



Work status and work ability of patients receiving kidney replacement therapy: results from a European survey

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ABSTRACT

Background. Employment is important for the quality of life and financial security of patients of working age receiving kidney replacement therapy (KRT). We aimed to examine self-reported work status and general, physical and mental work ability and to determine associations between demographic, disease-related, work-related and macroeconomic factors and employment.

Methods. Europeans from 37 countries, ages 19–65 years, treated with dialysis or kidney transplantation, filled out the web-based or paper-based cross-sectional EDITH kidney patient survey between November 2017 and January 2019. We performed descriptive analyses and multivariable generalized logistic mixed models.

Results. Of the 3544 patients, 36.5% were employed and working [25.8% of dialysis patients, 53.9% of kidney transplant recipients (KTRs)]. The mean general work ability was 5.5 out of 10 (dialysis: 4.8, KTRs: 6.5). Non-working patients (all: 4.1, dialysis: 3.9, KTRs: 4.7) scored lower than working patients (all: 7.7, dialysis 7.3, KTRs: 8.0). Working dialysis patients scored lower on physical and mental work ability (7.1 and 8.1) than working KTRs (8.0 and 8.4; $P < 0.001$). Impaired physical work ability (42.7%) was more prevalent than impaired mental work ability (26.7%). Male sex, age 40–49 years, higher education, home dialysis or kidney transplantation as current treatment, treatment history including kidney transplantation, absence of diabetes mellitus, better general work ability and higher country gross domestic product were positively associated with employment ($P < 0.05$).

Conclusions. Low employment rates and impaired work ability were prevalent among European patients receiving KRT. Demographic, disease-related, work-related and macroeconomic factors were associated with employment.

Keywords: chronic haemodialysis, dialysis, ESRD, kidney transplantation, peritoneal dialysis

INTRODUCTION

In Europe, $\approx 330\,000$ individuals of working age suffer from end-stage kidney disease (ESKD) and receive kidney replacement therapy (KRT) [1]. Patients receiving KRT find it important to be able to work, as it provides an income, social contact and the ability to contribute to society [2–5].

‘Work status’ refers to involvement in paid work while ‘work ability’ involves assessment of whether one is currently sufficiently capable to perform work given one’s health condition [6, 7]. Several single-country studies have reported on work status and work ability in patients receiving KRT [8–18]. However, these studies are difficult to compare, as work status and/or work ability were defined and measured in different ways, study populations were heterogeneous and social security systems differed markedly between countries. Furthermore, none have previously distinguished between physical and mental work ability, while this information is relevant for interventions to support employment. Moreover, several studies have addressed work status and work ability in kidney transplant recipients (KTRs) [10, 11, 17], whereas the few studies in dialysis patients are dated and suffer from small

KEY LEARNING POINTS

What is already known about this subject?

- Work may contribute to the quality of life of patients receiving kidney replacement therapy (KRT), as it generates an income, social contact and the ability to contribute to society.
- ‘Work status’ refers to involvement in paid work, while ‘work ability’ is a subjective assessment of whether one is currently sufficiently capable to perform work given one’s health condition.
- Several single-country studies have investigated work status and work ability and reported various associations with employment in patients receiving KRT. However, information regarding dialysis patients (one-third of the KRT patients of working age) is limited and no previous studies have distinguished between physical and mental work ability.

What this study adds?

- One-third of the KRT patients in our multinational European sample were working, with a striking difference between dialysis patients (25.8% working) and kidney transplant recipients (53.9% working).
- A significant proportion of employees receiving KRT struggled to meet work demands and their physical work ability was generally worse than their mental work ability. One in seven KRT patients reported good work ability, although they were not working.
- Male sex, age 40–49 years, higher education, current treatment with home dialysis or kidney transplantation, treatment history including kidney transplantation, absence of diabetes mellitus, better general work ability and higher country gross domestic product were positively associated with employment.

What impact this may have on practice or policy?

- We recommend that nephrologists and other healthcare professionals discuss patients’ preferences regarding employment and refer their patients to occupational health professionals, e.g. to support patients to remain at work or to help patients to return to work.
- Optimizing the availability of KRT modalities may help patients keep their job or return to work. Patients may benefit from flexible dialysis shifts, good access to home-based dialysis modalities and kidney transplantation, especially pre-emptive kidney transplantation.

sample sizes [12–14]. Notably, one-third of KRT patients of working age are receiving dialysis [1].

To date, several studies have described factors (e.g. demographic, disease-related, work-related) related to job prospects of patients receiving KRT [8, 10, 11, 15–18]. However, the impact of macroeconomic factors such as country gross domestic product (GDP) on employment has not yet been studied. GDP is an indicator of a country’s wealth and may influence treatment modality choice on the country level [19], which in turn may affect job prospects of KRT patients. In addition, country wealth may influence the availability of jobs, the employers’ willingness to hire persons with chronic diseases and the quality of social security systems.

Currently a comprehensive European study using uniform measures for work status and work ability in patients receiving KRT is lacking. Therefore the aims of this study were to examine self-reported work status and work ability and determine associations between demographic, disease-related, work-related and macroeconomic factors and employment in European ESKD patients of working age treated with dialysis or kidney transplantation (KTx).

MATERIALS AND METHODS

Participants

We used data from the EDITH kidney patient survey [20]. European adults with ESKD treated by any form of dialysis or KTx could participate. The current dataset included respondents ≤ 65 years of age who had started KRT at or older

than the age of 18 years, whereas retirees ($n = 829$), those with missing work status ($n = 25$) or those living outside Europe were excluded ($n = 177$).

Ethical aspects

The Medical Ethics Committee of the Amsterdam University Medical Centers, location AMC, judged that a comprehensive evaluation was not required since this study was not subject to the Dutch Medical Research Involving Human Subjects Act (W17 291#17.343). If deemed necessary by local hospitals, nephrologists obtained approval from their local ethics committee. Participation was voluntary.

Survey development and translation

For a complete overview of the survey’s development and translation, we refer to the original article about the EDITH kidney patient survey [20]. Briefly, we designed the survey using existing literature, input from a kidney patients’ advocate and questions about work ability from validated surveys. The survey was translated into 31 languages (Supplementary data, item 1) and offered on paper or web-based via LimeSurvey [21].

Data collection

The survey was promoted and distributed by local and national kidney patients’ associations, the European

Kidney Patients' Federation, the European Renal Association–European Dialysis and Transplantation Association, national societies of nephrology and individual nephrologists and their colleagues between November 2017 and January 2019.

We collected the following demographic variables: sex, year of birth, education level (no school/primary/secondary/vocational/higher education) and country. Countries were divided into tertiles based on 2016 gross domestic purchasing power parity (GDP PPP) data from the World Bank to study the association between a country's wealth and employment of its KRT patients [22]. Disease-related variables included current and previous KRT modalities, waitlist status, start year of KRT and self-reported comorbidity [diabetes mellitus (DM) and malignancy].

