RENINE year report 2016

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Nederlandse Federatie voor Nefrologie

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1. INTRODUCTION

Renine is the Dutch registry which contains data of patients on chronic renal replacement therapy (RRT). This is defined as either a renal transplant or dialysis for a period of at least 28 days. All dialysis centres in the Netherlands provide data to Renine. Data on patients with a transplant are provided by the 'Nederlandse Transplantatie Stichting'(NTS).

In this year report 2016 we present a number of key figures on renal care in the Netherlands. Both a description of the patients population is given as well as some trends over time. In comparison to the previous reports more emphasis is given to variation across centres.

Some changes in procedures were implemented in 2016. A small number of patients refuse permission for their data to be collected in Renine. In the past anonymised data of these patients were included in the database. As this no longer complies with current legislation we changed the procedures and from 1-1-2016 onwards data of these patients are fully omitted from the registry. It should be realized that the data provided in the report concerns the 96% of the patients who did give informed consent for data collection in Renine. The procedural changes might have resulted in slightly different numbers in 2016. However, overall coverage remains very high and the report provides valuable information on trends in renal care in the Netherlands. In addition, dialysis centres provide information on the number of patients in their centre that denied permission so that we are able to provide complete numbers of patients on renal replacement therapy in the Netherlands.

A number of clinical variables are being registered in Renine since 2010. This comprises quarterly data on biochemical variables, dialysis characteristics, and vascular access. Up until 2015 dialyses centres provided this data on a voluntary basis resulting in incomplete data. Since 2016 centres are obliged to supply this data resulting in a distinct improvement in coverage.

Renine is an important tool to monitor parameters related to quality of care of renal replacement therapy in the Netherlands. Together with stakeholders we want to improve the analyses and reporting of the data. The Board of Nefrovisie thanks all of the participating dialysis centres and the NTS for excellent cooperation.

Marc Hemmelder, CEO Nefrovisie

2. RENAL REPLACEMENT THERAPY: KEY FIGURES OF 2016

In 2016 the number of new patients starting renal replacement therapy registered in Renine was 1,905. For most of these patients the initial modality was dialysis. In Table 1 some general and therapy characteristics are shown of the incident patients.

Table 1. Characteristics of incident renal replacement therapy patients in 2016*

Modality at start RRT, at day 1	**N**	**%****
Haemodialysis	1,341	70
Peritoneal dialysis	290	15
Transplant	274	14
Primary kidney disease	**N**	**%****
Glomerulonephritis/sclerosis	179	9
Pyelonephritis	69	4
Polycystic kidney disease	109	6
Hypertension	227	12
Renal vascular disease	222	12
Diabetes type 1	50	3
Diabetes type 2	318	17
Other	356	19
Unknown	375	20
	Means (SD)	
Age (year)		
Dialysis patients	65.7 (14.7)	
Transplant patients	51.5 (16.4)	

*110 patients incident RRT did not provide consent for their data to be included in Renine. **The percentages do not add up to 100% due to rounding

There were 17,132 prevalent renal replacement therapy registered on December 31th 2016 (Table 2).

Table 2. Characteristics of prevalent renal replacement therapy patients (December 31th 2016)*

Modality	**N**	**%**
Haemodialysis	5,450	32
Peritoneal dialysis	870	5
Transplant	10,812	63
Primary kidney disease	**N**	**%**
Glomerulonephritis/sclerosis	2,863	17
Pyelonephritis	1,186	7
Polycystic kidney disease	1,500	9
Hypertension	1,957	11
Renal vascular disease	1,073	6
Diabetes type 1	655	4
Diabetes type 2	1,579	9
Other	3,410	20
Unknown	2,950	17
	Means (SD)	
Age (year)		
Dialysis patients	67 (15)	
Transplant patients	56 (15)	
Duration renal replacement therapy (year)		
Dialysis patients	4.7 (6.2)	
Transplant patients	12.6 (9.4)	

*244 prevalent RRT patients did not provide consent for their data to be included in Renine. **The percentages do not add up to 100% due to rounding

3. RENAL REPLACEMENT THERAPY: INCIDENCE AND PREVALENCE

Over the last decades the number of prevalent patients on renal replacement therapy steadily increased and this rise sustained in 2016 (Figure 3.1.). On December 31th 2016 17,132 patients were on renal replacement therapy (RRT). This equals 1,003 patients per million population (pmp) inhabitants of the Netherlands (Figure 3.2.).

However, incidence of new patients on renal replacement therapy has been quite stable over the last years. In 2016 1,905 new RRT patients were registered in Renine. This is a drop of 7% compared to 2015. The incidence per million inhabitants was 112. However, 110 incident dialysis patients were not included as they did not provide consent for their data to be registered in Renine. Taking this into account the incidence remained stable.

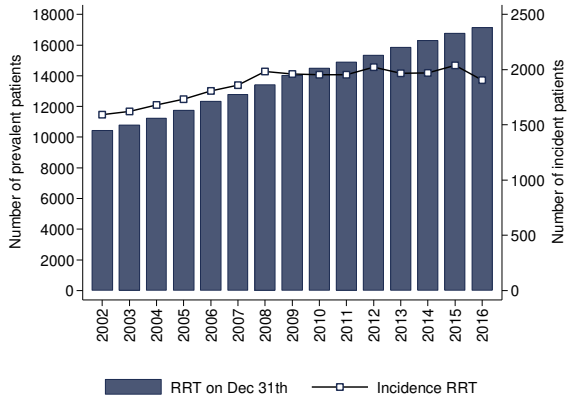


Figure 3.1. Prevalence and incidence of renal replacement therapy

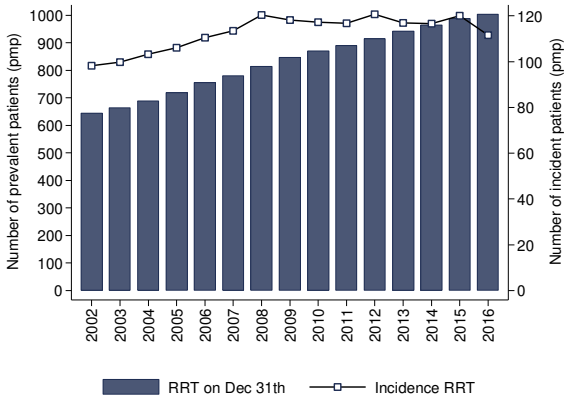


Figure 3.2. Prevalence and incidence of renal replacement therapy expressed per million population

The patients were categorized into five age categories. Age specific prevalence and incidences of renal replacement therapy per million age related population are shown in Figure 3.3. In 2016 the prevalence per million age-related population (pmarp) was with 2,373 patients per million highest in the age category 75 years and older. Prevalence of RRT in this age group seems to have reached a plateau level. Prevalence in patients aged 65-74 years is also high and the number of patients in this age category is still growing.

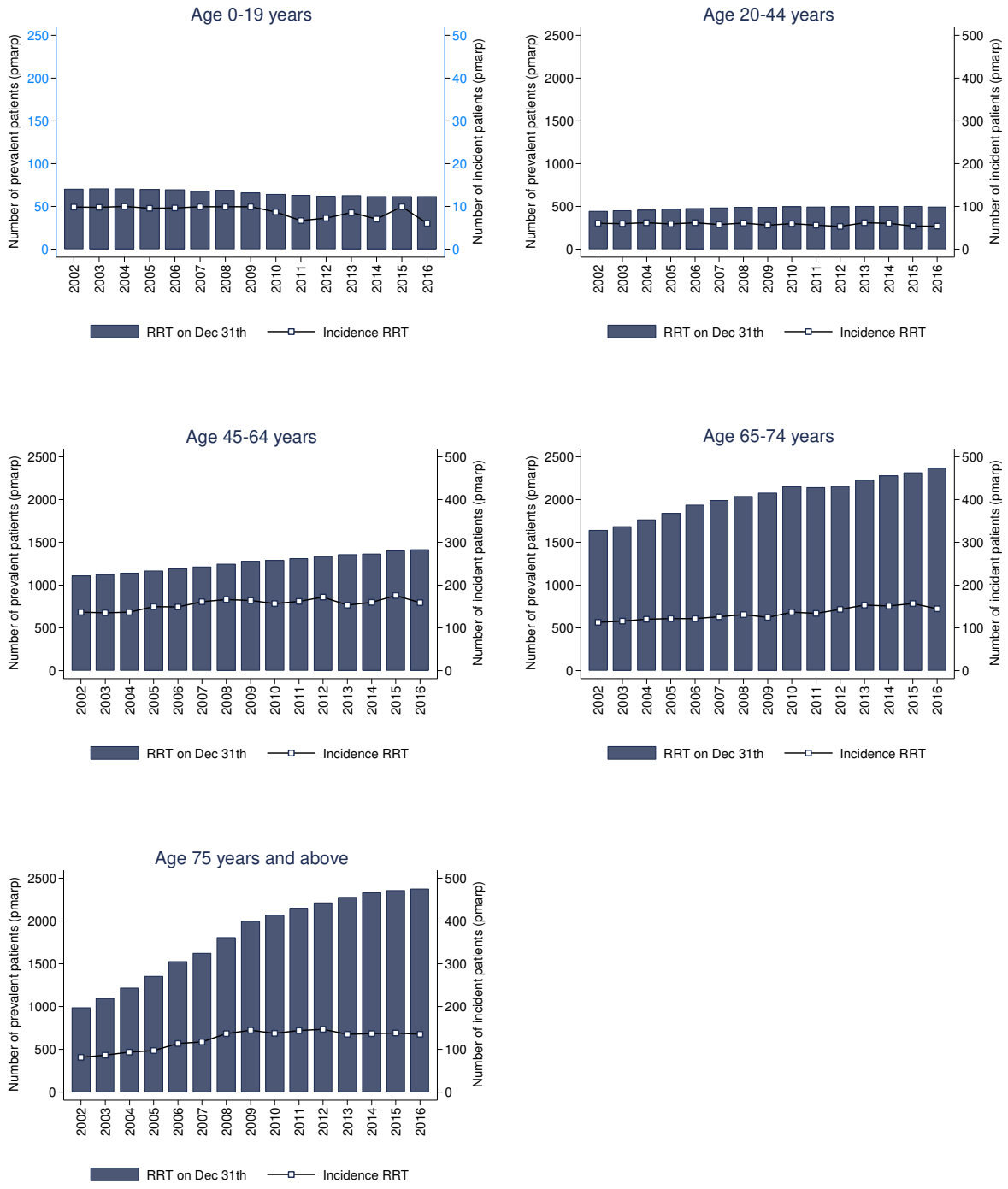
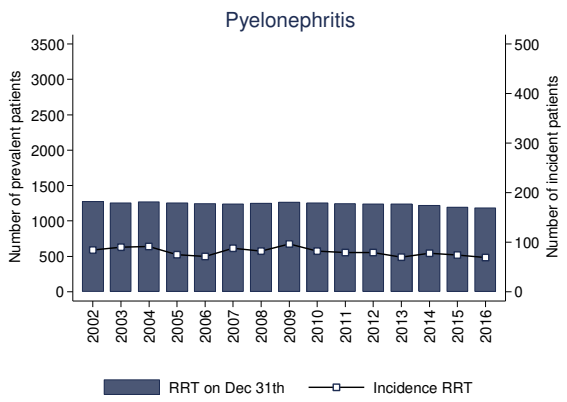
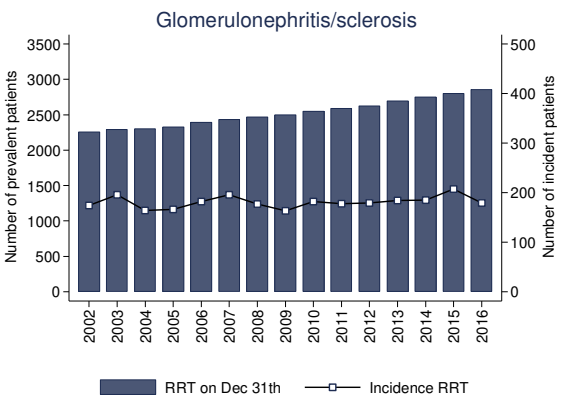
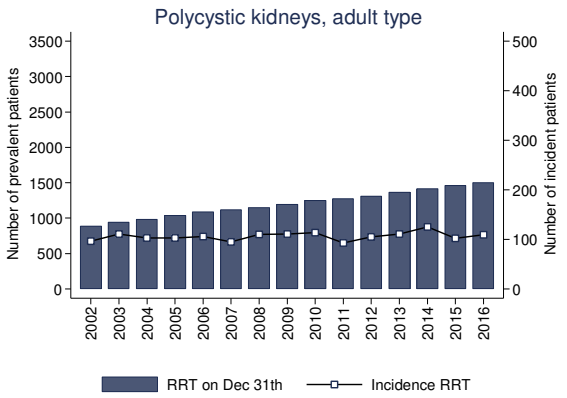


