Social Participation After Kidney Transplantation as a Predictor of Graft Loss and Mortality Over 10 Years

A Longitudinal Study

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Background. Social participation is considered to be an objective parameter for evaluating the success of transplantation. This study explores the association between posttransplant factors (kidney function, perceived side effects of immunosuppressive treatment, comorbidity, physical and mental health-related quality of life [HRQoL]) and social participation in patients 3 months to 6 years after kidney transplantation (baseline) and their impact on graft loss and mortality for up to 10 years (follow-up). **Methods.** At baseline, 331 patients provided their socioeconomic and medical data (comorbidity, kidney function) and completed the end-stage renal disease symptom checklist (perceived side effects), the Short Form Health Survey-36 and the Participation Scale. At follow-up, information on all-cause graft-loss and mortality was noted. Binary logistical regression exploring the effects of the independent variables on social participation and Cox regression analyses determining whether social participation predicted graft loss and mortality were performed. **Results.** Restrictions in social participation were associated with living alone, poorer kidney function, lower perceived side effects of corticosteroids, higher perceived cardiac and renal dysfunction, higher perceived posttransplantation distress, lower physical HRQoL, and fewer working hours. Restrictions in social participation increased the risk of all-cause graft loss 2.29-fold and the risk of all-cause mortality 11.94-fold during follow-up. Education, kidney function, and comorbidity also increased the risk for poor patient outcome. **Conclusion.** Kidney function, perceived side effects, comorbidities, and HRQoL affect social participation in patients after kidney transplantation. Additionally, social participation has a positive effect on long-term patient outcomes, decreasing the odds of graft loss and mortality over 10 years.

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Kidney transplantation (KT) is established as the best treatment modality for patients with end-stage renal disease because of its superior effect on mortality, cost, and quality of life in comparison with other renal replacement therapies.[1,2] When compared with patients on dialysis, patients after KT also report greater independence, more engagement in social and recreational activities, and a better ability to work.[3] In recent years, the level of social participation[4]—the level of involvement in life situations, such as self-care, learning and applying knowledge, domestic, community, and social life[5]—has become one of the goals and objective parameters for evaluating the success of transplantation. Among solid organ recipients, KT recipients have the highest likelihood of returning to work after transplantation[4] and thereby contributing to society as well as further improving their own quality of life. Previous studies have linked social participation with age and education,[6] clinical factors, such as comorbidity or time from KT,[7,8] and previous level of social participation.[4]

Immunosuppression plays an essential role in the process of preventing graft rejection and improving long-term survival. Its side effects can, however, compromise the Health-Related Quality of Life (HRQoL) of KT recipients[9] and potentially also their social participation (SP).[10] Kidney function is a vital indicator of the proficiency of the transplantation and of immunosuppressive treatment. Loss of kidney function was found to be associated with deteriorated HRQoL and poorer allograft survival[11-14]; however, its effect on SP was not confirmed,[7] unlike comorbidity, which was found to negatively influence SP.[8]

Although a number of studies have explored the determinants of SP in patients after KT, to our knowledge, no study

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has investigated the association of SP and long-term patient outcomes, such as graft loss or mortality. The aim of this study was to explore the association between post-KT factors, such as kidney function, side effects of immunosuppressive treatment, comorbidity, physical and mental HRQoL, and SP at baseline. Furthermore, we explored the impact of SP when controlled for relevant sociodemographic and medical factors at baseline on future graft loss and mortality for up to 10 years.

RESULTS

The basic characteristics of the sample are shown in Table 1. There were no differences found between the SP groups in their sociodemographic factors and medical factors, number of rejection episodes, or type of immunosuppressive protocol, except for kidney function. The significant differences between the SP groups are displayed in Table 2.

Social Participation

When analyzing the factors associated with restrictions in SP, the model produced by binary logistical regression explained 34.2% of the variance. Patients with restrictions in SP had a higher chance of living alone, poorer kidney function, lower levels of reported side effects of corticosteroids (end-stage renal disease symptom checklist-transplantation module [ESRD-SCL-TM]), higher levels of reported cardiac and renal dysfunction (ESRD-SCL-TM), higher reported transplantation-related distress (ESRD-SCL-TM), lower physical HRQoL, and fewer hours of work (Table 3).