Work-related variables included current work status, work ability and work hours (Supplementary data, item 2). Work status was dichotomized; respondents who were employed and working were classified as working and all others (employed and on sick leave, unemployed, student, housewife/house husband or receiving a disability pension) were classified as non-working. Work ability was measured with questions based on the Work Ability Index (WAI) [6, 7]. The question about general work ability asks one to compare one's current work ability against one's lifetime best work ability. The questions about physical and mental work ability ask working respondents about the ability to meet their job's physical and mental demands. General, physical and mental work ability were all scored between 0 and 10 and higher scores suggest better work ability. Numeric scores were also categorized; a score of 0–5 was categorized as poor, 6–7 as moderate, 8–9 as good and 10 as excellent [23]. We obtained several standard translations of the WAI items, but if unavailable, they were translated from English into other languages by native speakers (Supplementary data, Item 1).

Data analysis

Respondent characteristics were reported as means with standard deviations (SDs) and medians with interquartile ranges (IQRs) for continuous variables and as proportions for categorical variables. We compared characteristics between working and non-working respondents and performed separate analyses for dialysis patients and KTRs. We tested for differences using chi-squared tests for categorical variables, Mann–Whitney U tests for comparison of means and median test for comparison of medians.

We investigated associations between respondent characteristics (sex, age, education level, current treatment, treatment history, DM, malignancy, duration of KRT, general work ability, country GDP) and employment for complete cases using generalized logistic mixed models (SAS proc glimmix) with binary distribution and log linkage for the outcome (working versus non-working), providing relative risks with 95% confidence intervals (CIs) as effect measures. We calculated McFadden's pseudo- R^2 to assess the proportion of variance in the dependent variable that is predictable from the independent variable [24]. Values of 0.2 to 0.4 for R^2 represent an excellent fit [25]. A random intercept was added

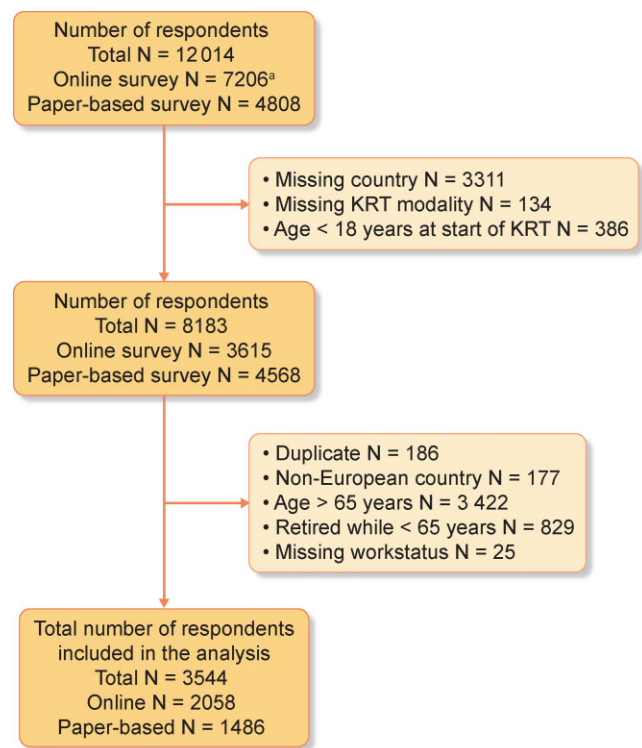


Figure 1: Flowchart. ^aThe webpages of the online surveys were visited 7 206 times but not all visitors completed the survey. We used incomplete surveys with information about country, any KRT modality reported, age and work status.

to the model to account for clustering of respondents within countries; however, because most models failed to converge, we present these as supplementary data. Two multivariable regression models were considered. The first was adjusted for possible *a priori* selected confounders based on the criteria for confounding [26]. The second model additionally controlled for self-reported general work ability as an *a priori* selected potential mediator, as this variable could explain (part of) the association between the determinants and employment. Moreover, treatment modality-specific associations were studied by including an interaction term between the determinant of interest and the current treatment modality (dialysis or KTx). We performed a sensitivity analysis with these two models, including only patients with good or excellent work ability. Furthermore, we performed a sensitivity analysis including retirees, which produced no relevant differences as compared with the main analyses. P-values < 0.05 were considered statistically significant. Statistical analyses were performed with SPSS Statistics 26.0 (IBM, Armonk, NY, USA) and SAS 9.4 (SAS Institute, Cary, NC, USA) [27, 28]. Data cannot be shared publicly due to the privacy of individual survey participants.

RESULTS

Respondent characteristics and work status

We included 3544 dialysis patients and KTRs from 37 European countries (Figure 1; Supplementary data, Table S1). Their mean age was 49.8 years, 50.7% were male, 52.4% received

in-centre haemodialysis and the mean KRT duration was 9.4 years (Table 1). A total of 38.4% of respondents lived in a low-GDP tertile country, 30.3% in a middle-GDP tertile country and 31.3% in a high-GDP tertile country. Sex and age distribution matched fairly with those of prevalent patients from the same countries in the European Renal Association Registry [1], but patients from middle-GDP countries were underrepresented in our sample (Supplementary data, Table S2).

A third (36.5%) of all respondents were working (i.e. employed and working), while the remaining were unemployed, student, housewife/house husband, receiving a disability pension or employed and on sick leave. The employment rate increased with better work ability: 11.1% of the patients with poor work ability were working compared with 47.9% of patients with moderate work ability, 69.2% of patients with good work ability and 79.3% of patients with excellent work ability.

Working respondents were more likely to live with a functioning transplant (56.1% versus 27.6%; $P < 0.001$), suffered less often DM (14.0% versus 23.9%; $P < 0.001$) and malignancy (2.4% versus 4.2%; $P < 0.05$) and were less likely to live in a low-GDP country (25.5% versus 45.8%; $P < 0.05$). Figure 2 and Supplementary data, Table S3 display the work status of respondents from seven countries with at least 150 respondents.

Employment was reported by 25.8% of dialysis patients and 53.9% of KTRs (Table 1). Working dialysis patients more frequently used a home-based dialysis modality, were more often on the KTx waitlist and suffered less often from DM or malignancy than non-working dialysis patients ($P < 0.05$). Working KTRs were more likely to have received a pre-emptive KTx or a living donor KTx compared with their non-working counterparts ($P < 0.05$).

General work ability

The mean general work ability in the total group of respondents was 5.5 on a 0 to 10-point scale (Table 1). Non-working respondents scored lower (4.1) than working respondents (7.7; $P < 0.001$). Two-thirds of all respondents reported impaired (poor or moderate) work ability. Notably, 40.9% of the working respondents reported impaired work ability, while 14.2% of the non-working respondents reported good or excellent work ability.

