



BMJ Open Predictors of return to work after kidney transplantation: a 12-month cohort of the Japan Academic Consortium of Kidney Transplantation study

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ABSTRACT

Objectives To investigate the cumulative return-to-work (RTW) rate and to identify predictors of employment after kidney transplantation (KT).

Design Retrospective, outpatient-based cohort study.

Setting This was a single-centre study of the largest Japanese kidney transplant centre.

Participants We selected Japanese kidney transplant recipients aged 20–64 years who were employed in paid jobs at the time of transplantation and who visited an outpatient clinic from December 2017 to March 2018. From 797 patients, we evaluated 515 in this study.

Interventions We interviewed patients at an outpatient clinic and investigated the timing and predictors of RTW using logistic regression models.

Primary and secondary outcome measures The primary outcome was the cumulative RTW rate, and the secondary outcome was to investigate the predictors of RTW after KT.

Results Among the 515 included recipients, the cumulative overall partial/full RTW rates at 2, 4, 6 and 12 months were 22.3%, 59.0%, 77.1% and 85.0%, respectively. The median duration from transplantation to RTW was 4 months. Regarding partial/full RTW, according to the multivariable analysis including all variables, male sex was a greater predictor for RTW than female sex (OR 2.05, 95% CI 1.32 to 3.20), and a managerial position was a greater predictor than a non-managerial position (OR 2.23, 95% CI 1.42 to 3.52). Regarding full RTW, male sex (OR 1.95, 95% CI 1.25 to 3.06) and managerial position (OR 1.95, 95% CI 1.25 to 3.06) were also good predictors.

Conclusions The cumulative RTW rate was 85.0% 1-year post-transplantation. Given that cumulative RTW rates varied by sex and position, transplant and occupational physicians should support kidney transplant recipients in the aspect of returning to work.

Trial registration number UMIN000033449

INTRODUCTION

End-stage renal disease (ESRD) is a chronic disease with a high mortality rate, and dialysis, which is one of the treatments of ESRD, decreases the quality of life of patients on dialysis. However, medications and public health

Strengths and limitations of this study

- Return to work (RTW) after kidney transplantation (KT) has become increasingly important not only for patients but also for medical professionals, companies and the society, because promoting RTW after KT may help to reduce indirect costs, such as sickness allowance and unemployment insurance.
- This study was based on a retrospective, outpatient-based cohort on the course of RTW among Japanese KT recipients, and patients' data were extracted from the Japan Academic Consortium of Kidney Transplantation study.
- The information collected through the interview included 'timing of RTW after KT', 'age at transplant', 'sex', 'marital status', 'diabetic or non-diabetic', 'pretransplant treatment', 'manual worker or non-manual worker', 'manager or non-manager', 'body mass index' and 'donor type'.
- Knowledge of comorbidities is necessary owing to their influence on time to RTW because participants may have had other disorders during sick leave, such as coronary disease or malignancy, which are often found in KT recipients. In addition, we excluded dead patients after KT, because this was a retrospective outpatient cohort study.

services for ESRD have improved markedly in recent years.^{1–5} In particular, advances in kidney transplantation (KT) have lowered the mortality risk and improved the quality of life of ESRD patients, as compared with dialysis; thus, KT seems to be the best ESRD treatment in selected patients without contraindications.^{1–3} KT relieves ESRD patients of the cost of dialysis and its complications, and KT results in more free time for ESRD patients to participate in social activities than dialysis does.^{4 5} Therefore, the Japanese society has been promoting KT for ESRD patients. In fact, the number of KTs in Japan has been increasing by approximately 1700 cases a year

and has doubled in the last 15 years; the prognosis of KT recipients is reported to be significantly improving.⁶

Although the prevalence of ESRD is higher in senior citizens, about one-third of ESRD patients belong to the 20–64 years old working age group in Japan.⁶ With the prolonged retirement age and improved KT treatment,⁷ the prevalence of KT within the working age group is expected to further increase in the near future.⁸