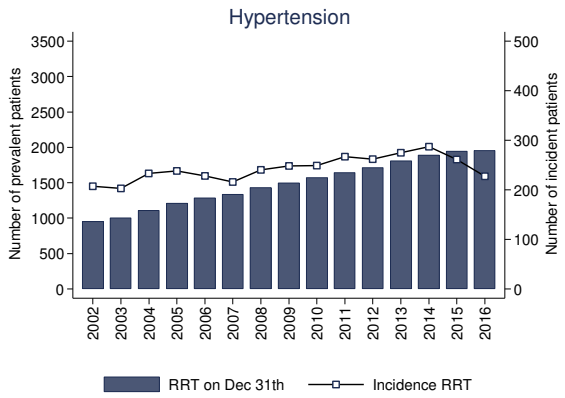
Figure 3.3. Age specific incidence and prevalence of renal replacement therapy. Numbers are expressed per million age-related population (pmarp). The y-axis of the youngest age category has been adjusted to 10% to improve readability.

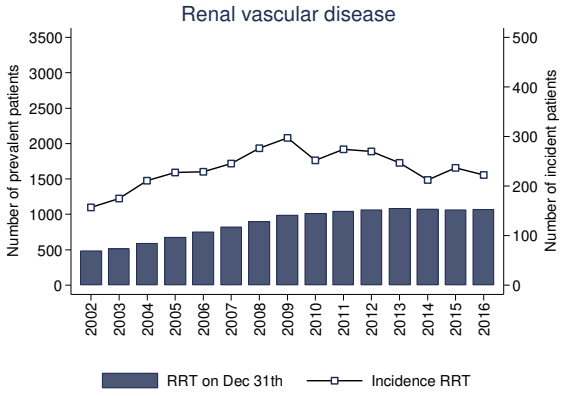
The primary kidney diseases were categorized in nine categories according to the ERA-EDTA categorization. In Appendix B an overview is given of these categories and the specific primary kidney diseases included in the categories. Figure 3.4. shows incidences and prevalences for the separate categories. The categories “miscellaneous” and “unknown” contribute most to RRT prevalence. Prevalence with hypertension, diabetes type 2 and miscellaneous is growing. However, incidence is stable.

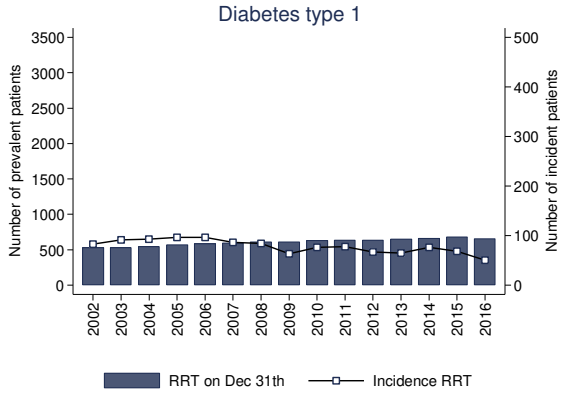

Pyelonephritis
Number of prevalent patients
Number of incident patients
RRT on Dec 31th
Incidence RRT


Glomerulonephritis/sclerosis
Number of prevalent patients
Number of incident patients
RRT on Dec 31th
Incidence RRT


Polycystic kidneys, adult type
Number of prevalent patients
Number of incident patients
RRT on Dec 31th
Incidence RRT


Hypertension
Number of prevalent patients
Number of incident patients
RRT on Dec 31th
Incidence RRT


Renal vascular disease
Number of prevalent patients
Number of incident patients
RRT on Dec 31th
Incidence RRT


Diabetes type 1
Number of prevalent patients
Number of incident patients
RRT on Dec 31th
Incidence RRT

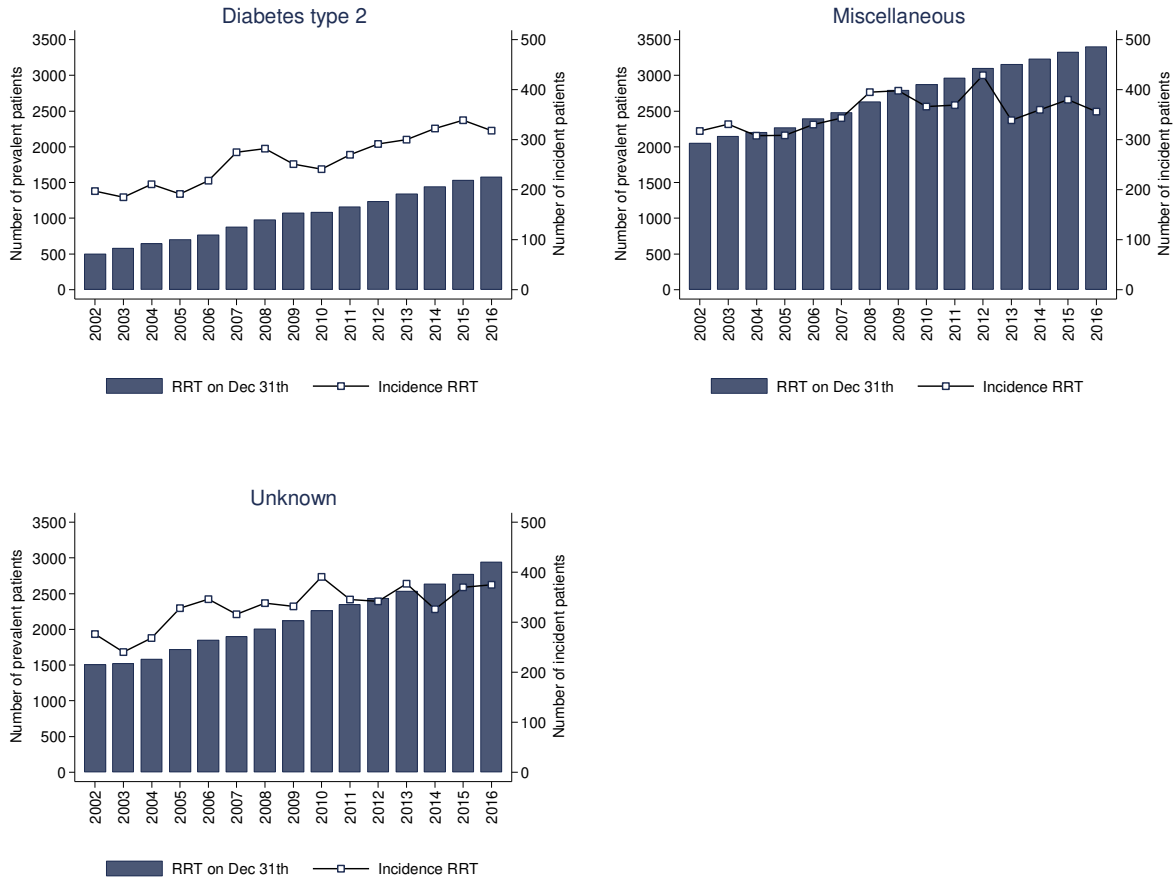


Figure 3.4. Incidence and prevalence of renal replacement therapy stratified for primary kidney disease categories.

4. DIALYSIS AND RENAL TRANSPLANTS; INCIDENCE AND PREVALENCE

The majority of prevalent renal replacement therapy patients receive treatment by a renal transplant. On December 31th 2016 this percentage was 63%. In patients aged 75 years or older the percentage living with a functioning renal transplant is lowest (i.e. 25%). In the youngest age category almost all patients (91%) were treated with a transplant.

Since 2009 overall prevalence of dialysis remained stable (Figure 4.1.). However, the age distribution of dialysis patients changed substantially over time with increasing numbers of elderly patients. In 2016 37% of all dialysis patients was 75 years or older. Prevalence of renal transplants is still increasing (Figure 4.2.). On December 31th 2016 almost half of the transplant patients (47%) was aged 45-64 years.