The mean work ability of dialysis patients was 4.8 (Table 1). Non-working dialysis patients scored lower (3.9) than working dialysis patients (7.3; $P < 0.001$). While half of the working dialysis patients were categorized as having good or excellent work ability, only one in eight non-working dialysis patients fell into this category ($P < 0.001$). Forty-nine percent of the working dialysis patients reported impaired work ability.

KTRs reported a mean work ability of 6.5 (Table 1) and this was lower in non-working patients (4.7) than in working patients (8.0; $P < 0.001$). While 65.5% of working KTRs reported good or excellent work ability, this was less frequently the case for non-working KTRs (18.4%; $P < 0.001$). Approxi-

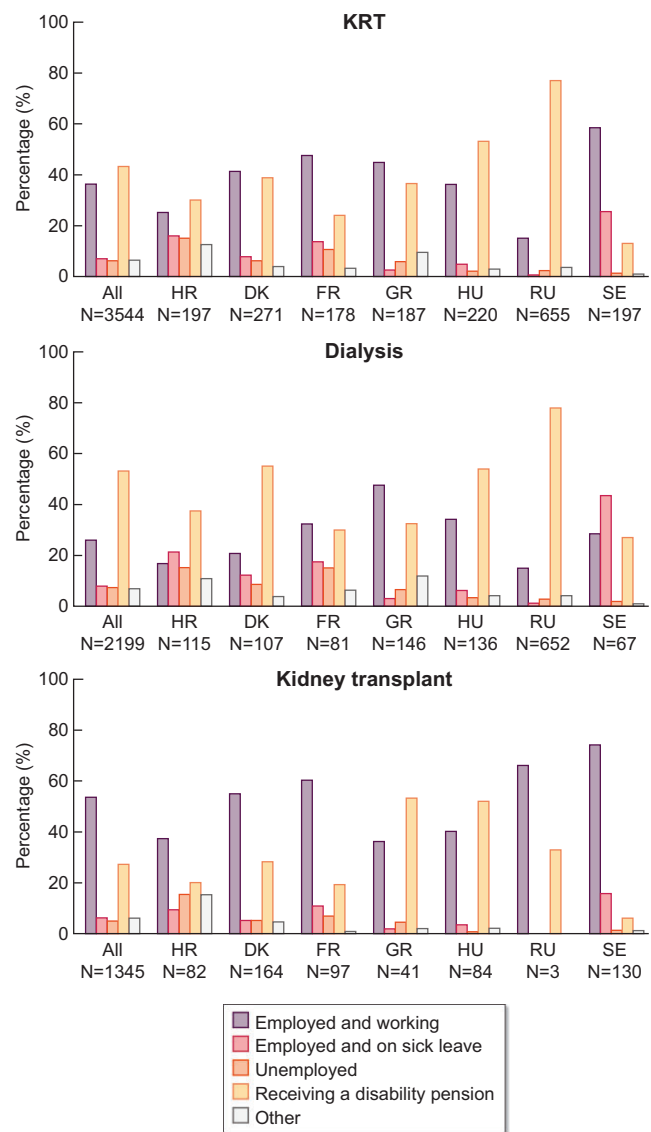


Figure 2: Comparison of work status of KRT patients, dialysis patients and KTRs from seven European countries with at least 150 respondents. The category 'Other' includes students and housewives/house husbands. HR, Croatia; DK, Denmark; FR, France; GR, Greece; HU, Hungary; RU, Russia; SE, Sweden.

mately one-third of the working KTRs reported impaired work ability.

Work hours, physical and mental work ability

Working patients receiving KRT reported an average of 33.8 work hours per week, with dialysis patients reporting fewer hours (31.6) than KTRs (35.4; $P < 0.001$) (Table 2). The mean physical work ability was lower (7.1) in dialysis patients compared with KTRs (8.0; $P < 0.001$). In total, 54.4% of dialysis patients and 33.3% of KTRs reported impaired physical work ability. The mean mental work ability was also lower in dialysis patients (8.1) than in KTRs (8.4; $P < 0.001$). Impaired mental work ability was reported by 30.6% of dialysis patients and 23.6% of KTRs.

Table 1. Characteristics of KRT patients, dialysis patients and KTRs, overall and by work status