As for ESRD, return to work (RTW) after KT has become increasingly important not only for patients but also for medical professionals, companies and the society, because promoting RTW after KT may help to reduce indirect costs, such as sickness allowance and unemployment insurance.^{9–10} In Japan, the balance between treatment and employment has been given more importance. This is in accordance with the published Japanese Ministry of Health, Labour and Welfare ‘guidelines for the support of therapy and working life in the Japanese workforce’ in 2016.¹¹ There seems to have been an increase in interest in the follow-up of workers after treatment who are willing to RTW.¹¹

In occupational health studies, RTW rates after KT varied notably in the literature despite the comparable study populations. In previous studies, RTW rates after KT ranged from 18% to 82%, and RTW seemed to be recognised as an objective outcome of complete recovery, indicating that the KT recipients’ work capacity had recovered to a level that enabled them to RTW.^{12–14} van der Mei *et al* reported that it might be difficult for KT recipients to work at the same level as a healthy individual because of compromised health status that might lead to functional limitations and disability.¹⁵ To provide effective rehabilitation for RTW after KT, it is very important to identify the predictors of a higher likelihood of RTW, as these would offer opportunities for interventions in the vocational rehabilitation process.

However, to the best of our knowledge, there have been no epidemiological Japanese studies investigating the rate and the predictors of RTW after KT. The objective of this study was to clarify the occupational pretransplant predictors of the time to RTW within a 12-month period from the day of KT.

METHODS

This study was based on a retrospective, outpatient-based cohort on the course of RTW among Japanese KT recipients. Patient data were extracted from the Japan Academic Consortium of Kidney Transplantation (JACK) study. The JACK is an ongoing multicentre, observational cohort study conducted in Japan. The objectives and protocol of the JACK have been described in more detail previously.^{8,16,17} The participants were patients who underwent KT at Tokyo Women’s Medical University and visited the outpatient Yochomachi Clinic for follow-up assessments.

ESRD patients aged 20–64 years who were employed in paid jobs at the time of KT were included in the study. We excluded patients with post-translation periods less

than 1 year, those who had never worked, dead patients and those who did not undergo regular outpatient clinic follow-up assessments. The interview was performed with 797 patients by 7 physicians from December 2017 to March 2018 at the outpatient clinic. Before obtaining study-related information, participants signed an informed consent form. The authors took complete responsibility for the integrity of the data and the accuracy of the analysis.

The primary outcome was RTW after KT. We defined partial/full RTW as restarting paid work not only fully but also partially. Partial RTW meant part-time job and short-time employment for handicapped patients, and full RTW meant full-time jobs as healthy people. Participants’ outcomes within the 12-month period of their KT days were obtained from their clinical data and interviews and were used for this study. Data on clinical characteristics were collected through a review of medical charts and patients’ interviews. The information collected through the interview included ‘timing of RTW after KT’, ‘age at transplant’, ‘sex’, ‘marital status’, ‘pretransplant treatment’, ‘manual worker or non-manual worker’, ‘manager or non-manager’, ‘donor type’, ‘diabetic or non-diabetic’, ‘body mass index (BMI)’ and ‘estimated glomerular filtration rate (GFR)’.

A ‘pre-emptive’ knowledge of the parameters of pretransplant treatment indicated patients who received KT without dialysis. A ‘non-manual worker’ was involved mainly in mental work (eg, ‘office worker’, ‘sales worker’ and ‘researcher’), while a ‘manual worker’ was involved mainly in physical work (eg, ‘technician’). A ‘manager’ was defined as an individual with an administrative position in a company or an individual owning a single proprietorship. In Japan, because living donors should be from families of KT recipients, the ‘donor type’ consisted of spouse, parent or other family members (eg, grandparent, brother and child), and there are no other choices except deceased donors.

Patients were stratified by median age into the following two groups: 40 years old or younger (reference) and 41 years old or older. Estimated GFR was divided into the following two groups: 45 mL/min/1.73 m² or lesser (reference) and more than 45 mL/min/1.73 m². To equalise the numbers, we categorised patients by age, the duration of pretransplant dialysis and estimated GFR into two groups according to their median. Patients were stratified by BMI into three groups by quartiles: less than 20 kg/m², between 20 and 24 kg/m² or more than 24 kg/m².