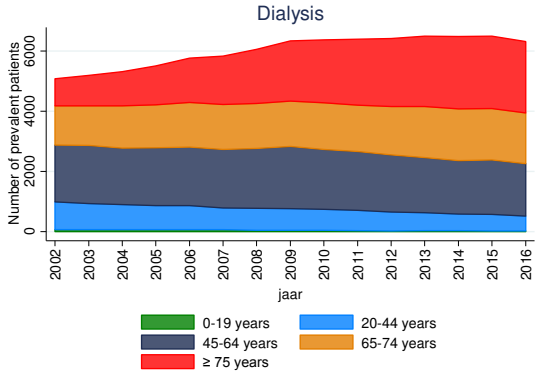


Figure 4.1. Prevalence of dialysis on December 31th.

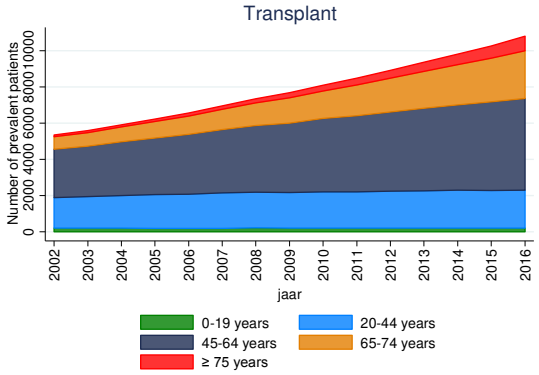


Figure 4.2. Prevalence of renal transplant on December 31th.

In 2016 1,656 patients started chronic dialysis treatment for the first time, which is marginally lower than in the previous years (Figure 4.3). Chronic dialysis therapy was furthermore initiated in 208 patients who already received chronic dialysis in the past. In total, 962 renal transplantations were performed in 2016 (Figure 4.4.).

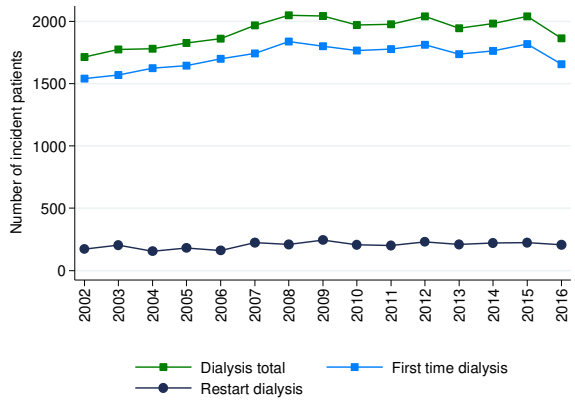


Figure 4.3. Incidence of dialysis per calendar year. A distinction was made between patients receiving chronic dialysis for the first time or in patients with chronic dialysis treatment in their history (e.g. restart after graft failure).

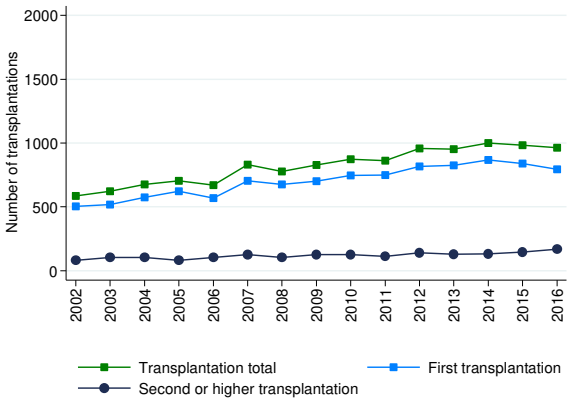


Figure 4.4. Transplantations per calendar year. A distinction was made between first transplantations and transplantations in patients with previous kidney transplantation(s).

The incidence of first-time dialysis is shown stratified for age categories in Figure 4.5. In the past the incidence in the three oldest categories steadily increased but in all three categories the incidence stabilized in recent years. Incidence is comparable in the age categories 45-64 years and older. A decreasing trend is observed in the age category 20-44 years. The number of transplants is highest in patients 45-64 years (Figure 4.6). Over time this number continuously increased, but in the last few years the number has been stable. Also the increase in number of transplants in the age category 65-74 years seems to have become stable.

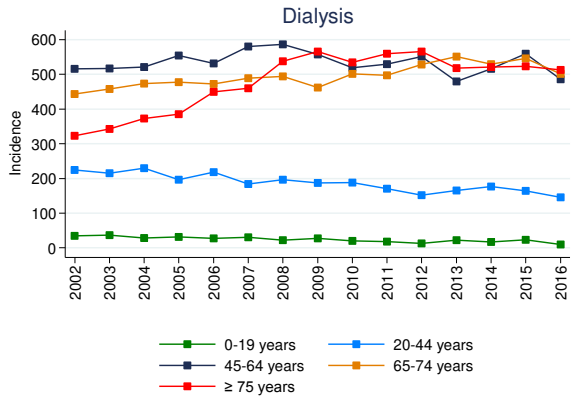


Figure 4.5. Incidence of first-time dialysis treatment in age categories.

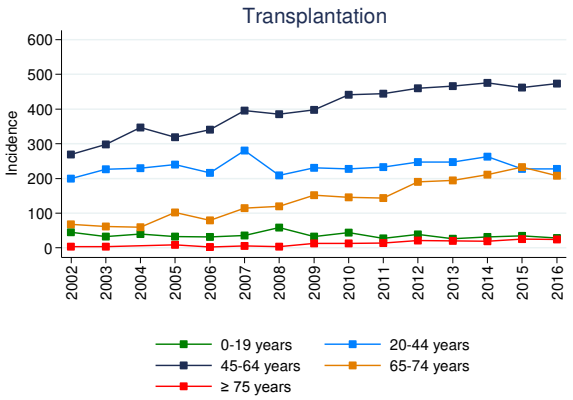


Figure 4.6. Number of renal transplantation in age categories

5. DIALYSIS MODALITIES

The majority of dialysis patients are being treated with haemodialysis. In 2016 only 14% of prevalent dialysis patients were on peritoneal dialysis. In the past this percentage gradually decreased over time. However, since 2014 this proportion remained constant. Of the patients starting first-time dialysis about 18% started on peritoneal dialysis in 2016. This percentage did not vary substantially in recent years.

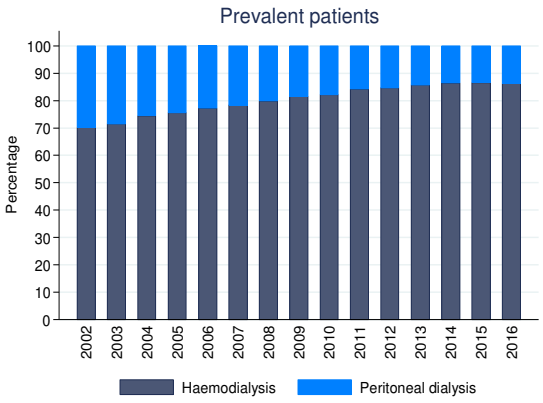


Figure 5.1. Distribution of haemodialysis and peritoneal dialysis in prevalent chronic dialysis patients. (Date: December 31th of each year).

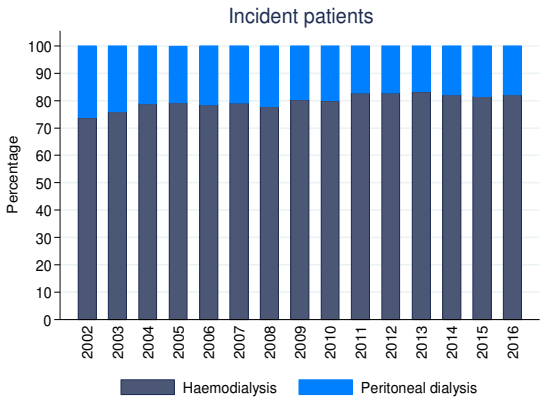


Figure 5.2. Distribution of haemodialysis and peritoneal dialysis in incident chronic dialysis patients per year.

Figures 5.3 and 5.4. show the absolute number prevalent and incident patients on peritoneal dialysis stratified for age categories.

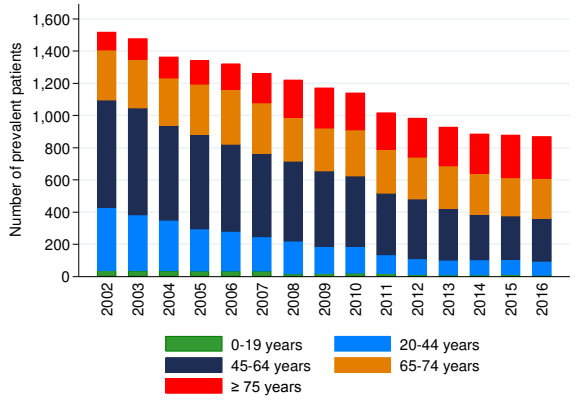


Figure 5.3. Number of prevalent peritoneal dialysis patients in age categories (December 31th)

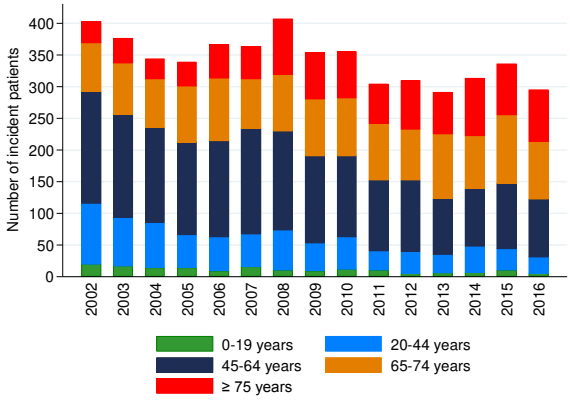


Figure 5.4. Number of incident peritoneal dialysis patients per year in age categories

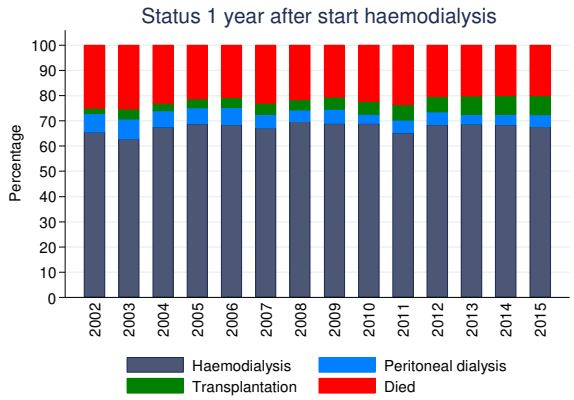


Figure 5.5. Status one year after start HD as percentage. The year represents the year in which HD was started.