Graft Loss and Mortality

Information on patient and graft survival was collected 4 to 10 years after the first data collection, with an average follow-up period of 7.1 (±2.3) years.

TABLE 1.

Characteristics of the sample

Sociodemographic variables (T1)	N (%) or mean (±SD)
Sex	
Men/women	187 (56.5%)/144 (43.5%)
Age	49.64 (±11.99)
Education	
Primary/Secondary/University	62 (18.7%)/152 (45.9%)/117 (35.3%)
Income	
Low (≤1.5×min wage)/average (1.5–2×min. wage)/high (≥2×min. wage)	190 (57.4%)/64 (19.3%)/77 (23.3%)
Family status	
Living alone/cohabitating	102 (30.8%)/229 (69.2%)
Medical variables	
Kidney function (estimated glomerular filtration rate [mL/min/1.73m^2])	54.74 (±19.29)
Time since transplantation at baseline, yr	1.63 (±1.43)
Charlson Comorbidity Index	2.76 (±1.16)
Organ donor	
Deceased/living	311 (94%)/ 20 (6%)
Duration of dialysis, yr	3.63 (±3)
Primary kidney disease	
Glomerulonephritis/tubointersticial nephritis/polycystic kidneys	134 (40.5%)/49 (14.8%)/24 (7.3%)
Diabetes mellitus/other or unknown causes	28 (8.5%)/96 (29%)
Current immunosuppressive protocol (T1)	
Pred + CsA + MMF[4]/Pred + MMF + Tac[5]/CsA + MMF/other	185 (55.9%)/79 (23.9%)/23 (7%)/44 (13.2%)
Side effects, coping and health-related quality of life	
Perceived side effects of immunosuppressive treatment (ESRD-SCL TM)	1.14 (±0.76)
Limited physical capacity/limited cognitive capacity/side effects of corticosteroids/cardiac and renal dysfunction/increased growth of gums and hair/KT-related psychologic distress	1.52 (±0.89)/ 1.17 (±0.87)/ 1.05 (±0.8)/ 1.07 (±0.83)/ 0.76 (±0.81)/ 1.27 (±0.76)
Physical and mental health-related quality of life (SF-36)	
PCS/MCS	39.52 (±9.47)/47.58 (±9.67)
The Participation Scale	
No restriction (SP1)/restrictions (SP2–SP4)	49 (14.8%)/ 282 (85.2%)
Hours of work per week	6.88 (±10.37)
Patient and graft survival	
Average follow-up, yr	7.09 (±2.3)
Patient and graft survival/patient mortality/graft loss	260 (78.5%)/ 21 (6.3%)/ 50 (15.1%)

Pred, prednisone; CsA, cyclosporin A; MMF, mycophenolate mofetil; Tac, tacrolimus; ESRD-SCL TM, end-stage renal disease symptom checklist-transplantation module; SF-36, Short Form (36) Health Survey; KT, kidney transplantation; PCS, physical component summary; MCS, mental component summary.

TABLE 2.

Significant results of Mann-Whitney *U* test comparison of social participation groups

	No restrictions in SP (SP1)	Some restrictions in SP (SP2–SP4)	Group comparison
	Mean (±SD)	Mean (±SD)	
Age	46.45 (±12.49)	50.2 (±11.8)	*
Kidney function (estimated glomerular filtration rate [mL/min/1.73 m^2])	64.44 (±16.73)	53.08 (±19.27)	***
Physical component summary (SF-36)	44.12 (±9.21)	38.72 (±9.31)	***
Limited cognitive capacity (ESRD-SCL-TM)	0.94 (±0.87)	1.13 (±0.86)	*
Cardiac and renal dysfunction (ESRD-SCL-TM)	0.74 (±0.77)	1.13 (±0.82)	***
Increased growth of gums and hair (ESRD-SCL-TM)	0.57 (±0.74)	0.79 (±0.82)	*
KT-related psychologic distress (ESRD-SCL-TM)	0.96 (±0.66)	1.32 (±0.77)	**
Hours of work per week	12.87 (±12.25)	5.86 (±9.67)	***

*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$.

ESRD-SCL TM, end-stage renal disease symptom checklist-transplantation module; SF-36, Short Form (36) Health Survey; KT, kidney transplantation.