Statistical analysis

We performed univariable analyses for all variables individually, and multivariable analyses including all variables. Survival analysis was performed to illustrate the cumulative RTW rates after KT using JMP Pro V.13 (SAS Institute, Cary, North Carolina, USA). Time of follow-up was calculated from the day of KT to either RTW or 12 months after, whichever came first. The cumulative rate

of RTW was measured at 2, 4, 6 and 12 months after the day of KT using the Kaplan-Meier analysis.

To identify the predictors of RTW, we used the logistic regression model for survival analysis. An OR of more than 1 indicated a shorter time to RTW, as compared with the reference. An OR of less than 1 meant a longer time to RTW.

Patient and public involvement

Patients and the public representatives worked with us to refine the research questions. However, it was difficult to involve patients in other areas of the study design due to data protection restrictions and the very technical methods required to do a data linkage analysis. For further patient and public involvement, patients and the public representatives will write a plain-language summary of the findings of this study. They will also design a leaflet for the dissemination of the findings to their peers and distribution among patient groups.

RESULTS

A total of 797 KT recipients visited the clinic from December 2017 to March 2018. Among the cohort of transplant recipients, 70 patients were younger than 20 years or older than 64 years, 89 had less than 1 year of post-transplantation period, while 22 refused to participate. There were 101 recipients involved in unpaid housework, and they were never in paid work before transplantation. Finally, there were 515 recipients who met the inclusion criterion of having been able to work at the time of KT. All these 515 candidates were on paid work before KT

and took a leave of absence from their jobs because of KT (figure 1).

As presented in table 1, the characteristics of the recipients were as follows: 350 (68.0%) of the 515 recipients were male and 165 (32.0%) were female. Patients' mean age on the transplant day was 43.5 years. The median duration from transplant to RTW was 4.0 months. After the 1 year period following the day of KT, 77 (15.0%) recipients had resigned from work, 438 (85.0%) had partial/full RTW and 393 (76.3%) had full RTW.

Figure 2 shows the Kaplan-Meier cumulative curve of time until partial/full RTW after KT. In the survival analysis, the overall cumulative RTW rates after KT at 2 months, 4 months, 6 months and 1 year were 22.3%, 59.0%, 77.1% and 85.0%, respectively. There was a steep increase in the partial/full RTW rate in the first year after KT.

The results of the univariable and multivariable analyses using Cox regression models are presented in tables 2A and 2B. We analysed the predictors of partial/full and full RTW by age at transplant, sex, marital status, pretransplant dialysis, non-manual worker or manual worker, manager or non-manager, donor type, diabetic or non-diabetic and estimated GFR 1 year after transplantation. Regarding partial/full RTW, according to the univariable analysis, age over 40 years (OR 1.43, 95% CI 1.00 to 2.04), male sex (OR 2.89, 95% CI 1.97 to 4.24), non-manual worker (OR 1.47, 95% CI 1.01 to 2.13) and managerial position (OR 2.95, 95% CI 1.99 to 4.37) significantly affected the time to RTW. Moreover, BMI of less than 20 kg/m² was significantly associated with delayed RTW (OR 0.61, 95% CI 0.41 to 0.91). According to the multivariable analysis