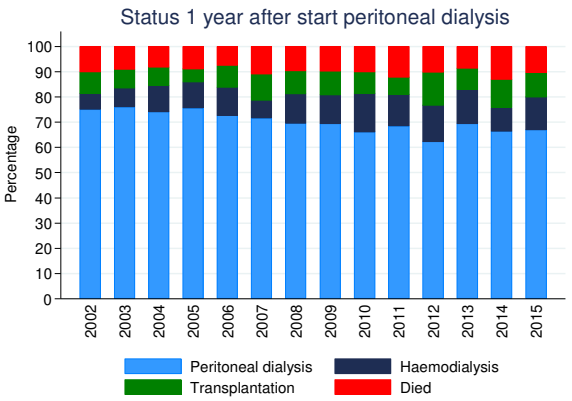


Figure 5.6. Status one year after start PD as percentage. The year represents the year in which PD was started.

Figure 5.5. and 5.6. show the status of patients one year after they started either haemodialysis or peritoneal dialysis as their first RRT modality. Mortality is higher and transplantation rate is lower in haemodialysis compared to peritoneal dialysis, possibly due to differences in case-mix. More patients switch from peritoneal to haemodialysis in the first year. Of the patients starting haemodialysis in 2015 after 1 year 72% of these were still treated with haemodialysis, 4% switched to peritoneal dialysis, 6% received a transplant and 18% died. In peritoneal dialysis the percentages that switched to either haemodialysis or received a transplant were somewhat higher, i.e. 11% switched to haemodialysis and 11% of these patients had a functioning transplant one year after they started peritoneal dialysis. Mortality was 11% one year after start of peritoneal dialysis.

6. HOME DIALYSIS

Home dialysis includes both home haemodialysis and peritoneal dialysis. On December 31th 2016 1,163 patients were on home dialysis, which represents 18% of prevalent dialysis patients (Figure 6.1 and 6.2.). Prevalence of home dialysis decreased over time but shows a slight increase again in the last few years which can be attributed to an increase in home haemodialysis (Figure 6.1).

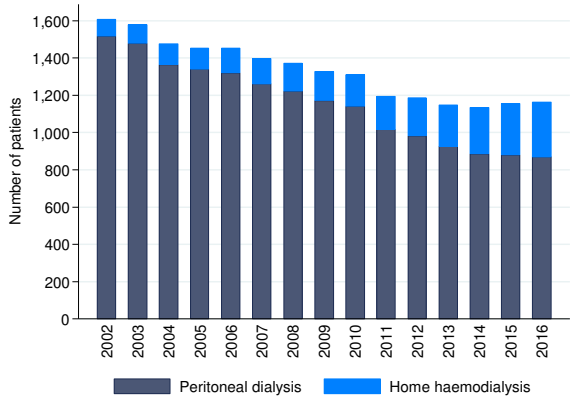


Figure 6.1. Number of prevalent home dialysis patients (peritoneal dialysis and home haemodialysis) at December 31th of each year.

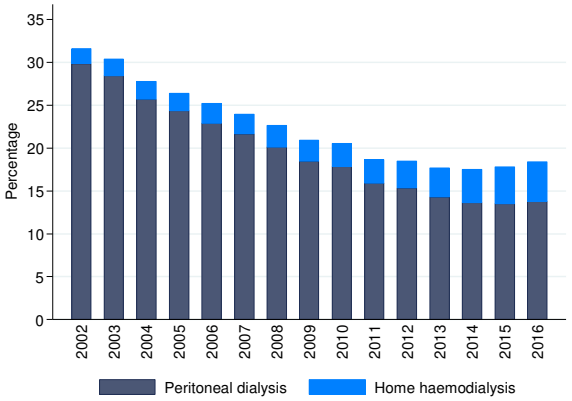


Figure 6.2. Home dialysis (peritoneal dialysis and home haemodialysis) as percentage of total dialysis in prevalent patient

In 2016 98 patients started home haemodialysis (figure 6.3. Age at which patients start of home haemodialysis patients shows an increased over time (figure 6.4.). In 2016 the mean age was 62 years.

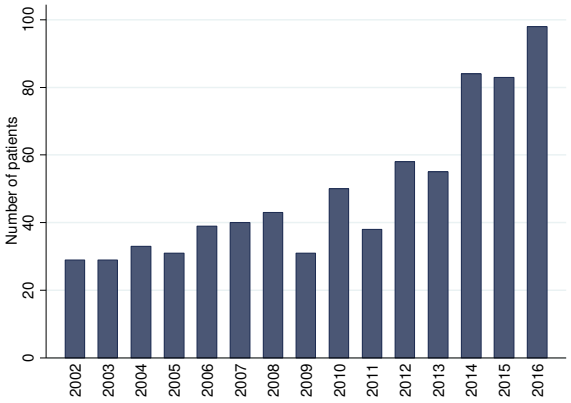


Figure 6.3. Number of patients starting home haemodialysis.

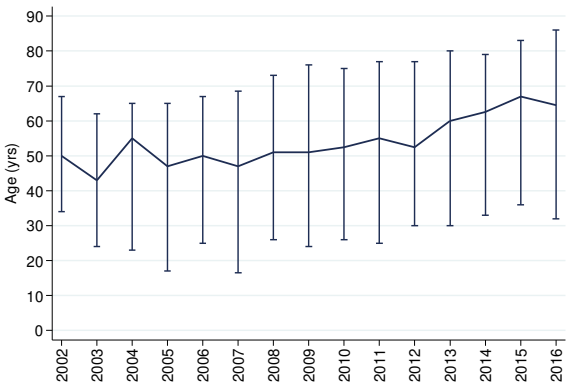


Figure 6.4. Median age of patients starting home haemodialysis. The error bars represents the 5-95th percentiles.

Figure 6.5. shows home dialysis in different age categories as percentages of total dialysis. These figures show in adult patients either stabilization of this percentage over the last few years or a small increase (i.e. in patients >75 years).

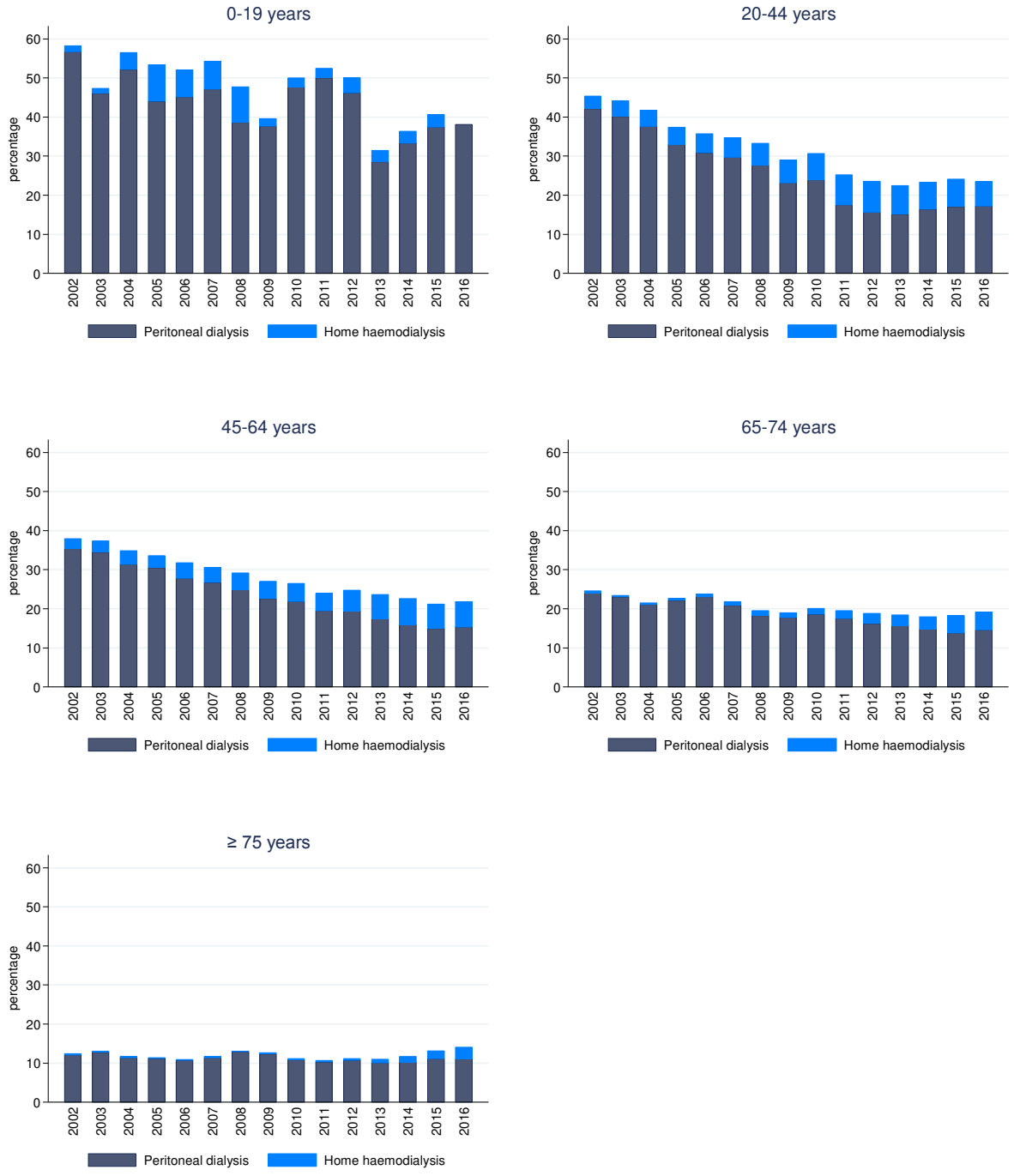


Figure 6.5. Home dialysis (peritoneal dialysis and home haemodialysis) as percentage of total dialysis in prevalent patients stratified for age categories.

The proportion of patients being treated with home dialysis shows substantial variation among centres. In Figure 6.6. a funnel plot shows the percentage of home dialysis of the total patients on dialysis treatment plotted against the total number of dialysis patients. The plot is adjusted for case-mix (age, sex, and primary kidney disease).