The chi-square of the Cox regression model for all-cause graft loss was 71.07 ($P \leq 0.001$) and only two variables contributed significantly to the model: decreased kidney function (hazard ratio [HR], 0.97; $P \leq 0.01$) and restrictions in SP. The risk of graft loss was significantly higher for patients perceiving restrictions in their SP (HR, 2.29; $P \leq 0.01$) (Table 4).

The chi-square of the Cox regression model for all-cause mortality was 50.3 ($P \leq 0.001$). The risk of dying during follow-up were increased for patients with primary (HR 3.48, $P \leq 0.01$) and secondary education (HR, 2.32; $P \leq 0.05$) as opposed to university education, for patients with higher number of comorbidities (HR, 1.28; $P \leq 0.05$), and for those perceiving restrictions in their SP (HR, 11.94; $P \leq 0.001$). The risk of dying during follow-up decreased for patients with better kidney function (HR, 0.98; $P \leq 0.05$) (Table 4).

DISCUSSION

With improvements in survival and morbidity in KT, one of the goals and objective parameters for evaluating the success of transplantation became the level of contribution to a meaningful and productive life.[4,15,16] Therefore, this study explored the determinants of social participation in patients 3 months to 6 years post-KT as well as the impact of social participation on future graft loss and patient mortality for

TABLE 3.

Factors associated with restrictions in social participation

		Factors associated with restrictions in SP (SP2–SP4)[a]		
		Wald	Exp (B)	95% CI
Age		0.3	0.99	0.95-1.03
Sex[b]		2.13	2	0.79-5.1
Family status[c]		7.12*	3.97	1.44-10.93
Education[d]	Primary	1.5	0.46	0.13-1.6
	Secondary	0.05	1.1	0.46-2.64
Time since KT, yr		0.62	1.15	0.81-1.63
Kidney function (eGFR)		18.35***	0.95	0.92-0.97
Charlson comorbidity index		0.33	0.89	0.01-1.32
Limited physical capacity	(ESRD-SCL-TM)	1.98	0.54	0.23-1.28
Limited cognitive capacity	(ESRD-SCL-TM)	1.09	0.64	0.27-1.49
Side effects of corticosteroids	(ESRD-SCL-TM)	5.46*	0.39	0.18-0.86
Cardiac and renal dysfunction	(ESRD-SCL-TM)	4.88*	2.64	1.12-6.26
Increased gum and hair growth	(ESRD-SCL-TM)	1.39	1.54	0.75-3.18
KT-related psychologic distress	(ESRD-SCL-TM)	5.92*	2.87	1.23-6.7
PCS		5.69*	0.93	0.89-0.99
MCS		0.33	1.02	0.96-1.07
Work hours per week		10.74***	0.95	0.92-0.98
Nagelkerke R^2			34.2%	

[a] Reference category: no restrictions in SP (SP1).
[b] Male sex.
[c] Married.
[d] University education.
*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$.
R^2: total variance explained by the model.
ESRD-SCL TM, end-stage renal disease symptom checklist-transplantation module; SF-36, Short Form (36) Health Survey; KT, kidney transplantation; PCS, physical component summary; MCS, mental component summary; eGFR, estimated glomerular filtration rate; 95% CI, 95% confidence interval.

TABLE 4.

Cox regression models containing predictors of graft loss and all-cause mortality

	All-cause graft loss (21 events) score			All-cause mortality (50 events) score		
	2Log Likelihood		x^2	2Log Likelihood		x^2
	142.23***		71.07	419.4***		50.26
	Wald	HR	95% CI for HR	Wald	HR	95% CI for HR
Age	0.29	0.97	0.94-1.04	0.92	1.02	0.98-1.05
Sex[a]	0.68	0.64	0.22-1.87	0.02	0.96	0.48-1.9
Family status[b]	0.00	1	0.31-3.26	2.03	1.63	0.83-3.18
Education[c]	2.8			7.9*		
Primary	2.42	0.18	0.02-1.57	7.59**	3.48	1.43-8.43
Secondary	0.83	0.62	0.22-1.73	4.12*	2.32	1.03-5.24
Time since KT, yr	0.00	1	0.69-1.45	3.1	0.84	0.69-1.02
Kidney function (eGFR)	4.99**	0.97	0.94-0.99	4.4*	0.98	0.96-0.99
CCI	2.41	0.43	0.15-1.25	5.7*	1.28	1.05-1.57
Work hours per week	0.04	1	0.97-1.04	0.5	0.98	0.94-1.03
Restrictions in SP (SP2–SP4)[d]	14.9**	2.29	1.51-3.5	11.55***	11.94	2.86-49.92