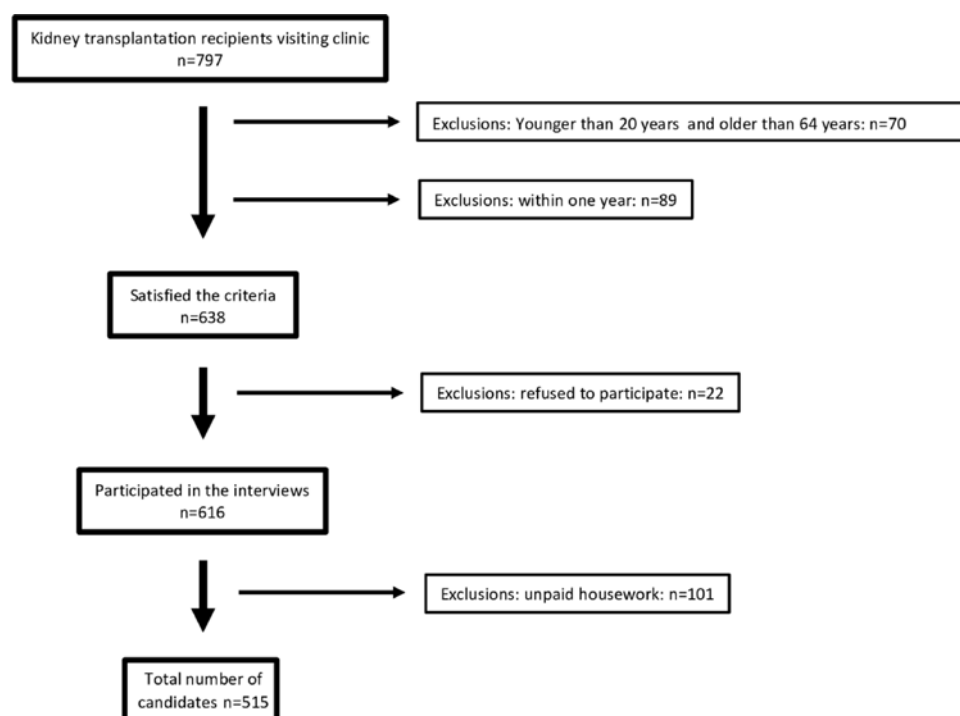


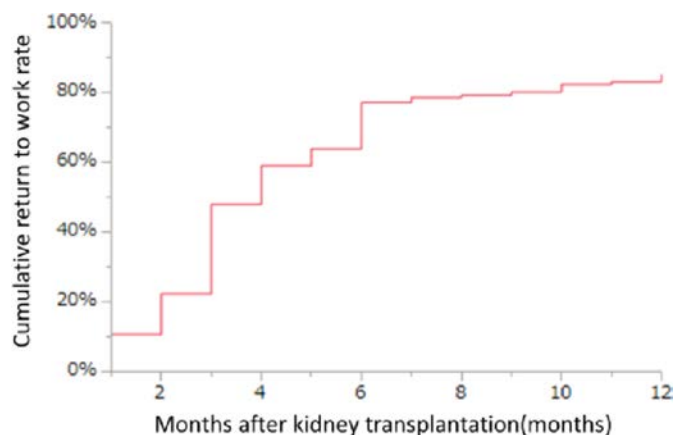
Figure 1 Study flow diagram.

Table 1 Participant characteristics and outcomes 12 months after kidney transplantation (KT) (n=515)

Variables	Total (n=515)
Age (years)	43.5±12.5
≤40	226 (43.9%)
>40	289 (56.1%)
Sex	
Male	350 (68.0%)
Female	165 (32.0%)
Marital status	
Married	370 (71.8%)
Single	145 (28.2%)
Pretransplant treatment	
Dialysis	437 (84.9%)
Dialysis free	78 (15.1%)
Non-manual worker/manual worker	
Manual worker	168 (32.6%)
Non-manual worker	347 (67.4%)
Manager/non-manager	
Non-manager	316 (61.4%)
Manager	199 (38.6%)
Donor	
Spouse	162 (31.5%)
Parent	263 (51.1%)
Other family members	60 (11.7%)
Deceased donor	30 (5.8%)
Diabetic/non-diabetic	
Diabetic	62 (12.0%)
Non-diabetic	453 (88.0%)
Body mass index (kg/m ²)	21.3±3.2
≤20	179 (34.8%)
>20 to ≤24	228 (44.3%)
>24	108 (21.0%)
Estimated GFR (mL/min/1.73 m ²)	48.5±14.2
≤45	221 (42.9%)
>45	294 (57.1%)
Time from KT to interview (months)	72.8±45.5
Full/partial RTW	438 (85.0%)
Full RTW	393 (76.3%)

GFR, glomerular filtration rate; RTW, return to work.

including all variables, male sex had a greater influence on RTW than the female sex (OR 2.05, 95% CI 1.32 to 3.20), and a managerial position greatly predicted RTW than a non-managerial position (OR 2.23, 95% CI 1.42 to 3.52). Regarding full RTW, according to the univariable analysis, age over 40 years (OR 1.55, 95% CI 1.09 to 2.20), male sex (OR 2.56, 95% CI 1.74 to 3.77), unmarried status (OR 1.60, 95% CI 1.08 to 2.36), non-manual worker

**Figure 2** Cumulative partial/full return-to-work rate from the initial day of kidney transplantation using Kaplan-Meier survival analysis.