Characteristics	KRT patients			Dialysis patients			Kidney transplant recipients					
	All (n = 3544)	Working (n = 1293)	Non-working (n = 2251)	P-value*	All (n = 2199)	Working (n = 568)	Non-working (n = 1631)	P-value*	All (n = 1345)	Working (n = 725)	Non-working (n = 620)	P-value*
Male %	50.7	56.4	47.4	<0.001	52.3	58.6	50.1	0.001	48.1	54.7	40.5	<0.001
Age (years), %												
19–29	3.4	1.9	4.2	<0.000	3.6	2.3	4.1	<0.000	2.9	1.5	4.5	0.003
30–39	14.0	14.3	13.8	1	15.3	15.8	15.1	1	11.9	13.1	10.5	
40–49	27.3	31.2	25.0		27.0	27.7	24.7		27.7	29.4	25.6	
50–59	36.7	37.4	36.3		34.5	33.8	34.7		40.3	40.1	40.5	
60–65	18.7	15.2	20.7		19.6	14.4	21.4		17.2	15.9	18.9	
Mean (SD)	49.8 (9.9)	49.3 (9.2)	50.0 (10.3)	<0.001	49.6 (10.2)	48.6 (9.3)	50.0 (10.4)	<0.001	50.0 (9.4)	49.8 (9.0)	50.2 (9.9)	0.144
Median (IQR)	51.0 (43.0–58.0)	50.0 (42.0–56.0)	52.0 (43.0–58.0)	0.002	51.0 (42.0–58.0)	49.0 (42.0–56.0)	52.0 (42.0–59.0)	<0.001	51.0 (43.0–57.0)	51.0 (43.0–57.0)	52.0 (44.0–58.0)	0.346
Education level, %												
Primary/secondary education	33.0	22.7	39.0	<0.00	35.1	20.1	40.4	<0.00	29.7	24.8	35.5	<0.001
Vocational/higher education	67.0	77.3	61.0	1	64.9	79.9	59.7	1	70.3	75.2	64.5	
Current treatment, %												
In-centre HD	52.4	34.4	62.8	<0.000	84.5	78.3	86.6	<0.000	0.0	0.0	0.0	0.002
Home HD	2.9	3.1	2.8	1	4.7	7.0	3.9	1	0.0	0.0	0.0	
PD	6.7	6.4	6.9		10.8	14.6	9.5		0.0	0.0	0.0	
Living donor KTx	12.4	20.4	7.9		0.0	0.0	0.0		32.8	36.4	28.5	
Deceased donor KTx	25.5	35.7	19.7		0.0	0.0	0.0		67.2	63.6	71.5	
Treatment history, %												
Only dialysis	44.8	29.0	54.6	<0.00	79.3	75.4	80.6	0.020	0.0	0.0	0.0	0.007
Dialysis and transplantation	50.0	62.3	42.4	1	20.7	24.6	19.4		88.1	85.9	90.7	
Only transplantation	5.2	8.7	3.0		0.0	0.0	0.0		11.9	14.1	9.3	
Not on waitlist, % of current dialysis patients	60.4	46.1	65.5	<0.001	60.4	46.1	65.5	<0.001				
Self-reported comorbidity, %												
DM	20.1	14.0	23.9	<0.001	22.6	14.5	25.8	<0.001	16.4	13.7	19.6	0.007
Malignancy	3.5	2.4	4.2	0.017	3.9	2.0	4.6	0.018	3.0	2.7	3.3	0.588
Total duration of KRT, %												
≤5 years	43.0	38.7	45.4	<0.000	54.1	58.3	52.7	0.021	24.8	23.3	26.5	0.183
>5 years	57.0	61.3	54.6	1	45.9	41.7	47.3		75.2	76.7	73.5	
Mean (SD)	9.4 (8.0)	10.3 (8.3)	8.9 (7.8)	<0.001	7.6 (7.1)	7.3 (7.1)	7.7 (7.1)	0.173	12.4 (8.5)	12.6 (8.4)	12.1 (8.6)	0.183
Median (IQR), years	7.0 (3.0–13.8)	8.0 (4.0–15.0)	6.0 (3.0–13.0)	<0.001	5.0 (2.0–10.0)	5.0 (2.0–10.0)	5.0 (2.0–10.0)	0.021	10.0 (6.0–18.0)	11.0 (6.0–18.0)	10.0 (5.0–17.0)	0.235
Current self-reported work status, %												
Employed and working	36.5	100.0	0.0	<0.001	25.8	100.0	0.0	<0.001	53.9	100.0	0.0	<0.001
Employed and on sick leave	7.2	0.0	11.4		7.7	0.0	10.4		6.5	0.0	14.0	
Unemployed	6.4	0.0	10.1		7.2	0.0	9.7		5.2	0.0	11.3	
Receiving a disability pension	43.4	0.0	68.3		52.8	0.0	71.1		28.0	0.0	60.8	
Student	1.4	0.0	2.3		1.1	0.0	1.5		1.9	0.0	4.2	
Housewife/house husband	5.1	0.0	8.0		5.4	0.0	7.3		4.5	0.0	9.7	
General work ability, %												
Poor (0–5)	47.0	13.7	67.6	<0.001	56.6	19.0	70.9	<0.001	32.1	9.6	59.3	<0.001
Moderate (6–7)	21.7	27.2	18.3		20.3	30.0	16.6		23.7	24.9	22.3	
Good (8–9)	22.5	40.7	11.2		18.3	40.0	10.1		28.9	41.3	13.9	
Excellent (10)	8.9	18.4	3.0		4.7	11.0	2.4		15.3	24.2	4.5	
Mean score (SD)	5.5 (3.1)	7.7 (1.9)	4.1 (2.9)	<0.001	4.8 (3.1)	7.3 (1.9)	3.9 (2.9)	<0.001	6.5 (2.9)	8.0 (1.8)	4.7 (2.9)	<0.001
Median score (IQR)	6.0 (3.0–8.0)	8.0 (7.0–9.0)	4.0 (2.0–6.0)	<0.001	5.0 (2.0–7.0)	8.0 (6.0–9.0)	4.0 (1.0–6.0)	<0.001	7.0 (5.0–9.0)	8.0 (7.0–9.0)	5.0 (2.0–7.0)	<0.001
GDP of country, %												
Low	38.4	25.5	45.8	<0.001	49.2	32.9	54.8	<0.001	20.7	19.7	21.9	0.003
Middle	30.3	34.5	27.9		28.3	39.6	24.3		33.7	30.5	37.4	
High	31.3	40.0	26.3		22.6	27.5	20.8		45.6	49.8	40.6	

SD, standard deviation; IQR, interquartile range; HD, haemodialysis; PD, peritoneal dialysis.

*P-values calculated using chi-squared tests for categorical variables, Mann–Whitney U tests for comparison of means and median and median test for comparison of medians.

Table 2. Work hours and physical and mental work ability of working respondents, overall and by current modality

Characteristics	KRT patients (n = 1293)	Dialysis patients (n = 568)	KTRs (n = 725)	P-value*
Work hours per week				
Mean (SD)	33.8 (11.5)	31.6 (11.9)	35.4 (10.9)	<0.001
Median (IQR)	37.0 (27.0–40.0)	35.0 (24.0–40.0)	39.0 (30.0–40.0)	<0.001
Physical work ability, %				
Poor (0–5)	16.5	22.2	11.9	<0.001
Moderate (6–7)	26.2	32.2	21.4	
Good (8–9)	35.2	32.4	37.4	
Excellent (10)	22.2	13.2	29.3	
Mean score (SD)	7.6 (2.1)	7.1 (2.1)	8.0 (2.0)	<0.001
Median score (IQR)	8.0 (6.0–9.0)	7.0 (6.0–9.0)	8.0 (7.0–10.0)	<0.001
Mental work ability, %				
Poor (0–5)	8.5	9.8	7.4	0.008
Moderate (6–7)	18.2	20.8	16.2	
Good (8–9)	41.1	41.5	40.7	
Excellent (10)	32.3	27.9	35.7	
Mean score (SD)	8.3 (1.8)	8.1 (1.9)	8.4 (1.8)	<0.001
Median score (IQR)	9.0 (7.0–10.0)	8.0 (7.0–10.0)	9.0 (8.0–10.0)	0.003

SD, standard deviation; IQR, interquartile range.

*P-values calculated using chi-squared tests for categorical variables, Mann–Whitney U tests for comparison of means and median test for comparison of medians.

Associations between respondents' characteristics and employment

In unadjusted analyses, male sex, vocational/higher education, being treated with home dialysis or KTx (versus in-centre haemodialysis), history including KTx (versus only dialysis), being on KRT for more than 5 years, higher self-reported general work ability and living in a middle- or high-GDP country (versus low-GDP country) were positively associated with employment, whereas having DM or malignancy significantly reduced the likelihood of employment (Figure 3 and Supplementary data, Table S4). There was a non-linear association between age and employment, with the highest likelihood of being employed for patients ages 40–49 years. Malignancy was no longer significantly associated with employment when adjusting for sex and age (Supplementary data, Table S4). After adjustment for additional confounders, being on KRT for more than 5 years was no longer significantly associated with employment.