[a] Reference category: male sex.
[b] Reference category: married.
[c] Reference category: university education.
[d] Reference category: no restrictions in SP (SP1).
*$P \leq 0.05$; **$P \leq 0.01$; *** $P \leq 0.001$.
CCI, Charlson comorbidity index; KT, kidney transplantation; eGFR, estimated glomerular filtration rate; 95% CI, 95% confidence interval; HR, hazard ratio.

up to 10 years. Our findings indicate that patients who reported "restrictions in SP" had poorer kidney function, lower levels of reported side effects of corticosteroids, higher levels of reported cardiac and renal dysfunction, and higher levels of transplantation-related distress. Additionally, patients with "restrictions" also had a higher chance of living alone, lower physical HRQoL, and fewer hours of work than patients with "no restrictions." Unlike the previous study of Van der Mei et al.[8] who found no association between kidney function and SP, poor kidney function was identified in this study as one of the most significant factors associated with restrictions in SP. Higher levels of perceived side effects of immunosuppressive treatment have been previously linked with lower perceived HRQoL[17,18]; however, a study on their effect on SP is still lacking.[10] Our results indicate that not all perceived side effects are negatively associated with restrictions in SP—patients who perceive their cardiac and renal function as worse and report increased anxiety about the uncertainty of how long the transplanted graft will function, or who broods about the kidney donor also tend to report restrictions in SP. Surprisingly, patients with no restrictions in SP were more likely to report more side effects of corticosteroids. This could indicate that if the KT recipients perceive their immunosuppressive treatment as effective in maintaining good kidney function, the presence of side effects, such as changes to their appearance, for example, a puffy face, do not deter them from being actively involved in their lives and community. It is also possible that other factors, such as age, sex, or time from transplantation, have an underlying role in the way side effects determine HRQoL and SP.

When it comes to SP and HRQoL, our results linking restrictions in SP and lower physical HRQoL are similar to a previous study conducted by Levasseur et al.[19] who found a weak relationship between total scores of quality of life and SP in a sample of older persons. Thraen-Borowski et al.[20] on the other hand found that engaging in any social participation versus none was associated with higher mental, but not physical, HRQoL in older, long-term colorectal cancer survivors.

In our sample, belonging to the group reporting "restrictions in SP" was not only associated with significantly lower physical HRQoL but also with a higher chance of living alone. When compared with the "no restrictions" group, this group was also significantly older and with a lower number of work hours, factors that might have been affecting their level of SP even before the transplantation. The "restrictions group" also had a higher presence of more severe, however, possibly temporary factors such as side effects, and perhaps by managing these, the perception of one's restrictions would change as well. Unfortunately, in this study, we were not able to further explore this hypothesis.

When analyzing the impact of SP on future patient outcomes, we found that decreased kidney function and restrictions in SP increased the risk of future graft loss. In addition, lower education, worse kidney function, higher comorbidity, and restrictions in SP increased the risk for mortality. Although to our knowledge no study to date has explored SP as a determinant of survival or mortality, studies in the general population support these findings. Hsu[21] found that having paid or unpaid work could lower future risk of mortality for the elderly in Taiwan, concluding that activities that accompany economic security or spiritual well-being may be related to longevity. Similarly, Dalgard and Haheim,[22], in their study with 17 years follow-up, found that SP had a strong direct effect on mortality and argued that SP is related to inner, psychologic resources and life style and has a rather stable effect on the control over one's own life, and thereby health. To a certain extent, this may explain why the number of hours spent at work, study, or housework was not associated with graft loss or mortality. According to Van der Mei et al.,[10] the work status of patients after KT improved after the surgery, but it did not necessarily lead to "normal" work outcomes. The participation scale used in this study captures more than

the ability to work because it includes the perceptions of equal opportunities to take part in life situations related to self-care, domestic life, and community life,[23] all of which are associated with having control over one's own life, as mentioned by Dalgard and Haheim.[22]