(OR 1.59, 95% CI 1.09 to 2.30) and a managerial position (OR 2.23, 95% CI 1.55 to 3.20) significantly affected the time to RTW. According to the multivariable analysis including all variables, male sex was a stronger factor for RTW than the female sex (OR 1.95, 95% CI 1.25 to 3.06), and a managerial position strongly predicted RTW than a non-managerial position (OR 1.95, 95% CI 1.25 to 3.06). In addition, non-manual workers had a tendency towards full RTW after KT.

DISCUSSION

In this study, the overall cumulative partial/full and full RTW rates were 85.0% and 76.3%, respectively, 1 year after KT. Moreover, 'male sex' and 'a managerial position' were identified as predictors of both partial/full and full RTW. To the best of our knowledge, this was the first large-scale clinical study in Japan that demonstrated cumulative RTW rates and identified the predictors of time to RTW after KT among ESRD patients using the survival analysis. Moreover, our institutions were the highest volume centres in Japan; thus, our data reliably represented the Japanese environment of KT.

As Hensing previously reported, the time to RTW tends to be heavily right-skewed.¹⁸ As shown in figure 2 (Kaplan-Meier curve), the median time to RTW was approximately 4 months, and the incidence of RTW was more concentrated in the former 6 months than in the latter 6 months. A Dutch study reported that the rate of RTW after KT (without complications) showed an early increase which later became stable within a year.¹⁹ In contrast, Christensen *et al* reported that, with increasing duration of sick leave, RTW rates decreased, and occupational rehabilitation at the early stages of sick leave may remain important.²⁰ In general, RTW for KT patients is quite complex and dependent on a variety of medical and non-medical factors. For example, pretransplant conditions, post-transplant complications, side effects of immunosuppression, frequent medical follow-up visits, rejection episodes, and uncertainty and anxiety regarding potential graft loss

Table 2A Univariable and multivariable analyses of predictors of partial/full return to work among Japanese kidney transplant recipients

Variables	Univariable analysis		Multivariable analysis	
	OR (95% CI)	P value	OR (95% CI)	P value
Age (years)				
≤40	1		1	
>40	1.43 (1.00 to 2.04)	0.049	0.67 (0.39 to 1.14)	0.141
Sex				
Female	1		1	
Male	2.89 (1.97 to 4.24)	<0.0001	2.05 (1.32 to 3.20)	0.0015
Marital status				
Married	1		1	
Single	1.42 (0.95 to 2.13)	0.085	1.23 (0.79 to 1.92)	0.366
Pretransplant treatment				
Dialysis	1		1	
Pre-emptive	1.43 (0.86 to 2.39)	0.172	1.24 (0.71 to 2.17)	0.442
Non-manual worker/manual worker				
Manual worker	1		1	
Non-manual worker	1.47 (1.01 to 2.13)	0.045	1.33 (0.89 to 2.00)	0.168
Manager/non-manager				
Non-manager	1		1	
Manager	2.95 (1.99 to 4.37)	<0.0001	2.23 (1.42 to 3.52)	0.0005
Donor				
Spouse	1		1	
Parent	1.20 (0.80 to 1.81)	0.369	1.44 (0.79 to 2.63)	0.278
Other family members	0.66 (0.36 to 1.21)	0.182	0.78 (0.40 to 1.51)	0.461
Deceased donor	0.71 (0.32 to 1.57)	0.396	0.71 (0.29 to 1.74)	0.449
Diabetic/non-diabetic				
Diabetic	1		1	
Non-diabetic	1.10 (0.63 to 1.89)	0.739	1.59 (0.84 to 3.05)	0.156
Body mass index (kg/m²)				
<20 to ≤24	1		1	
≤20	0.61 (0.41 to 0.91)	0.015	0.82 (0.53 to 1.29)	0.398
>24	0.81 (0.48 to 1.36)	0.419	0.71 (0.39 to 1.31)	0.274
Estimated GFR (mL/min/1.73m²)				
≤45	1		1	
>45	0.96 (0.67 to 1.37)	0.819	1.04 (0.70 to 1.54)	0.836