The addition of general work ability as a potential mediator to our models attenuated the effect of all associations (except for KRT duration). However, general work ability partially mediated the associations between age and employment in older (50–59 and 60–65 years) but not in younger patients (20–29 and 30–39 years).

Positive associations between vocational/higher education, current treatment with home dialysis or KTx, treatment history including KTx or higher country GDP and employment were also found in the subgroup of patients with good or excellent work ability (Supplementary data, Figure S1). Male sex was no longer significantly associated with employment in this subgroup.

Interaction analyses revealed that positive associations between vocational/higher education or country GDP and employment were stronger in dialysis patients compared with KTRs ($P < 0.05$) (Figure 4 and Supplementary data, Table S5).

Similarly, negative associations between DM or being on KRT for more than 5 years and employment were stronger in dialysis patients ($P < 0.05$). Associations between the other variables (i.e. sex, age, malignancy and work ability) and employment were not significantly different for dialysis patients and KTRs.

The associations between higher education level or country GDP and employment were also stronger in dialysis patients compared with KTRs in the subgroup of patients with good or excellent work ability (Supplementary data, Figure S2). The association between DM or being on KRT for more than 5 years were not different between the two groups in this subgroup.

Analyses with country included as a random effect in the generalized logistic mixed models gave comparable results as models without random effects, except for GDP (Supplementary data, Table S6).

DISCUSSION

In this large multinational study, patients with ESKD receiving KRT from nearly all European countries were surveyed about their work status and work ability. We found a low employment percentage and impaired work ability among both dialysis patients and KTRs. Moreover, we identified several demographic, disease-related, work-related and macroeconomic factors associated with employment in these patients.

Work status

In our study, 36.5% of the patients receiving KRT were working. Only a quarter of the dialysis patients were employed and this low percentage could be explained by the poor health status of dialysis patients and the time required for dialysis treatments. KTRs usually have a better health status, but still only half of them were working, which is considerably less than the European average (73.2%) [29]. Our findings match the results found in several single-country studies in European

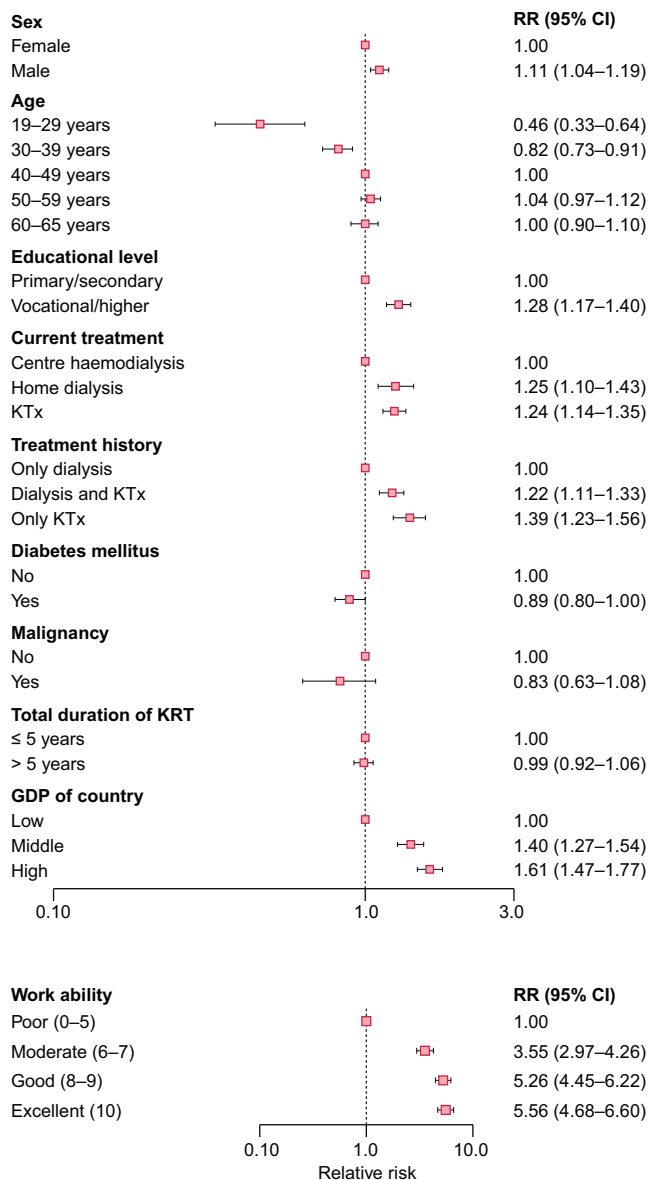


Figure 3: Associations between respondents' characteristics and employment for patients receiving KRT. Results were adjusted for confounders, when applicable, and work ability as a mediator (see also Supplementary data, Table S4). RR, risk ratio.

KRT patients [8, 11, 14–17]. However, comparison between studies is hampered by differences in the classification of work status and heterogeneity of study populations.

Work ability

KTRs reported a mean general work ability of 8 out of 10, which is consistent with the literature [10, 17] and comparable with the average of European employees [30–35]. Working dialysis patients scored lower on average (7.3). However, one-third of working KTRs and half of the working dialysis patients reported impaired general work ability, whereas this applies to less than one-fifth of the European employees [31, 36–39]. Employees with other severe chronic diseases (e.g. DM,

malignancy) have reported similar proportions of impaired general work ability [39, 40].

Interestingly, one in seven KRT patients rated their general work ability as good or excellent, even though they were not working. These patients may be willing to work but may experience discrimination in the job market. Furthermore, we hypothesize that sufficient unemployment or disability benefits may reduce the need to find a job in certain countries. On the other hand, in countries without disability benefits, patients may struggle to meet work demands in order to ensure an income.

This study was the first to distinguish between physical and mental work ability in KRT patients. Half of the working dialysis patients and one-third of working KTRs reported impaired physical work ability, whereas this is between 10 and 15% in the general population [41, 42]. Although impaired mental work ability was less frequently reported, the prevalence was still twice as high as that of the general population [41, 42].

Associations between respondents' characteristics and employment

We found a positive association between male sex and employment, whereas others have provided conflicting evidence regarding this topic [8, 10, 11, 13, 14, 16, 17]. Our finding could potentially be explained by various sociological, legal and disease-related factors. First, traditional role patterns, in which men work outside the house while women invest time in the household and children, may play a role [11]. Lower employment percentages among European women of working age in the general population (67.4% versus 79.0% among men) support this assumption [29]. Moreover, some European countries have a lower retirement age for women than for men [43]. Second, the epidemiology and outcomes of chronic kidney disease (CKD) are different in men and women [44]. Female patients experience a worse quality of life, a higher symptom burden and more hospitalizations than men [44]. Furthermore, women are less often placed on the kidney transplant waitlist and more frequently have preformed antibodies that decrease their chance to receive a deceased donor kidney transplant [44, 45], although their access to living donor KTx does not seem to be limited [44, 45]. Pre-transplant employment, which is one of the most important predictors of employment after KTx [16, 46], was associated with male sex, which gives male patients a higher probability of employment [46].