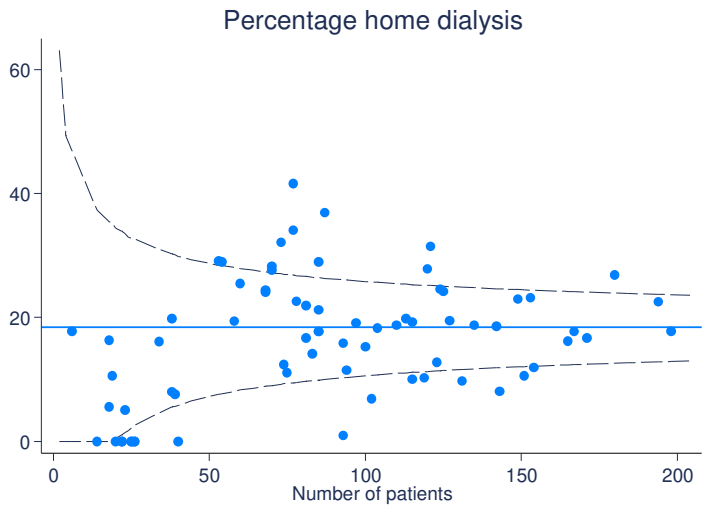


Figure 6.6. Funnel plot showing centre variation in percentage home dialysis compared to total dialysis. Home dialysis includes peritoneal dialysis and home haemodialysis. Data is adjusted for age, sex, and primary kidney disease categories.

7. RENAL TRANSPLANTATIONS

Prevalence of renal transplants, separately for patients with and without a history of dialysis, is shown in figure 7.1. The proportion of transplant patients without previous dialysis increased substantially over time (Figure 7.2.). Figures 7.3. and 7.4. show the same data for prevalent patients with a kidney from a deceased or a living donor. The percentage living donor showed a steep increase over time and this percentage reached 50% in 2016.

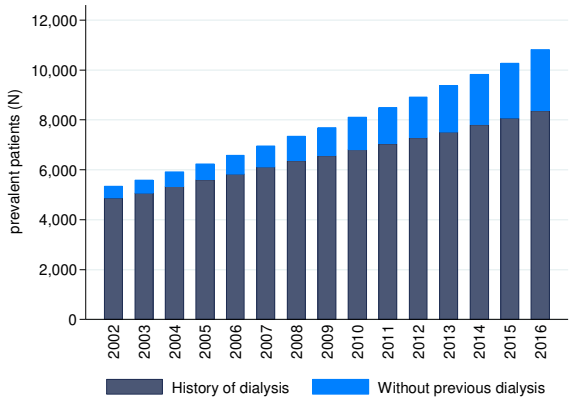


Figure 7.1. Number of prevalent transplant patients divided according to dialysis history.

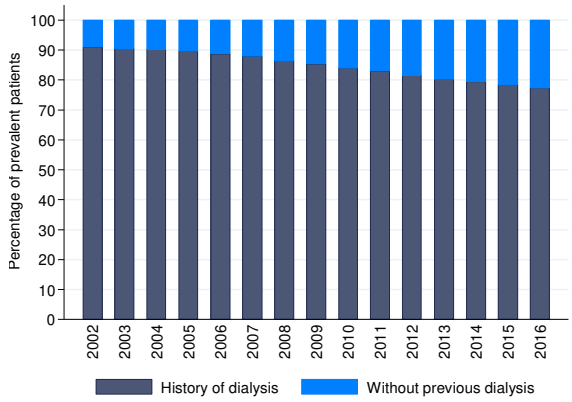


Figure 7.2. Percentage of prevalent transplant patients with and without a history of dialysis.

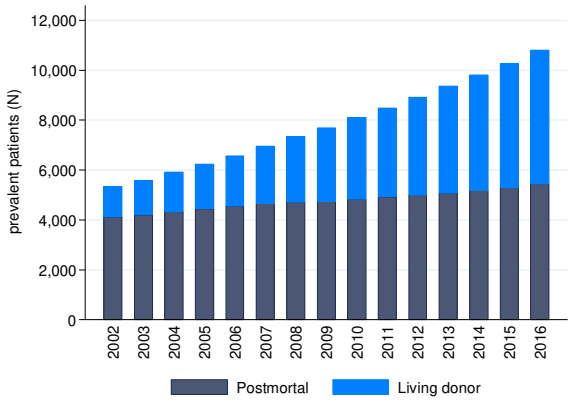


Figure 7.3. Number of prevalent transplant patients according to donor type.

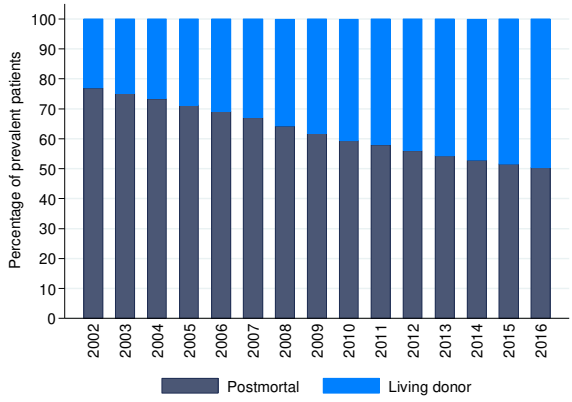


Figure 7.4. Distribution of prevalent transplant patients according to donor type.

Figure 7.5. shows the distribution of prevalent transplant patients in 2016 grouped into four categories (living/post mortal and with or without previous dialysis). This distribution differs over age categories.

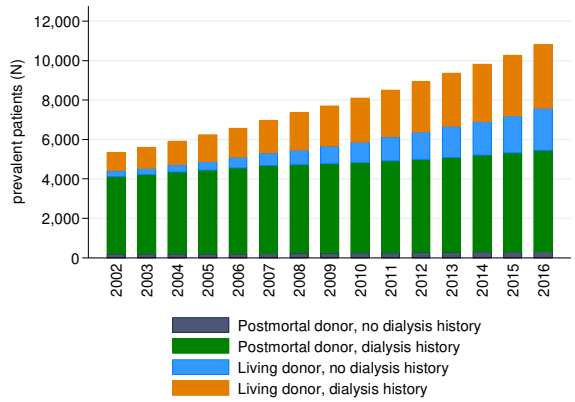


Figure 7.5. Number of prevalent dialysis patients according to type of transplant .

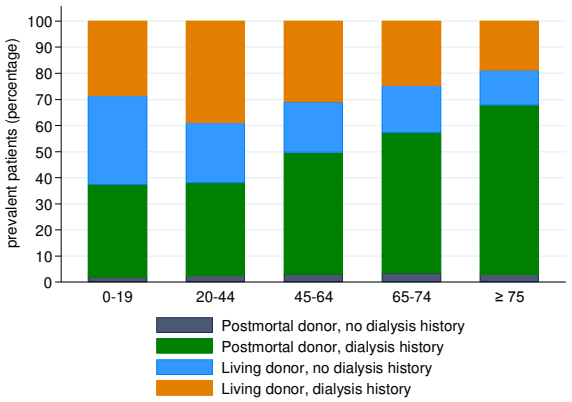


Figure 7.6. Distribution of transplant types in age categories in transplant patients (December 31th 2016).

In 2016, 962 renal transplantations were registered in Renine. Over the years, more living donor transplantations in patients without a history of dialysis treatment have been performed (Figure 7.7.). In young patients the majority of transplantations in 2016 were with living donor kidneys (Figure 7.8).

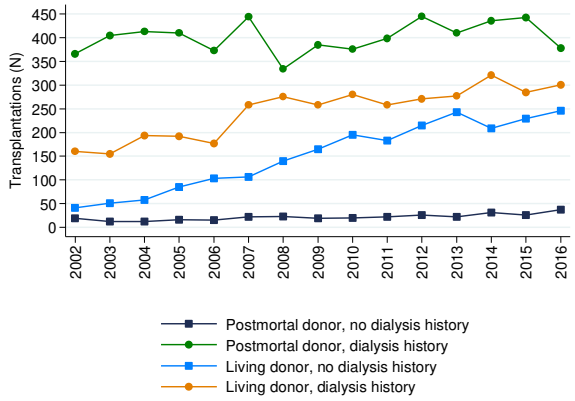


Figure 7.7. Number of different types of renal transplantations over time.

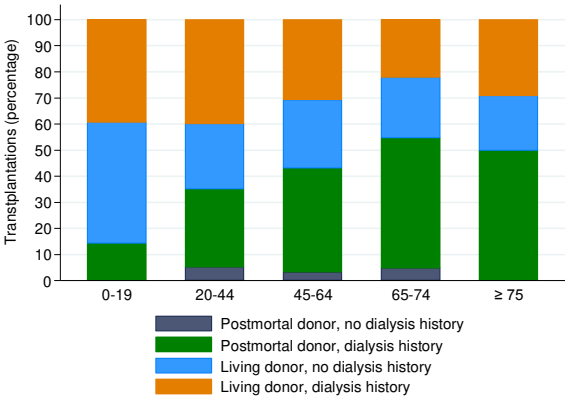


Figure 7.8. Distribution of different types of renal transplantations in age categories in the year 2016.

8. MORTALITY ON DIALYSIS

In 2016 1,335 patients died on renal replacement therapy. The majority of the deaths (n=1,130, 85%) were patients on dialysis therapy. Five-years survival from start of dialysis treatment varies from 90% in patients of 18-44 year to 60% for patients 45-64 years. Over the years survival on dialysis improved as is shown in Figure 8.1. The improvement is most obvious in the age categories older than 65 years. This is striking considering the higher prevalence of comorbidities over the years. Unfortunately, adjustment for comorbidities is not possible as this is not registered in Renine. The survival curves were adjusted for age, sex and primary kidney disease categories.