GFR, glomerular filtration rate.

lead to reduced RTW.^{21–24} Non-medical factors, such as type and status of job, also crucially influence RTW, as they deeply involve the occupational environment and social security. In Japan, individuals with disability, such as transplant patients, are given financial and occupational compensations. Transplant recipients still receive healthcare insurance after KT, and have advantages in employment, because companies are required to employ individuals with disability, which should account for 2.0% of all employees. These policies usually promote RTW; however, these compensations can be controversial,

because they either promote or delay RTW, as some recipients prefer to not RTW, whereas others prefer to partially RTW after KT.

Although KT may not fully restore normalcy to patients' lives, recent studies based on data collected from national registries revealed a 40%–70% employment rate in a large sample of participants.^{25–29} However, some articles reported that the employment rate of KT recipients decreased significantly from 68% to 38%¹² and worsened after KT.³⁰ There have been many reports on the RTW rate after transplants. Among them, employment rates

**Table 2B** Univariable and multivariable analyses of predictors of full return to work among Japanese kidney transplant recipients

Variables	Univariable analysis		Multivariable analysis	
	OR (95% CI)	P value	OR (95% CI)	P value
Age (years)				
≤40	1		1	
>40	1.55 (1.09 to 2.20)	0.014	1.56 (0.92 to 2.62)	0.096
Sex				
Female	1		1	
Male	2.56 (1.74 to 3.77)	<0.0001	1.95 (1.25 to 3.06)	0.0033
Marital status				
Married	1		1	
Single	1.60 (1.08 to 2.36)	0.017	1.46 (0.95 to 2.23)	0.081
Pretransplant treatment				
Dialysis	1		1	
Pre-emptive	1.16 (0.72 to 1.89)	0.529	1.37 (0.81 to 2.30)	0.239
Non-manual worker/manual worker				
Manual worker	1		1	
Non-manual worker	1.59 (1.09 to 2.30)	0.016	1.47 (0.99 to 2.19)	0.057
Manager/non-manager				
Non-manager	1		1	
Manager	2.23 (1.55 to 3.20)	<0.0001	1.95 (1.25 to 3.06)	0.0033
Donor				
Spouse	1		1	
Parent	1.30 (0.88 to 1.92)	0.196	1.24 (0.70 to 2.20)	0.455
Other family members	0.74 (0.41 to 1.34)	0.324	0.82 (0.43 to 1.56)	0.552
Deceased donor	0.91 (0.42 to 1.97)	0.804	0.92 (0.38 to 2.19)	0.837
Diabetic/non-diabetic				
Diabetic	1		1	
Non-diabetic	1.17 (0.69 to 1.99)	0.562	1.42 (0.77 to 2.62)	0.264
Body mass index (kg/m²)				
<20 to ≤24	1		1	
≤20	0.72 (0.49 to 1.07)	0.104	0.96 (0.62 to 1.49)	0.861
>24	0.71 (0.44 to 1.17)	0.184	0.75 (0.45 to 1.26)	0.282
Estimated GFR (mL/min/1.73m²)				
≤45	1		1	
>45	1.05 (0.74 to 1.49)	0.779	1.02 (0.70 to 1.49)	0.908

GFR, glomerular filtration rate.

among KT recipients are generally said to be higher than those among other transplant patients, and KT recipients would be expected to achieve local employment.³¹ These differences in RTW rate among the different studies may be explained by the differences in company healthcare systems, study participants, and study design and methodologies, making it difficult to estimate an overall RTW rate after KT.^{12 14 25–29 31}

In Japan, some studies have reported about the sick leave rate of stroke and cancer patients, among others.^{9 10} They showed that the predictors of early RTW include

young age, male sex and a managerial position. Based on these data, we investigated the predictors of early RTW after KT in this study.

