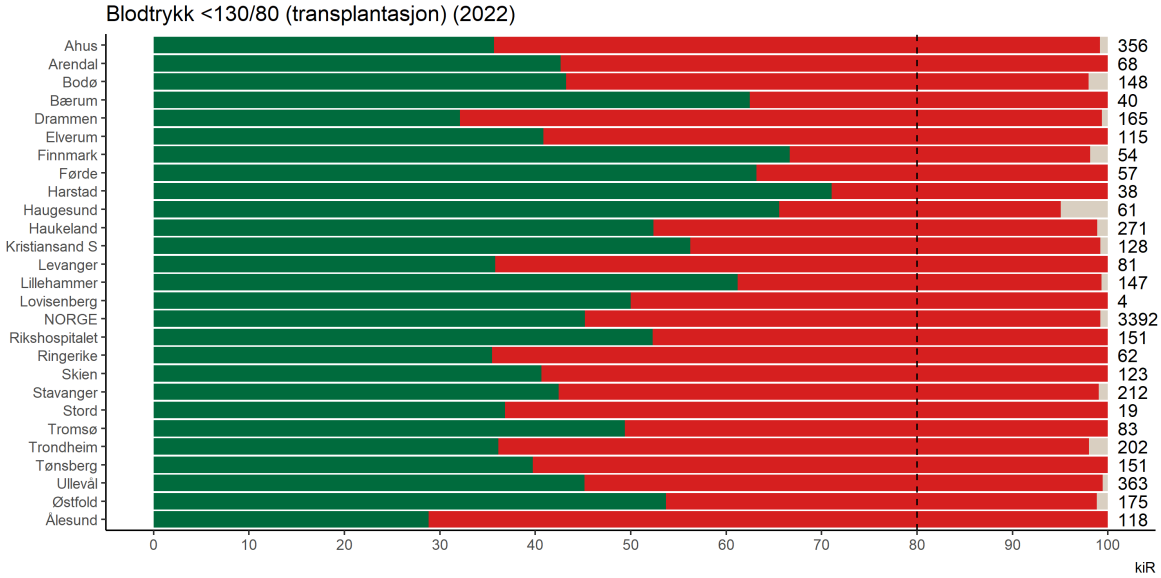

Figure A-77:

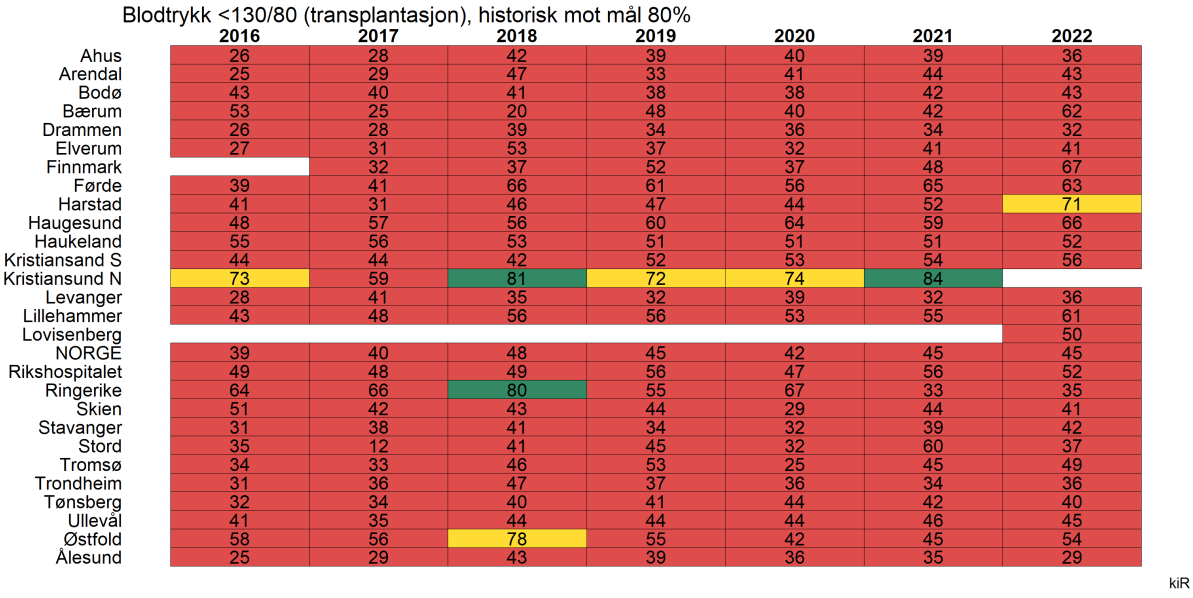

Figure A-78:

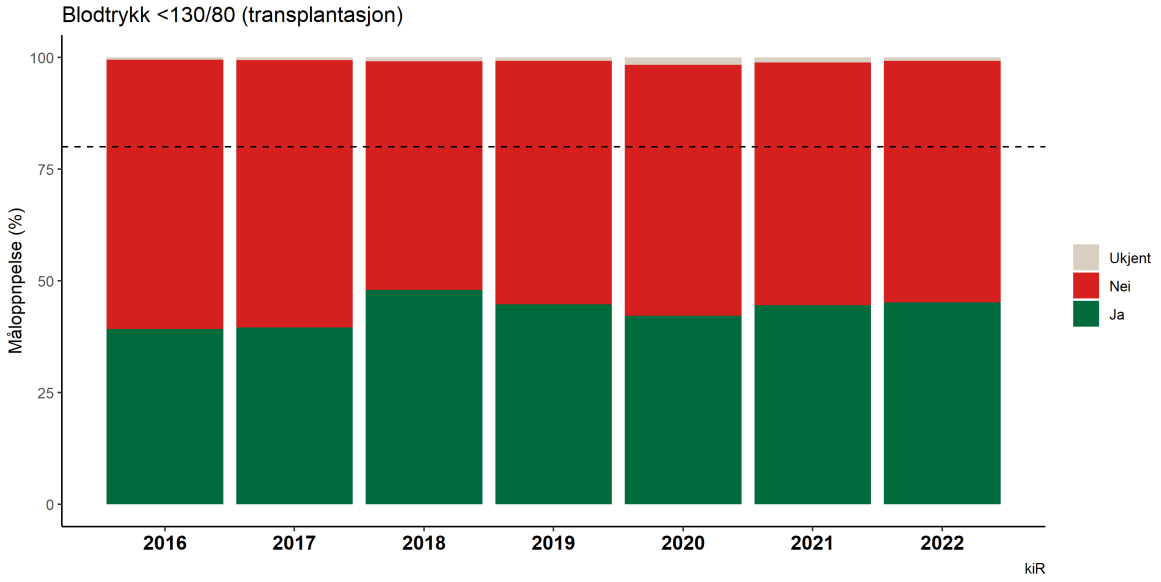

Figure A-79:

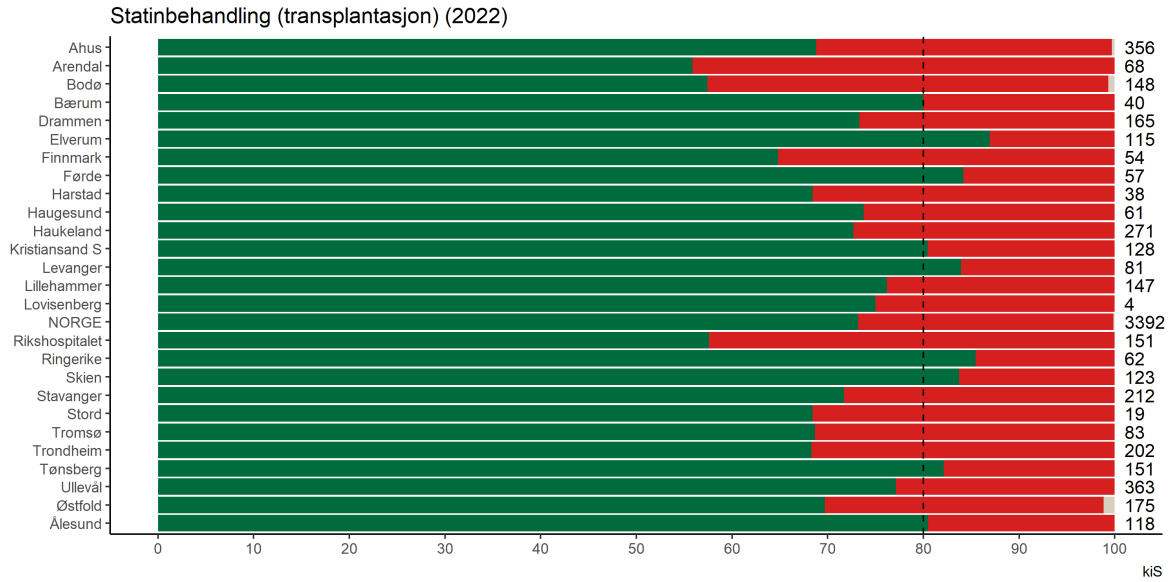

Figure A-80:

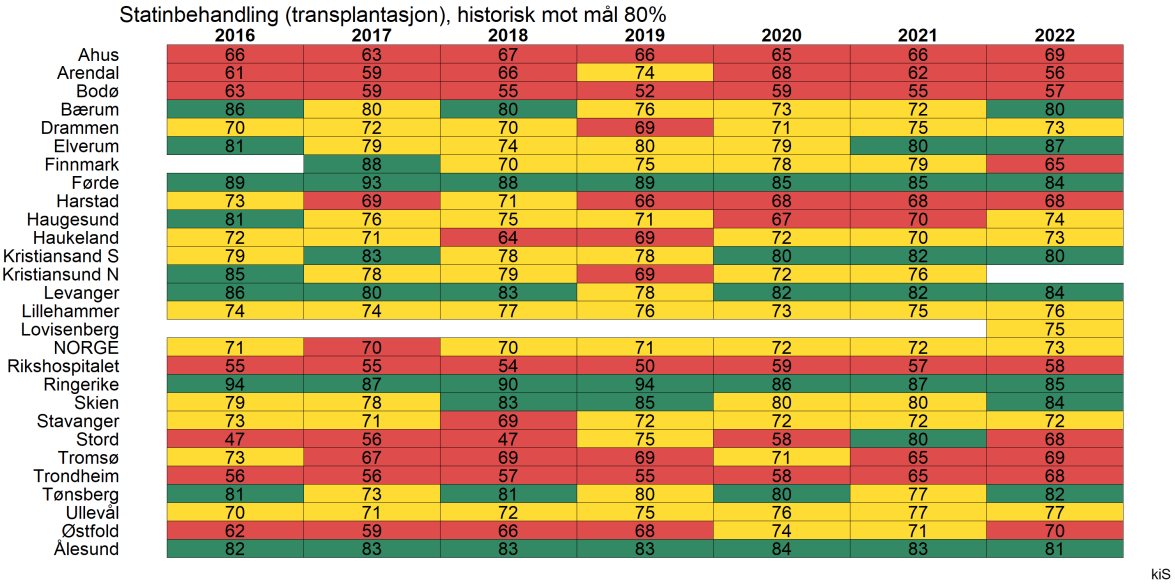

Figure A-81:

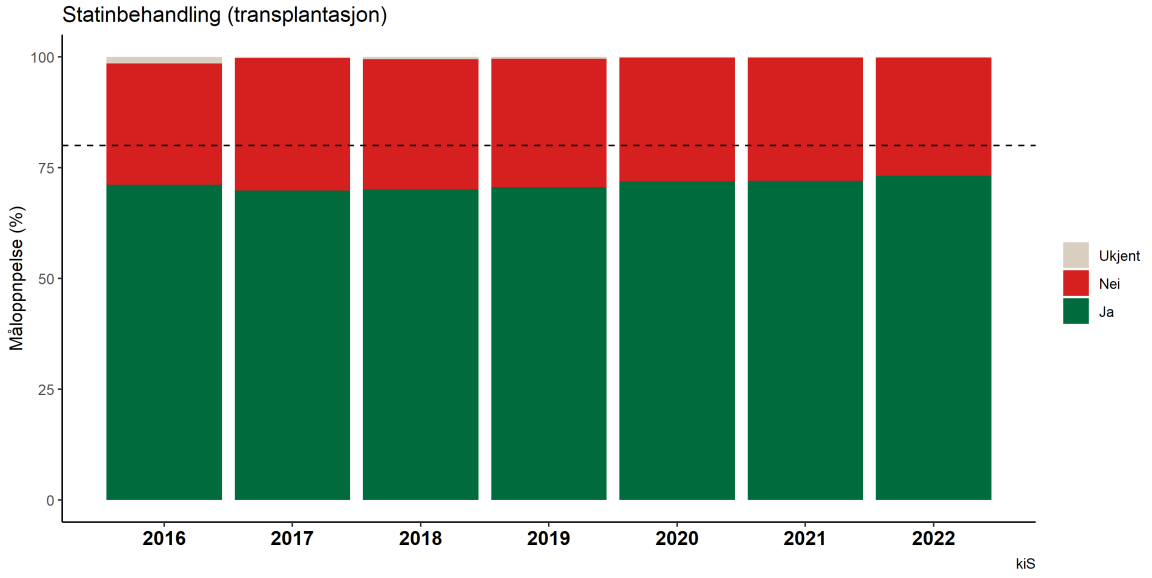

Figure A-82:

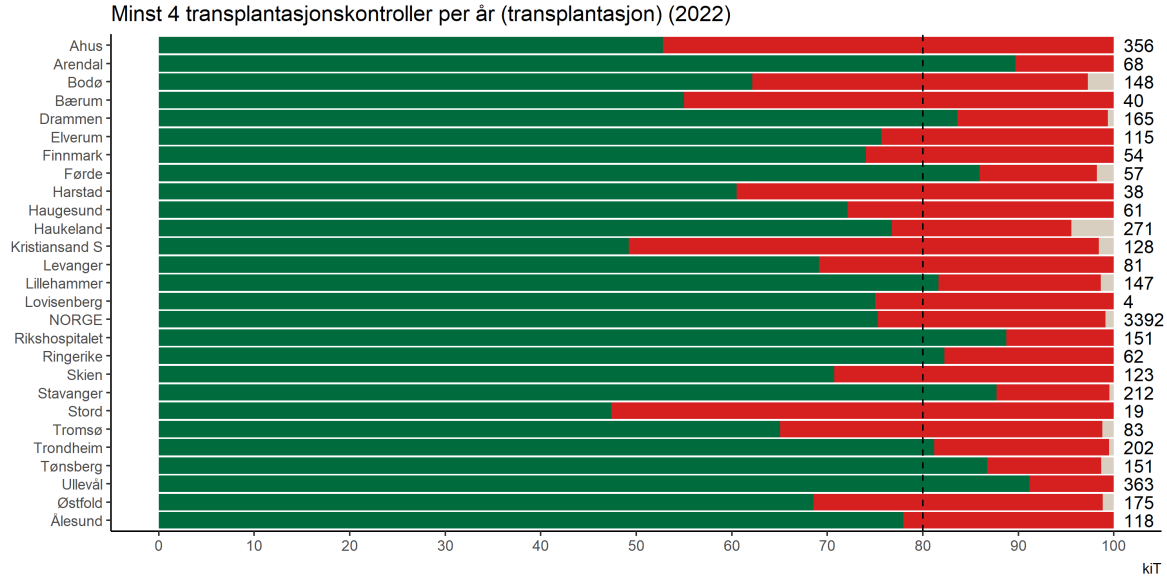

Figure A-83:

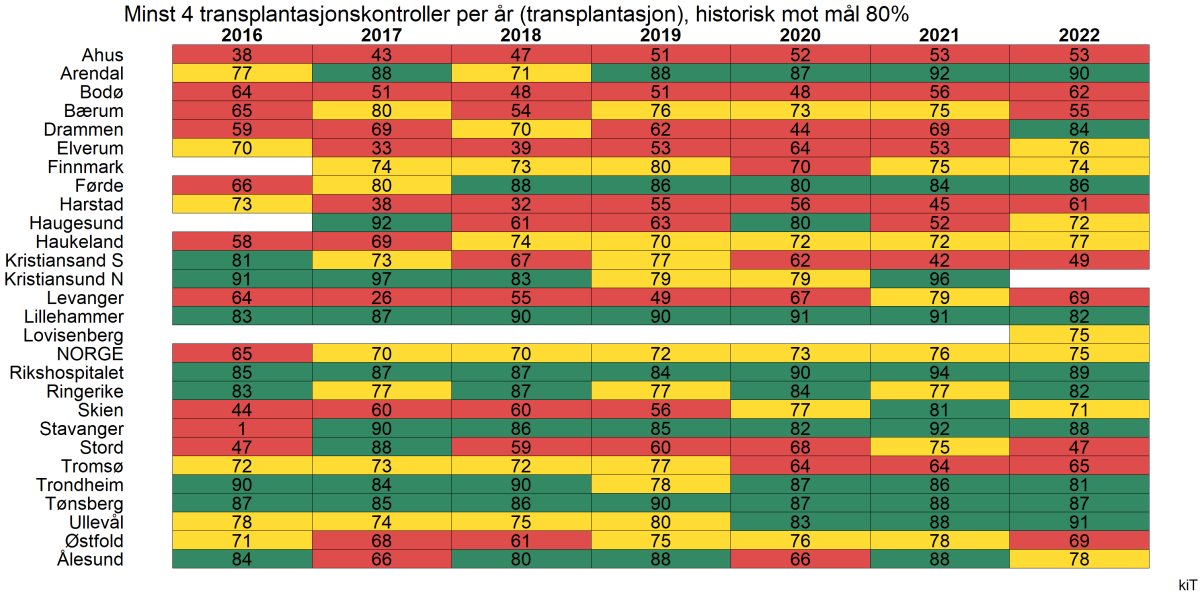

Figure A-84:

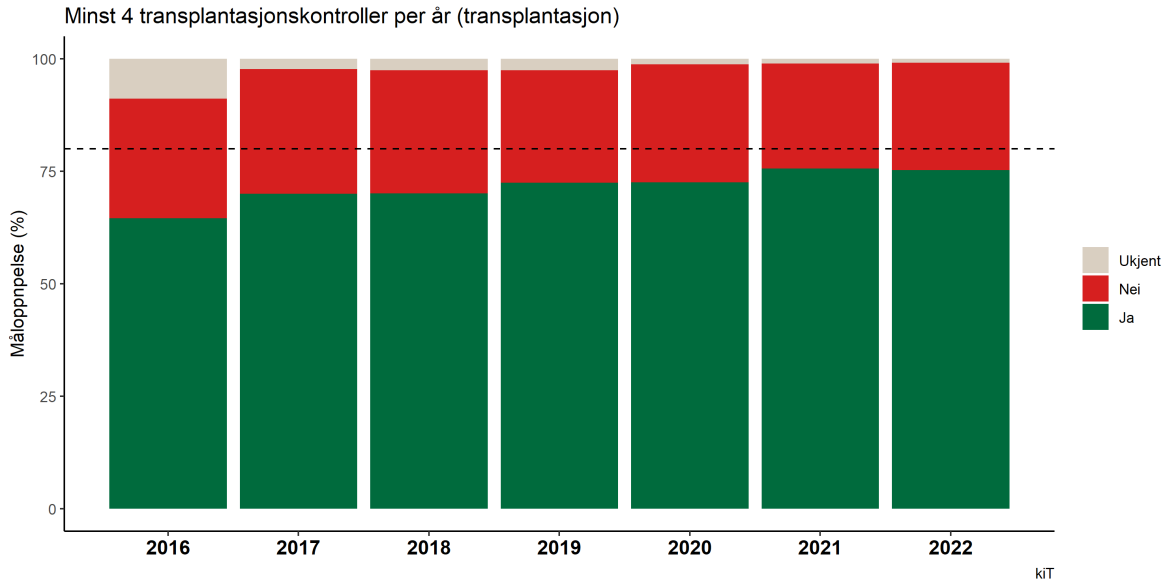

Figure A-85:

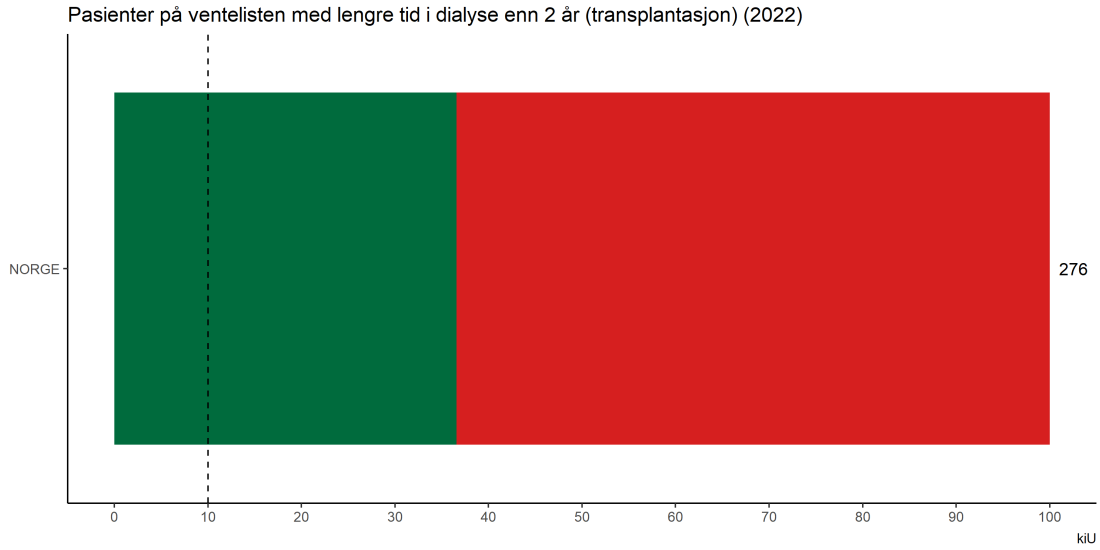

Figure A-86:

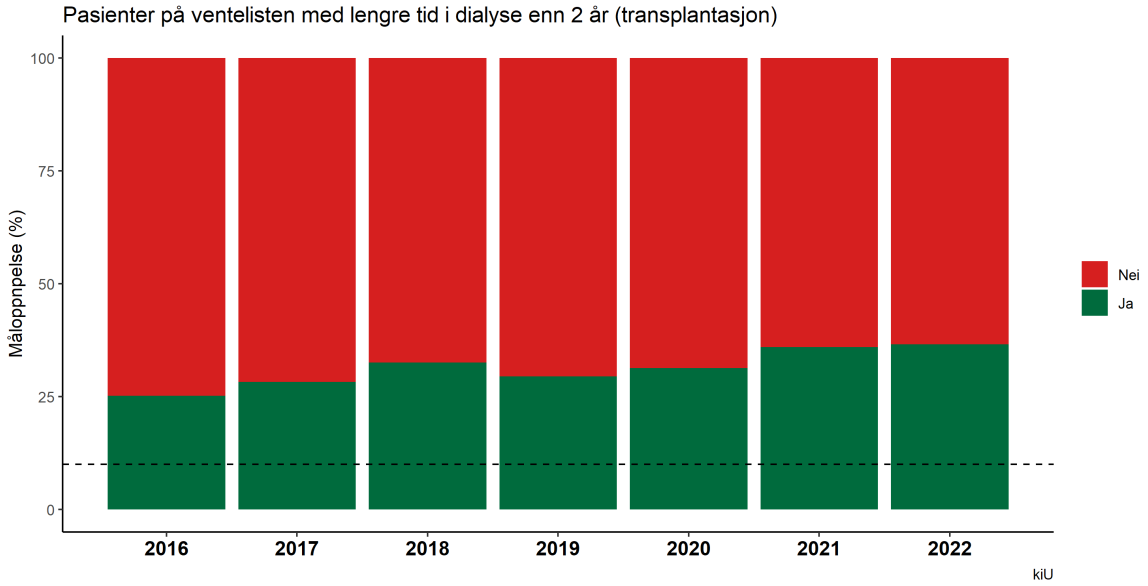

Figure A-87:

Appendix; center annual RRT numbers.

		New patients in RRT 2022				Patients in RRT by 31.12.2022					Dialyses etc. 2022			Died 2022		
	Satellittes	HD/HDF	PD	Pre-emptive	Total	HD/HDF	HjemmeHD	PD	Graft	Total	HD sessions	Pl.exch.	Other	Dial.pat	Tx-pat	Not tx-cand.
AHUS	1	24	15	2	41	114	10	56	360	540	**21,216**	0	0	38	25	117
Arendal		10	3	1	14	27	0	9	71	107	**3,685**	0	35	9	2	8
Bergen	3	31	4	3	38	102	0	16	292	410	**15,461**	54	47	19	11	68
Bodø	9	12	8	5	25	70	0	20	164	254	**11,777**	1	0	18	11	48
Bærum		14	0	1	15	35	0	1	69	105	**4,746**	0	0	12	5	20
Drammen	1	15	13	2	30	50	5	18	172	245	**8,534**	36	0	21	17	25
Elverum		9	6	2	17	47	2	16	117	182	**7,825**	0	29	11	5	43
Finnmark	5	3	0	0	3	15	1	5	45	66	**2,514**	0	0	4	7	9
Førde	2	2	5	1	8	25	0	9	59	93	**3,966**	0	0	10	3	19
Harstad		1	1	0	2	12	0	1	38	51	**1,865**	0	0	2	2	6
Haugesund	2	9	1	2	12	39	0	3	68	110	**5,660**	43	25	8	4	24
Hønefoss	1	22	6	1	29	31	1	11	63	106	**3,949**	0	0	12	2	18
Kristiansand S	1	14	4	0	18	43	0	14	132	189	**6,450**	25	0	14	3	31
Kristiansund N	1	0	0	0	0	17	0	1	49	67	**3,590**	0	0	7	3	14
Levanger	6	8	6	1	15	62	0	11	83	156	**9,884**	8	115	16	6	52
Lillehammer	3	15	6	2	23	71	1	16	156	244	**9,910**	11	0	13	9	47
Lovisenberg		4	5	0	9	38	0	7	6	51	**4,330**	0	0	6	0	44
Rikshospitalet		1	1	1	3	8	1	0	150	159	**2,717**	180	61	2	2	1
Stavanger		26	6	4	36	82	4	21	215	322	**12,263**	36	32	18	14	54
Stord		1	2	0	3	8	0	3	20	31	**1,512**	0	0	1	1	5
Telemark	4	15	7	2	24	64	3	22	128	217	**9,868**	12	0	13	11	49
Tromsø	3	3	9	2	14	27	2	13	92	134	**5,078**	22	0	6	6	24
Trondheim	5	28	7	2	37	103	3	18	223	347	**16,010**	67	164	27	14	80
Tønsberg		13	18	1	32	40	2	26	156	224	**6,336**	30	71	21	17	32
Ullevål		30	12	6	48	70	2	44	369	485	**13,591**	36	0	34	19	71
Østfold	2	24	7	4	35	105	8	24	208	345	**16,670**	3	0	20	17	106
Ålesund	1	4	5	0	9	47	2	15	120	184	**8,183**	56	0	17	7	49
SUM	***50***	***338***	***157***	***45***	***540***	***1,352***	***47***	***400***	***3,625***	***5,424***	***217,590***	***620***	***579***	***379***	***223***	***1,064***
# Pr. mill innb.		*61.6*	*28.6*	*8.2*	*98.4*	*246.3*	*8.6*	*72.9*	*660.4*	*988.2*						*193.8*
% of total		*62.6*	*29.1*	*8.3*	*100,0*	*24.9*	*0.9*	*7.4*	*66.8*	*100,0*						*19.6*

Appendix; Quality indicators for NNR.