We found a non-linear association between age and employment, with the highest likelihood of employment found in patients between 40 and 49 years old. Older patients were less likely to be employed [9, 16], but this also applied to the youngest patients in our study. The latter may have a history of CKD and other disabilities, causing them to reach developmental milestones later in life [47]. They may need more time to complete their education and may have limited work experience, leading to lower chances for employment [48].

In our multinational sample, we found a positive association between treatment with home dialysis or KTx

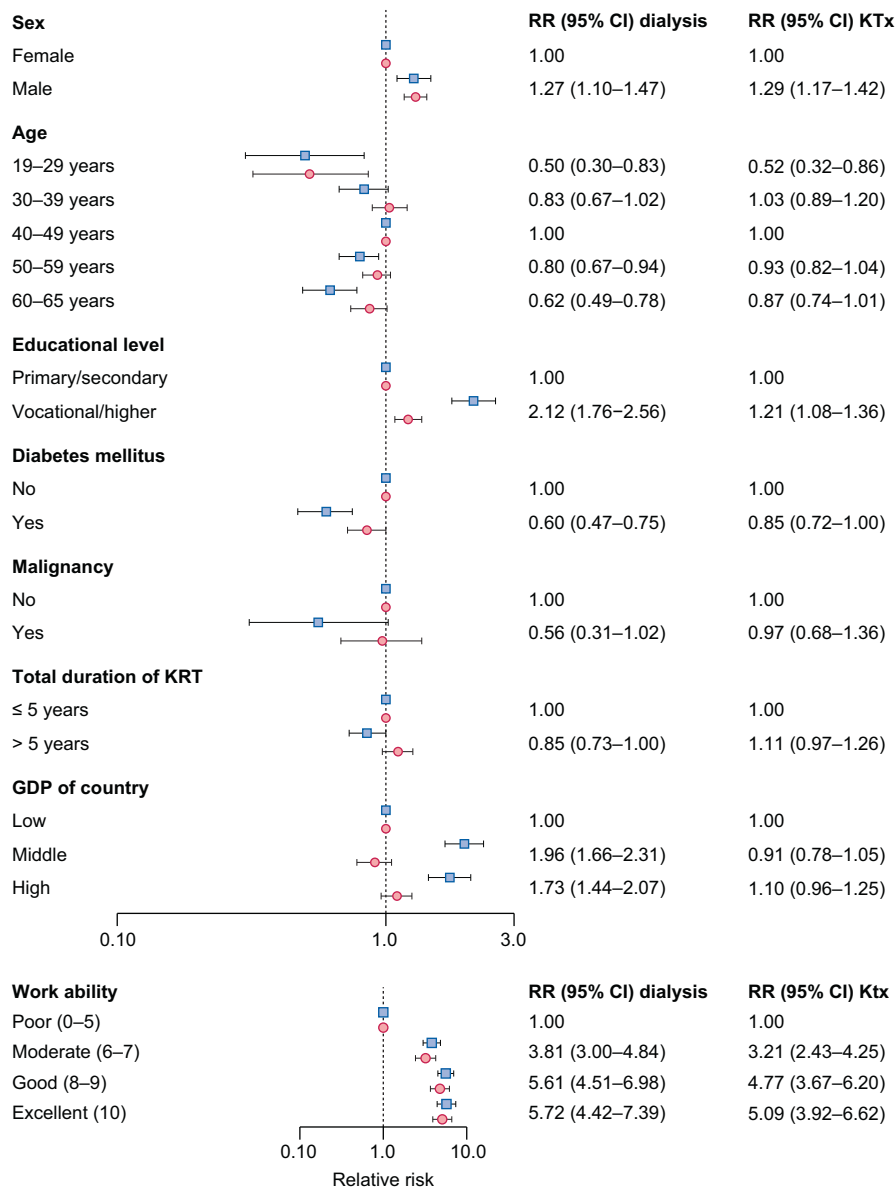


Figure 4: Associations between respondents’ characteristics and employment, comparing dialysis patients and KTRs. The blue bars represent dialysis patients; the red bars represent KTRs. Results were adjusted for confounders when applicable (see also Supplementary data, Table S5). RR, risk ratio.

and employment [8, 15]. Some suggest that KRT modality has no impact on employment, but rather, employment status influences the choice of KRT modality [14, 49]. Nephrologists and other healthcare professionals may be more likely to recommend home dialysis or KTx to working patients [50, 51].

A low education level and DM were both associated with lower employment rates in patients receiving KRT [8–11, 13, 15, 16]. For the first time, we investigated these associations within one study in dialysis patients and KTRs separately. We found a lower likelihood of employment in lower-educated or diabetic dialysis patients compared with KTRs. Dialysis patients usually have a worse physical condition, which may cause more difficulties in lower-educated patients who depend

more on physically demanding jobs. Complications of DM, such as visual impairment, neuropathy and a higher incidence of cardiovascular events, may impede employment. The risk of complications may be different for dialysis patients and KTRs, as the latter may have new-onset DM after KTx, causing fewer complications due to a shorter disease duration and better glycaemic control [52].

Living in a middle- or high-GDP country, however, was associated with an increased likelihood of employment for dialysis patients but not for KTRs. Higher-income countries may experience an ageing workforce with shortages of employees, which could result in more opportunities in the labour market for persons with chronic diseases. Moreover, we speculate that higher-income countries have more possibilities

for sick leave and part-time work, which can be beneficial for dialysis patients.

In line with previously published studies, the findings of our study show that work ability was strongly associated with employment not only in KTRs, but also in dialysis patients [10, 17]. Both groups could benefit from interventions to improve work ability [53, 54], which should ideally start before KRT initiation, as pretreatment work status is an important predictor of work status after KRT initiation [13, 15, 16]. Future studies may investigate the effect of treatment schedules (frequency and duration) on work status and work ability to offer optimal treatment to dialysis patients.