As for the results of the Cox regression analysis, we demonstrated that RTW was sooner among male recipients than among female recipients, which was consistent with the findings of a previous study.³² There are possible explanations for this sex difference. Most married female KT recipients whose husbands are engaged in paid work do not necessarily need to make an early RTW. The predominance of male in the formal employment is a

social phenomenon that follows the trend of the general population.¹³ A large percentage of the female population is still predominantly involved in unpaid housework, and the sex differences in this study reflect the differences in the social and domestic roles of men and women in the Japanese society.³³ Although we excluded unpaid work in this study, we should consider that female recipients might have changed to unpaid housework after KT. From the perspective of work-life conflict, this result should be suggestive for occupational physicians to discuss about sexual equality.

Recipients involved in managerial positions tended to take a shorter time to RTW than non-managers. To the best of our knowledge, there are no KT recipient studies investigating the managerial position as a predictor of RTW. In some studies, among managers, the RTW rate among those with more work-related loyalty was shown to be higher.^{10 31} However, there was a conflicting report stating that recipients with a high family income had no significant tendency to RTW.²⁷ Endo *et al* hypothesised that managers with more important occupational positions have a stronger intent to RTW than non-managers, which may explain the higher RTW rate.¹⁰ They also demonstrated that there is no strong relationship between intent and income. In addition, non-manual workers tended to make, especially, full RTW after KT. This data suggested that full RTW can be physically burdensome for transplant recipients, and non-manual workers may have the advantage in terms of RTW.

Other factors reported that predictors of RTW include having high education levels, high-paying jobs, married status and non-diabetic status.^{12 27–29 32 34} It is expected that a shorter dialysis duration before KT could result in a better likelihood of RTW, because the mortality and complications after KT depend on the duration of dialysis.^{35 36} However, in this study, there were no differences in the duration of dialysis. Two other studies also reported that pretransplant dialysis was not a significant predictor of RTW.^{37 38} This could be due to the fact that most KT donors in Japan are alive; thus, patients are allowed to decide when they would undergo KT, keeping in mind not only their physical condition but also their job status. In other words, the timing of KT could be based on the patients' preference.⁶

In general, RTW is one of the most important outcomes of therapy in ESRD. Compared with dialysis, KT offers the opportunity of RTW and provides substantial economic and social benefits to patients.^{2 32 39} RTW itself may improve the quality of life of KT recipients by providing an opportunity for social reintegration and increasing self-esteem.^{9 40} However, RTW may be regarded as a proof of social recovery, which entails the assumption that patients' work capacity has recovered to a level that enables them to RTW.⁹ However, RTW for KT patients is quite complex, and is dependent on a variety of medical and non-medical factors. Our study is helpful in predicting RTW after KT for both factors.

When interpreting the results of the present study, several limitations should be noted. First, we cannot deny

the existence of comorbidities. Participants may have had other disorders during sick leave, such as cardiovascular diseases or malignancies, that are often found in KT recipients. Knowledge of comorbidities is necessary owing to their influence on time to RTW. Second, because this study was retrospective in nature, the possibility of recall bias regarding the timing of RTW exists. Third, because we could not include patients who had died after KT or who had been lost to follow-up, there was an immortal time bias and the rate of RTW could have been overestimated. In future studies, further clarification of the predictors of sick leave due to ESRD is required to better support the drafting of the RTW strategy. Prospective studies on all ESRD patients, which should include not only KT but also dialysis patients, are needed to investigate the RTW strategy.

CONCLUSION

The cumulative partial/full RTW rates at 2, 4, 6 and 12 months were 22.3%, 59.0%, 77.1% and 85.0%, respectively, in this study. Moreover, 'male sex' and 'a managerial position' were identified as predictors of partial/full and full RTW. Our study findings are helpful not only for medical professionals but also for companies and the society, as we provide some hints for improving RTW support system and healthcare policies.

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Competing interests None declared.

Patient consent for publication Obtained.

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Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request.

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