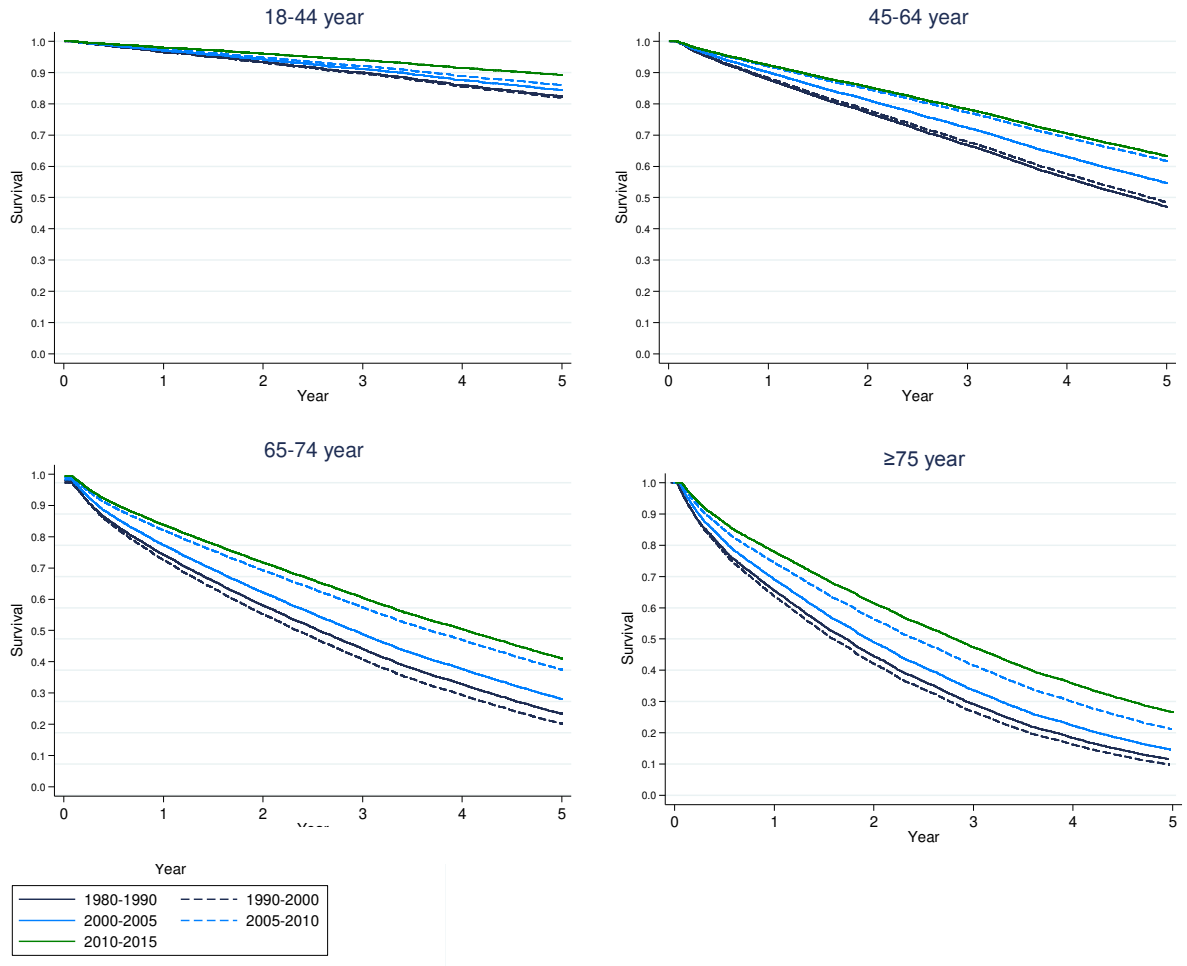


Figure 8.1. Survival curves for patients starting dialysis as first RRT modality in different cohorts, stratified for age categories. The curves were adjusted for age, sex, and categories of primary kidney disease.

Causes of death were categorized according to the categorization as applied by the UKRR (Appendix C). In Figure 8.2 and 8.3. absolute and relative numbers of causes of death are shown for patients who died on dialysis therapy. Since four years 'treatment stop' is the most dominant cause of death. In Figure 8.4. causes of death of patients on dialysis is shown stratified for age below or above 65 years. 'Treatment stop' is more common in elderly patients, whilst cerebrovascular accidents and malignancies are less often recorded as cause of death.

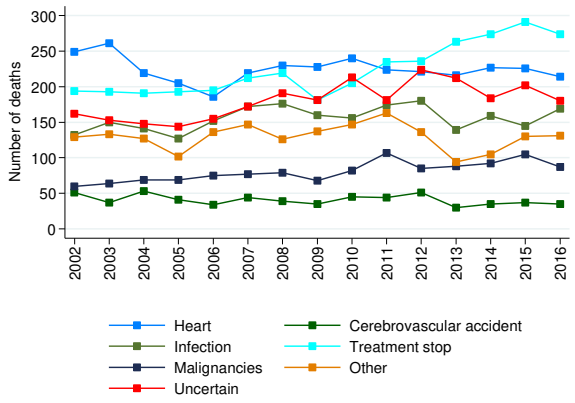


Figure 8.2. Causes of death over time.

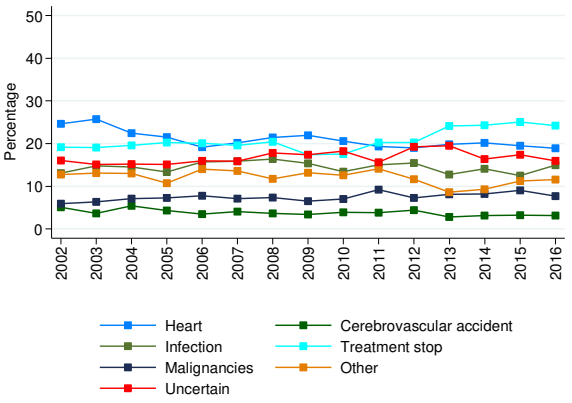


Figure 8.3. Causes of death expressed as percentage of total over time.

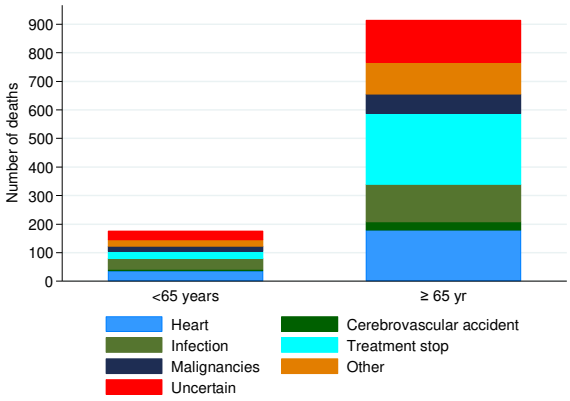


Figure 8.4. Absolute numbers of causes of death stratified for patients below or above 65 years.

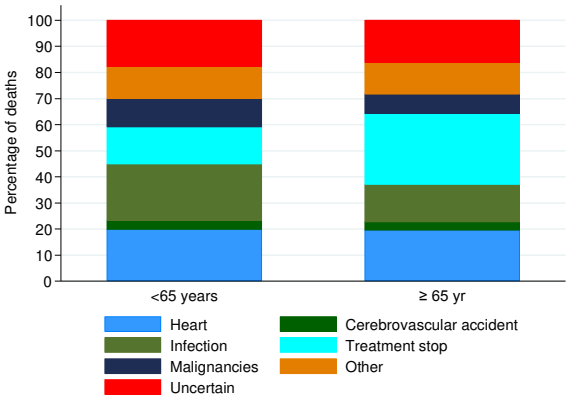


Figure 8.5. Causes of death stratified for patients below or above 65 years expressed as percentages of total.

9. CLINICAL VARIABLES

Since 2016 registration of clinical variables is an obligatory component of the Renine registry. This resulted in a substantial higher availability of data as can be seen in Figures 9.1. and Figure 9.2. However, ample room for improvement remains as data collection is still far from complete. Centres are requested to provide individual patient data four times per calendar year.

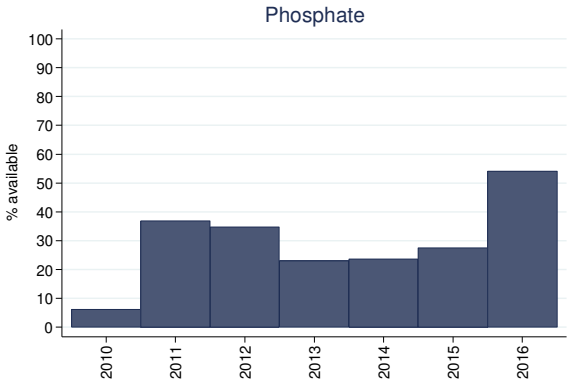


Figure 9.1. Availability of phosphate measurements expressed as percentage of the total number of potential measurements.

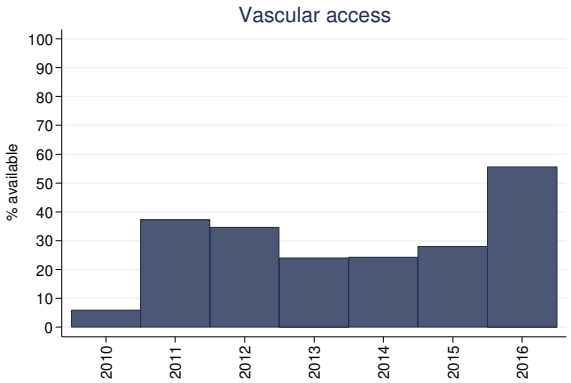


Figure 9.2. Availability of vascular access data expressed as percentage of the total number of potential measurements.

Figure 9.3. shows categories of a number of clinical indicators stratified for age categories. Substantial variation in observed mean values is observed across different centres as is shown in the funnel plots (Figure 9.4). Adjustments were performed for differences in case-mix (age, sex, and primary kidney disease categories).