Strengths and limitations

This comprehensive survey included >3500 dialysis and kidney transplanted patients from 37 countries in Western and Eastern Europe. Work status and work ability were assessed using uniform questions in 31 different languages. However, our study has limitations. Regardless of the large sample size, only a fraction of all KRT patients living in the participating countries completed the survey. Due to this sampling bias, our findings may not be generalizable to all European patients receiving KRT. Previous single-country studies achieved full population coverage by linking data from the national bureau of statistics to data from renal registries to assess work status [8, 55]. This was impossible in our multinational study due to the absence of national renal registries, unavailability of data about work status on an individual patient level or the impossibility to link data. Moreover, one always relies on surveys to study work ability, which is subjective information. Selection bias is inherent to surveys and usually difficult to solve. Healthier and higher-educated patients who are more likely to be employed may be overrepresented in this study, which may have led to an overestimation of employment rate and work ability. We attempted to reduce selection bias by prior assessment of the survey's comprehensibility by patients, offering online and paper versions of the survey in 31 languages and assistance when filling out the survey. As patients were not directly approached by the research team, we were unable to calculate a response rate or compare respondents with non-respondents. Furthermore, work status was self-reported and some patients might have misinterpreted answer options. Although we were able to adjust for several confounders in the associations between respondents' characteristics and employment, we were unable to control for other potentially relevant variables (e.g. work status before KRT initiation). For this reason, and due to the cross-sectional design of our study, we are unable to infer causality to our results.

CONCLUSION

We found that low employment rates and impaired work ability were highly prevalent in a large sample of European patients receiving KRT. Only a quarter of the European dialysis patients are working and a significant proportion of them struggle to meet the physical and mental demands of their job. Although KTRs generally have a better health status than

dialysis patients, their employment rate and work ability also deserve attention, as they lag behind those in the general population.

Employment was associated with several patient characteristics, of which many are not modifiable. Treatment choice could be a modifiable characteristic. Patients may benefit from flexible dialysis shifts and improved access to home-based dialysis modalities and KTx, especially pre-emptive [16–18]. Furthermore, nephrologists and other healthcare professionals may discuss patients' preferences about employment in an earlier stage of the disease, as early support may help employed patients to remain at work. As we found differences between lower- and higher-income countries in Europe, we believe that strategies to improve the work status of KRT patients should be tailored to socio-economic conditions.

SUPPLEMENTARY DATA

Supplementary data are available at *ndt* online.

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AUTHORS' CONTRIBUTIONS

R.d.J., K.J., V.S. and A.d.B. conceived the research idea and study design. R.d.J., Z.M., K.J. and V.S. were responsible for data acquisition. R.d.J., E.B., N.C., F.B., Z.M., K.J., V.S. and A.d.B. performed data analysis/interpretation. R.d.J., N.C., K.J. and V.S. performed statistical analysis. Supervision or mentorship were performed by V.S. and A.d.B. Each author contributed important intellectual content during manuscript drafting or revision, accepts personal accountability for the author's own contributions and agrees to ensure that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved.

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CONFLICT OF INTEREST STATEMENT

All the authors have nothing to disclose.

REFERENCES

1. ERA-EDTA Registry. *ERA-EDTA Registry Annual Report 2017*. Amsterdam: Amsterdam UMC, location AMC, Department of Medical Informatics, 2019
2. Vooijs M, Leensen MCJ, Hoving JL *et al*. Value of work for employees with a chronic disease. *Occup Med* 2017; **68**: 26–31
3. Urquhart-Secord R, Craig JC, Hemmelgarn B *et al*. Patient and caregiver priorities for outcomes in hemodialysis: an international nominal group technique study. *Am J Kidney Dis* 2016; **68**: 444–454
4. Sautenet B, Tong A, Manera KE *et al*. Developing consensus-based priority outcome domains for trials in kidney transplantation: a multinational Delphi Survey with patients, caregivers, and health professionals. *Transplantation* 2017; **101**: 1875–1886
5. Manera KE, Johnson DW, Craig JC *et al*. Patient and caregiver priorities for outcomes in peritoneal dialysis: multinational nominal group technique study. *Clin J Am Soc Nephrol* 2019; **14**: 74–83