27-11-2017

Norsk Nyreregister -- Kvalitetsmål

Pasientgruppe	Kvalitetsmål	Måltall	Hva måler det?
Biopsi	Andel med alvorlige komplikasjoner i forbindelse med biopsitaking (definert som blodtransfusjon eller intervensjon)	<2%	Måler sikkerhet ved biopsitaking
	Andel biopsier med ≥10 glomeruli	90%	Måler kvalitet på selve biopsitakingen
	Andel biopsier endeligbesvart fra patologiavdelingene innen 1 mnd	80%	Måler rutiner og struktur i utredningsapparatet
	Andel primære biopsier med moderate til uttalte kroniske forandringer i biopsien	<30%	Mål på om pasientene utredes tidlig nok i forløpet av sin nyresykdom
CKD5	Andel med blodtrykk under 140/90 mmHg	75 %	Mål på om guidelines og anbefalinger følges
	Andel med fosfat < 1,5 mmol/L	75 %	Mål på om guidelines og anbefalinger følges
	Andel med bikarbonat > 20 mmol/L	75 %	Mål på om guidelines og anbefalinger følges
	Andel med Hgb > 10 g/dL (10-12 hvis ESA)	75 %	Mål på om guidelines og anbefalinger følges
	Gjennomført "Nyreskole" ved start i CKD5 (hvis kjent av nefrolog > 4 mnd.)	75 %	Fange opp at behandlingen for hver enkelt pasient tilpasse den enkelte pasient og er planlagt i god tid.

27-11-2017

Pasientgruppe	Kvalitetsmål	Måltall	Hva måler det?
Dialyse (felles)	Andel kjent >4 mnd før dialyseoppstart	75 %	Fanges pasientene opp av avdelingen? Henvisningspraksis, ressurser og opplæring av primærhelsetjeneste og kollegaer
	Andel i hjemmedialyse (hjemmeHD + PD)	30%	Mål på om individualisert behandling etterstrebes i stort nok omfang
Hemodialyse	Andel med ukentlig Kt/V >2,3 (inkludert restfunksjon)	80 %	Mål på bevissthet og kvalitet av dialysebehandlingen
	Andel pasienter, kjent > 4 mndr, som starter HD på fistel	75 %	Er det en plan for når og hvordan pasientene skal starte? Interne prosedyrer for å planlegge dialyseoppstart
	Andel med predialytisk fosfat < 1,78 mmol/L	75 %	Mål på fokus og behandling av metabolske forstyrrelser og komplikasjoner
Peritonealdialyse	Andel med ukentlig Kt/V >1,7 (inkludert restfunksjon)	80 %?	Mål på bevissthet og kvalitet av dialysebehandlingen
	Antall peritonitter per år	≤ 0.5 /pas.år	Mål på at behandlingen blir utført på tilfredsstillende måte
Transplantasjon	Andel med blodtrykk under 130/80 mmHg	80%	Mål på om guidelines og anbefalinger følges
	Andel som bruker statin	80%	Mål på om guidelines og anbefalinger følges
	Andel med ≥ 4 transplantasjons kontroller per år	80%	Mål på om pasientene blir tatt hånd om på en god nok måte
	Antall aktivt på Tx-venteliste med dialysetid > 2 år (unntatt PRA≥80%)	< 10%	Mål på om behandlingstilbudet er godt nok
	Biopsipåvist akutt rejeksjon første år etter transplantasjon	< 20%	Overordnende mål på om behandlingen er godt nok tilpasset pasientene
	Graftoverlevelse	vs. ScandiTx	Sammenligner overordnede kvalitet på behandlingen i forhold til land som er naturlig å sammenligne med (Norden)