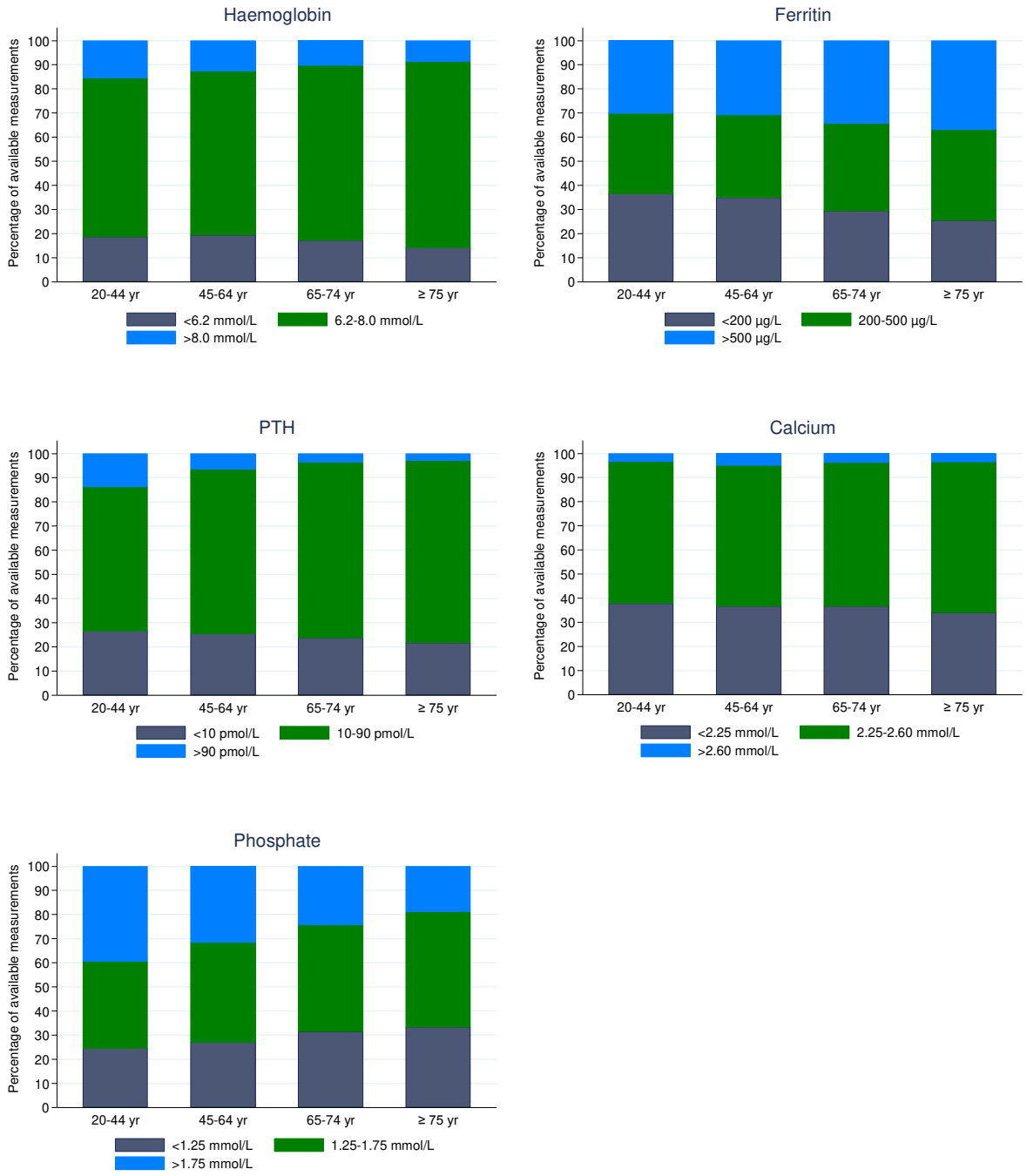


Figure 9.3. Categories of clinical variables stratified for age categories

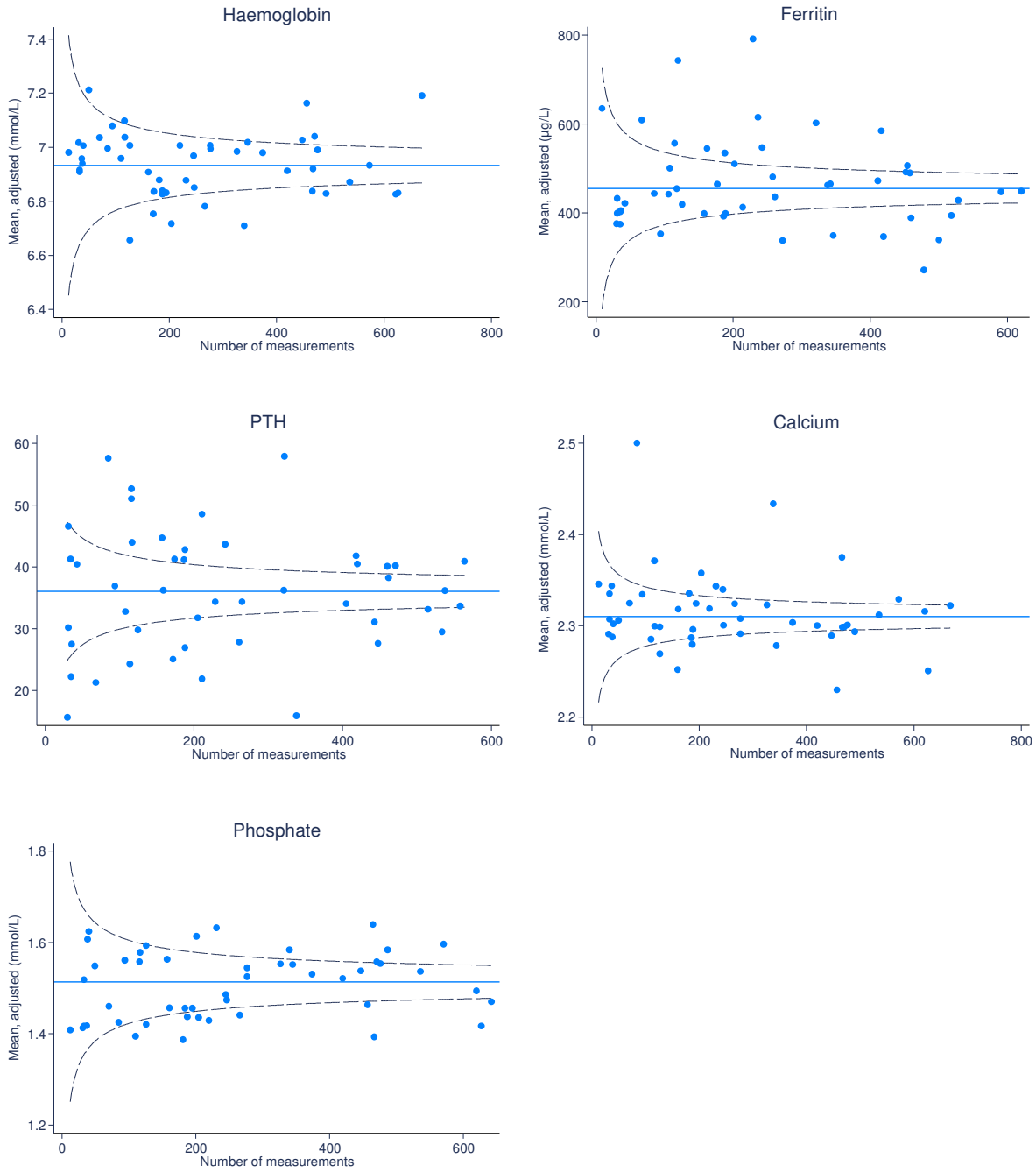


Figure 9.4. Funnel plots showing centre variation of mean values of clinical variables. The funnels were adjusted for differences in case-mix (age, gender, and PRD categories).

Figure 9.5. shows the distribution of different types of vascular access for prevalent haemodialysis patients. At start of haemodialysis (Figure 9.6.) vascular access is more often by catheter.

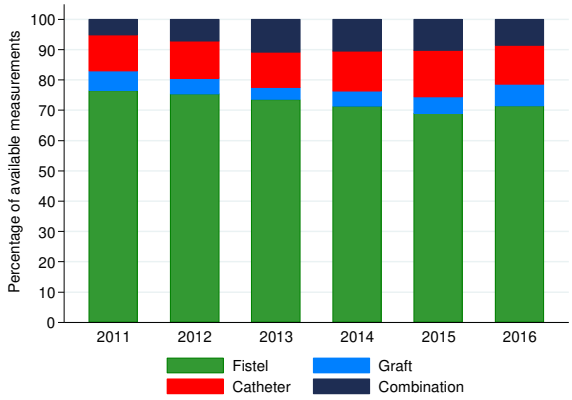


Figure 9.5. Distribution over types of vascular access. All available data.

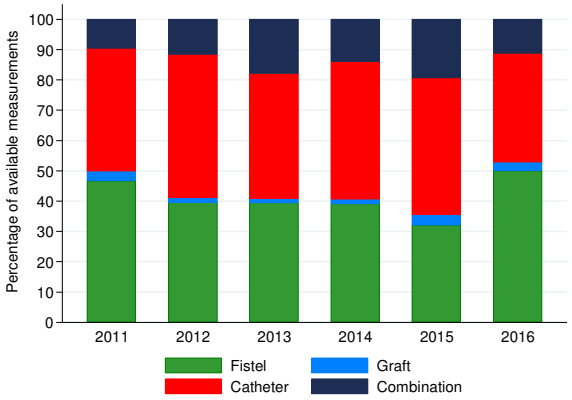


Figure 9.6. Distribution over types of vascular access at start of haemodialysis.

Also for vascular access considerable centre variation is observed (Figure 9.7.). The funnel is adjusted for differences in case-mix.

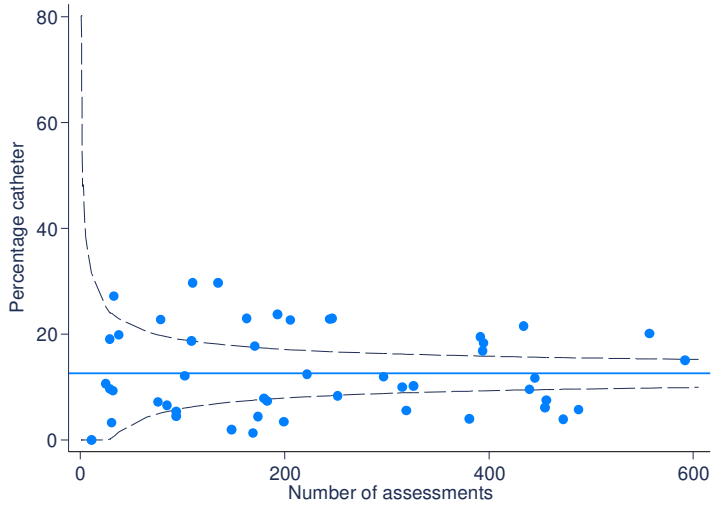


Figure 9.7. Funnel plot showing centre variation in percentage catheter. Data is adjusted for age, sex, and primary kidney disease categories.