6. Ilmarinen J, Tuomi K. *Work Ability Index for Aging Workers*. Helsinki: Finnish Institute of Occupational Health, 1993
7. Tuomi K, Ilmarinen J, Jahkola A. *Work Ability Index*, 2nd rev. edn. Helsinki: Finnish Institute of Occupational Health, 1998
8. Helantera I, Haapio M, Koskinen P *et al*. Employment of patients receiving maintenance dialysis and after kidney transplant: a cross-sectional study from Finland. *Am J Kidney Dis* 2012; **59**: 700–706
9. Imanishi Y, Fukuma S, Karaboyas A *et al*. Associations of employment status and educational levels with mortality and hospitalization in the dialysis outcomes and practice patterns study in Japan. *PLoS One* 2017; **12**: e0170731
10. Sangalli V, Dukes J, Doppalapudi SB *et al*. Work ability and labor supply after kidney transplantation. *Am J Nephrol* 2014; **40**: 353–361
11. van der Mei SF, van Sonderen EL, van Son WJ *et al*. Social participation after successful kidney transplantation. *Disabil Rehabil* 2007; **29**: 473–483
12. Neri L, Rocca Rey, LA, Gallieni M *et al*. Occupational stress is associated with impaired work ability and reduced quality of life in patients with chronic kidney failure. *Int J Artif Organs* 2009; **32**: 291–298
13. Curtin RB, Oberley ET, Sacksteder P *et al*. Differences between employed and nonemployed dialysis patients. *Am J Kidney Dis* 1996; **27**: 533–540
14. van Manen JG, Korevaar JC, Dekker FW *et al*. Changes in employment status in end-stage renal disease patients during their first year of dialysis. *Perit Dial Int* 2001; **21**: 595–601
15. Agence de la Biomédecine. *Étude Quavi-REIN—Dialyse & Greffe 2011, Qualité de vie des patients insuffisants renaux chroniques terminaux*. Paris: Agence de la Biomédecine, 2011
16. Eppenberger L, Hirt-Minkowski P, Dickenmann M. Back to work? Socioeconomic status after kidney transplantation. *Swiss Med Wkly* 2015; **145**: w14169
17. Jordakieva G, Grabovac I, Steiner M *et al*. Employment status and associations with workability, quality of life and mental health after kidney transplantation in Austria. *Int J Environ Res Public Health* 2020; **17**: 1254
18. Kutner N, Bowles T, Zhang R *et al*. Dialysis facility characteristics and variation in employment rates: a national study. *Clin J Am Soc Nephrol* 2008; **3**: 111–116
19. van de Luijckgaarden MWM, Jager KJ, Stel VS *et al*. Global differences in dialysis modality mix: the role of patient characteristics, macroeconomics and renal service indicators. *Nephrol Dial Transplant* 2013; **28**: 1264–1275
20. de Jong RW, Stel VS, Rahmel A *et al*. Patient-reported factors influencing the choice of their kidney replacement treatment modality. *Nephrol Dial Transplant* 2021; doi: 10.1093/ndt/gfab059
21. Limesurvey. *LimeSurvey: an open source survey tool*. <http://www.limesurvey.org> (6 November 2021, date last accessed)
22. World Bank. Indicators. <https://data.worldbank.org/indicator> (20 August 2019, date last accessed)
23. Gould R, Koskinen S, Seitsamo J *et al*. Data and methods. In: Gould R, Ilmarinen J, Jarvisalo J, Koskinen S (eds). *Dimensions of Work Ability: Results of the Health 2000 Survey*. Helsinki: Finnish Centre for Pensions, Social Insurance Institution, National Public Health Institute, Finnish Institute of Occupational Health, 2008: 25–32
24. McFadden D. Conditional logit analysis of qualitative choice behavior. In: Zarembka P (ed). *Frontiers in Econometrics*. New York: Academic Press, 1974: 105–142
25. McFadden D. Quantitative methods for analyzing travel behaviour of individuals: some recent developments. Discussion paper 474. Cowles Foundation for Research in Economics, Yale University, 1977. <https://cowles.yale.edu/sites/default/files/files/pub/d04/d0474.pdf> (6 November 2021, date last accessed)
26. Jager KJ, Zoccali C, Macleod A *et al*. Confounding: what it is and how to deal with it. *Kidney Int* 2008; **73**: 256–260
27. IBM. *IBM SPSS Statistics for Windows, Version 25.0*. Armonk, NY: IBM, 2017
28. SAS Institute. *SAS Enterprise Miner 9.4*. Cary, NC, SAS Institute
29. Eurostat. Database. <http://ec.europa.eu/eurostat/data/database> (26 May 2020, date last accessed)
30. El Fassi M, Bocquet V, Majery N *et al*. Work ability assessment in a worker population: comparison and determinants of work ability index and work ability score. *BMC Public Health* 2013; **13**: 305
31. Kinnunen U, Nätti J. Work ability score and future work ability as predictors of register-based disability pension and long-term sickness absence: a three-year follow-up study. *Scand J Public Health* 2018; **46**: 321–330
32. Koolhaas W, van der Klink JJJ, de Boer MR *et al*. Chronic health conditions and work ability in the ageing workforce: the impact of work conditions, psychosocial factors and perceived health. *Int Arch Occup Environ Health* 2014; **87**: 433–443
33. Freyer M, Formazin M, Rose U. Factorial validity of the work ability index among employees in Germany. *J Occup Rehabil* 2019; **29**: 433–442
34. Juszczak G, Czerw AI, Religioni U *et al*. Work ability index (WAI) values in a sample of the working population in Poland. *Ann Agric Environ Med* 2019; **26**: 78–84
35. Kudász F, Nagy K, Kóvágó Z *et al*. Workability index among ageing Hungarian workers. *J Occup Environ Med* 2016; **22**: 53–65
36. Oellingrath IM, De Bortoli MM, Svendsen MV *et al*. Lifestyle and work ability in a general working population in Norway: a cross-sectional study. *BMJ Open* 2019; **9**: e026215
37. van den Berg S, Burdorf A, Robroek SJW. Associations between common diseases and work ability and sick leave among health care workers. *Int Arch Occup Environ Health* 2017; **90**: 685–693
38. Lindström I, Pallasaho P, Luukkonen R *et al*. Reduced work ability in middle-aged men with asthma from youth: a 20-year follow-up. *Respir Med* 2011; **105**: 950–955
39. Hakkarainen P, Sund R, Arffman M *et al*. Working people with type 1 diabetes in the Finnish population. *BMC Public Health* 2017; **17**: 805
40. de Boer AG, Verbeek JH, Spelten ER *et al*. Work ability and return-to-work in cancer patients. *Br J Cancer* 2008; **98**: 1342–1347
41. Couwenberg AM, Intven MPW, Gregorowitsch ML *et al*. Patient-reported work ability during the first two years after rectal cancer diagnosis. *Dis Colon Rectum* 2020; **63**: 578–587
42. Gregorowitsch ML, van den Bongard HJGD, Couwenberg AM *et al*. Self-reported work ability in breast cancer survivors: a prospective cohort study in the Netherlands. *Breast* 2019; **48**: 45–53
43. Finnish Centre for Pensions. *Retirement Ages*. <https://www.etk.fi/en/work-and-pensions-abroad/international-comparisons/retirement-ages/> (16 July 2020, date last accessed)
44. Carrero JJ, Hecking M, Chesnaye NC *et al*. Sex and gender disparities in the epidemiology and outcomes of chronic kidney disease. *Nat Rev Nephrol* 2018; **14**: 151–164
45. ERA-EDTA Registry. *ERA-EDTA Registry Annual Report 2016*. Amsterdam: Amsterdam UMC, location AMC, Department of Medical Informatics, 2018
46. Danuser B, Simcox A, Studer R *et al*. Employment 12 months after kidney transplantation: an in-depth bio-psycho-social analysis of the Swiss Transplant Cohort. *PLoS One* 2017; **12**: e0175161
47. Stam H, Hartman EE, Deurloo JA *et al*. Young adult patients with a history of pediatric disease: impact on course of life and transition into adulthood. *J Adolesc Health* 2006; **39**: 4–13
48. Murray PD, Dobbels F, Lonsdale DC *et al*. Impact of end-stage kidney disease on academic achievement and employment in young adults: a mixed methods study. *J Adolesc Health* 2014; **55**: 505–512
49. Hirth RA, Chernew ME, Turenne MN *et al*. Chronic illness, treatment choice and workforce participation. *Int J Health Care Finance Econ* 2003; **3**: 167–181
50. Jassal SV, Krishna G, Mallick NP *et al*. Attitudes of British Isles nephrologists towards dialysis modality selection: a questionnaire study. *Nephrol Dial Transplant* 2002; **17**: 474–477
51. Jung B, Blake PG, Mehta RL *et al*. Attitudes of Canadian nephrologists toward dialysis modality selection. *Perit Dial Int* 1999; **19**: 263–268
52. Chan Chun Kong D, Akbari A, Malcolm J *et al*. Determinants of poor glycemic control in patients with kidney transplants: a single-center retrospective cohort study in Canada. *Can J Kidney Health Dis* 2020; **7**: 2054358120922628

53. Rasgon S, Schwankovsky L, James-Rogers A *et al.* An intervention for employment maintenance among blue-collar workers with end-stage renal disease. *Am J Kidney Dis* 1993; **22**: 403–412
54. Jansen DL, Heijmans M, Rijken M *et al.* The development of and first experiences with a behavioural self-regulation intervention for end-stage renal disease patients and their partners. *J Health Psychol* 2011; **16**: 274–283.
55. Jarl J, Gerdtham UG, Desatnik P *et al.* Effects of kidney transplantation on labor market outcomes in Sweden. *Transplantation* 2018; **102**: 1375–1381

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