10. CONCLUSIONS

In this 2016 report, Nefrovisie provides in collaboration with NfN an almost complete coverage (>96%) of RRT in the Netherlands. The number of prevalent patients on RRT is still increasing due to increased prevalence of renal transplantation. However, incidence of RRT is stable. Some shifts in treatment modalities over time are being observed. The dialysis population is ageing. Younger patients are predominantly being transplanted with a distinct increase in especially living donor transplants. In elderly patients an increase in especially home haemodialysis could be observed.

Starting from 2016 dialyses centres are obliged to provide a number of clinical indicators four times per year for every dialysis patient registered in Renine. In comparison to previous years we observed a substantial increase in availability of clinical data, although the percentage of coverage of clinical data is just above 50%. There is need for improvement. For the available clinical indicators considerable variation exists over the centres.

Another important observation is the improvement over time in survival on dialysis treatment, which is especially observed for older patient groups. This is remarkable regarding the known increase in the comorbidity burden of the dialysis population. These results were adjusted for some case-mix factors, but unfortunately no information is yet available on the presence of comorbidities.

APPENDIX A. METHODS AND DEFINITIONS

Incidence
An incident population is defined as the population starting renal replacement therapy or a specific treatment modality in a calendar year. Unless otherwise stated this only includes first-time start of renal replacement therapy or a specific dialysis treatment modality.

Prevalence
Prevalence is defined as the population on renal replacement therapy or a specific treatment modality on December 31th of a calendar year.

Per million population (pmp)
The incidence or prevalence pmp is the observed incident or prevalent count divided by the general population in that year and multiplies by one million.

Per million age-related population (pmarp)
The incidence or prevalence pmarp is the observed incident or prevalent count for a specific age group divided by the general population of that age group and multiplied by one million.

Coding
Renal diseases and causes of death were defined according to the ERA-EDTA coding systems and classified into groups. See Appendix B and C for details.

Survival analysis
Cox regression was used to estimate (adjusted) survival curves for dialysis treatment as first renal replacement therapy in different cohorts. Subject were censored in case of a renal transplantation, recovery of renal function, loss to follow-up or end of follow-up time (December 31th 2016). Survival was analysed from day 1 of chronic dialysis treatment. Analyses were stratified for age categories. Because of low numbers patients younger than 18 years were excluded from this analysis. The survival curves were adjusted for fixed values of age (30 yr for the age category 18-44 years; 55 yr (45-64 years); 70 yr (65-74 years) and 80 yr (age category ≥75 years), sex (63% men) and primary kidney disease categories (24% Diabetes; 19% Hypertension/renal vascular disease; 11% Glomerulonephritis; 46% Other causes).

Funnel plots
Centre variations in the year 2016 are presented by funnel plots. In these plots a centre-specific mean or percentage is plotted against a variable indicating centre size. For binary and continuous outcomes 95%-confidence intervals were plotted based on the binomial and normal distribution respectively. Funnels are plotted around the average estimate over all centres. Any centres which fall outside the 95%-confidence intervals of the funnels are significantly different from the average. The funnel shape of the limits reflects the fact that for smaller centres a greater observed difference from the average is required for it to be statistically significantly different. To account for differences in case-mix a number of adjustments were performed by indirect standardization. For binary outcomes a logistic model with age, sex, and primary kidney disease as independent variables was used to derive a probability of the event for every individual patient. These probabilities were summed over the patients within a centre to give an expected number of events (E). A standardized percentage is calculated by multiplying the ratio of observed and expected events (O/E) by the overall percentage over all centres. For continuous outcomes expected outcomes were estimated using linear regression models. An adjusted mean was calculated by adding the difference between the observed and expected mean (O-E) to the overall mean value.

APPENDIX B. CATEGORIES OF PRIMARY KIDNEY DISEASE

Category	ERA-EDTA code	Primary renal disease
Glomerulonephritis/sclerosis	10	Glomerulonephritis, histologically NOT examined
	11	Severe nephrotic syndrome with focal sclerosis (paediatric patients only)
	12	IgA nephropathy (proven by immunofluorescence, not code 85)
	13	Dense deposit disease membrano-proliferative GN, type II (proven by immunofluorescence and/or electron microscopy)
	14	Membranous nephropathy
	15	Membrano-proliferative GN, type I (proven by immunofluorescence and/orelectron microscopy - not code 84 or 89)
	16	Rapidly progressive GN without systemic disease (crescentic, histologically confirmed, not coded elsewhere)
	19	Glomerulonephritis, histologically examined
	17	Focal segmental glomerusclerosis with nephrotic syndrome in adults
Pyelonephritis	20	Pyelonephritis/Interstitial nephritis-cause not specified
	21	Pyelonephritis/Interstitial nephritis associated with neurogenic bladder
	22	Pyelonephritis/Interstitial nephritis due to congenital obstructive uropathy with or without vesico-ureteric reflux
	23	Pyelonephritis/Interstitial nephritis due to acquired obstructive uropathy
	24	Pyelonephritis/Interstitial nephritis due to vesico-ureteric reflux without obstruction
	25	Pyelonephritis/Interstitial nephritis due to urolithiasis
	29	Pyelonephritis/Interstitial nephritis due to other cause
Polycystic kidneys, adult type	41	Polycystic kidneys, adult type (dominant)
Hypertension	71	Renal vascular disease due to malignant hypertension (NO primary renal disease)
	72	Renal vascular disease due to hypertension (NO primary renal disease)
Renal vascular disease	70	Renal vascular disease-type unspecified
	79	Renal vascular disease-classified
Diabetes, type 1	80	Type I Diabetes Mellitus
Diabetes, type 2	81	Type II Diabetes Mellitus
Miscellaneous	30	Tubulo interstitial nephritis (not pyelonephritis)
	31	Nephropathy due to analgesic drugs
	32	Nephropathy due to cis-platinum
	33	Nephropathy due to cyclosporin A
	39	Nephropathy caused by other specific drug
	40	Cystic kidney disease-type unspecified

Category	ERA-EDTA code	Primary renal disease
	42	Polycystic kidneys, infantile (recessive)
	43	Medullary cystic disease, including nephronophthisis
	49	Cystic kidney disease-other specified type
	50	Hereditary/Familial nephropathy-type unspecified
	51	Hereditary nephritis with nerve deafness (Alport's Syndrome)
	52	Cystinosis
	53	Primary oxalosis
	54	Fabry's disease
	59	Hereditary nephropathy-other
	60	Congenital renal hypoplasia-type unspecified
	61	Oligomeganephronic hypoplasia
	63	Congenital renal dysplasia with or without urinary tract malformation
	66	Syndrome of agenesis of abdominal muscles (Prune Belly Syndrome)
	73	Renal vascular disease due to polyarteritis
	74	Wegener's granulomatosis
	82	Myelomatosis/light chain deposit disease
	83	Amyloid
	84	Lupus erythematosus
	85	Henoch-Schoenlein purpura
	86	Goodpasture's Syndrome
	87	Systemic sclerosis (scleroderma)
	88	Haemolytic Uraemic Syndrome including Moschcowitz Syndrome
	89	Multi-system disease-other
	90	Cortical or tubular necrosis
	91	Tuberculosis
	92	Gout
	93	Nephrocalcinosis and hypercalcaemic nephropathy
	94	Balkan nephropathy
	95	Kidney tumour
	96	Traumatic or surgical loss of kidney
	99	Other identified renal disorders
	34	Lead induced interstitial nephropathy
	75	Ischaemic renal disease / cholesterol embolisation
	76	Glomerulonephritis related to liver cirrhosis
	78	Cryglobulinaemic glomerulonephritis
Unknown	0	Chronic renal failure, aetiology uncertain

APPENDIX C. CATEGORIES OF CAUSES OF DEATH

Category	ERA-EDTA code	Cause of death
Heart	11	Myocardial ischaemia and infarction
	14	Other causes of cardiac failure
	15	Cardiac arrest / sudden death; other cause or unknown
	16	Hypertensive cardiac failure
	18	Fluid overload / pulmonary oedema
Cerebrovascular accident	22	Cerebro-vascular accident, other cause or unspecified
Infection	30	Infection
	31	Pulmonary infection (bacterial - not code 73)
	32	Pulmonary infection (viral)
	33	Pulmonary infection (fungal or protozoal; parasitic)
	34	Infections elsewhere except virus hepatitis
	35	Septicaemia
	36	Tuberculosis (lung)
	37	Tuberculosis (elsewhere)
	38	Generalized viral infection
	39	Peritonitis (all causes except for Peritoneal Dialysis)
	100	Peritonitis (bacterial, with peritoneal dialysis)
	101	Peritonitis (fungal, with peritoneal dialysis)
	102	Peritonitis (due to other cause, with peritoneal dialysis)
Treatment stop	51	Patient refused further treatment for ESRF
	54	ESRF treatment withdrawn for medical reasons
	61	Uremia caused by graft failure
	53	ESRF treatment ceased for any other reason
Malignancy	66	Malignant disease, possibly induced by immunosuppressive therapy
	67	Malignant disease: solid tumors except those of 66
	68	Malignant disease: lymphoproliferative disorders except those of 66
Other	12	Hyperkalaemia
	13	Haemorrhagic pericarditis
	17	Hypokalaemia
	21	Pulmonary embolus
	23	Gastro-intestinal haemorrhage
	24	Haemorrhage from graft site
	25	Haemorrhage from vascular access or dialysis circuit
	26	Haemorrhage from ruptured vascular aneurysm (not code 22 or 23)
	27	Haemorrhage from surgery (not code 23, 24 or 26)
	28	Other haemorrhage (not codes 23-27)

Category	ERA-EDTA code	Cause of death
	29	Mesenteric infarction
	41	Liver disease due to hepatitis B virus
	42	Liver disease due to other viral hepatitis
	43	Liver disease due to drug toxicity
	44	Cirrhosis - not viral
	45	Cystic liver disease
	46	Liver failure - cause unknown
	52	Suicide
	62	Pancreatitis
	63	Bone marrow depression
	64	Cachexia
	69	Dementia
	70	Peritonitis (sclerosing, with peritoneal dialysis)
	71	Perforation of peptic ulcer
	72	Perforation of colon
	73	Chronic obstructive airways disease
	80	Accident (all causes)
	81	Accident related to ESRF treatment (not code 25)
	82	Accident unrelated to ESRF treatment
	90	Gastro-intestinal - other
	99	Other identified cause of death
Uncertain	0	Cause of death uncertain / not determined