Strengths and Limitations

The main strength of this study is the combination of sociodemographic, medical, and psychosocial variables in a prospective follow-up for an average of 7.1 years. In addition, our cohort included a relevant number of national transplanted recipients, as during the observation period the average number of patients undergoing kidney transplant at the Louis Pasteur University Hospital Transplantation centre in Kosice, Slovakia, was 31.4 per year—about one quarter or all KTs carried out in Slovakia. Furthermore, for this study all consecutive patients fitting the inclusion criteria were asked to participate to prevent selection bias. However, this may also be considered as one of the limitations of the study—all of our patients were enrolled from a single center. Because SP has been previously found to differ depending on culture and ethnicity[24] and our sample consisted of predominantly white Caucasian patients, our findings cannot be generalized without further consideration. The study participants were not assessed at a uniform posttransplantation time. We did control all analyses for the number of years since KT, but it was not a significant factor in either analysis. We have limited information on patients who dropped out before the start of this study because of graft loss or mortality as well as on the level of their social participation before KT. In our sample, only approximately 15% of patients reported no restrictions, which could have affected the results.

It is also important to mention the potential limitations of the scales used in this study. The ESRD-SCL-TM scale was originally developed with a specific input from KT recipients in the era of predominantly prednisone-based and cyclosporine-based immunosuppressive protocols, and therefore some of its items may not be relevant. We compared the results of ESRD-SCL-TM in our patients depending on their immunosuppressive protocol, but surprisingly, no differences were found regarding the type of protocol. The Participation Scale was previously used in a large number of chronic disease populations; however, to our knowledge, this is the first study that uses it in KT recipients. Finally, causal associations between predictors and outcomes cannot be definitely confirmed.

Implications

Patients reporting no restrictions in social participation, better kidney function, lower number of comorbidities, and higher education had higher odds of surviving with a functioning graft. These results show the importance of close monitoring of posttransplantation SP along with kidney function and comorbidities because of their effect on long-term patient outcomes. Although time spent at work was associated with higher SP, it did not directly affect future outcomes, and therefore monitoring SP should include all factors outlined by the International Classification of Functioning, Disability, and Health.

Special attention should be paid to the management of the side effects of immunosuppressive treatment because poor management of anti-rejection medication seems to have a strong link to restrictions in SP. Although some of these effects may not seem as severe, they can cause a high level of distress in the patient and lead to decreased SP and possibly even to breaking the immunosuppressive regimen. However, to confirm this relationship, pathways between perceived side effects, SP, and adherence should be examined. A multidisciplinary team at a transplantation unit could assist their patients in improving their future social participation by providing information on opportunities to get involved in various interest groups to increase their skills and level of participation or in patient groups which could provide peer support from others experiencing a similar situation to their own. In other cohorts, interventions using a problem-solving approach, delivering a combination of services, and providing skills-training were previously used to increase social participation, with the strongest evidence supporting a problem-solving approach.[25] The benefits of this approach need to be verified in KT recipients, however. Future research should also consider additional factors, such as physical activity, adherence, and depression, as well as the level of pretransplant SP.

Furthermore, the effect of improvement/deterioration of posttransplantation SP on long-term patient outcomes should be explored.

Conclusion

We found that restrictions in social participation were associated with living alone, worse kidney function, more severe side effects of immunosuppressive treatment, and lower physical HRQoL. No restrictions in SP at baseline was associated with decreased odds of graft loss or dying at follow-up, along with higher education, better kidney function, and a lower number of comorbidities. Our findings show the importance of closely monitoring not only kidney function but also SP. To further unravel the relationships pathways between perceived side effects, both SP and HRQoL should be examined.

MATERIALS AND METHODS

Sample

All consecutive patients from the Louis Pasteur University Hospital Transplantation centre in Kosice, Slovakia (catchment area, about 1.5 million inhabitants), who underwent a kidney transplant in the years 2003 to 2009 and met the inclusion criteria were asked to participate. To be included in the study, patients had to fulfil the following criteria: to be a minimum of 3 months and a maximum of 6 years after KT, to have a functioning graft, and to have no psychiatric disease, including severe dementia and mental retardation, listed in their medical records. At follow-up in the year 2013, data on patient status (patient and graft survival) were collected.

Of the total number of patients visiting the Transplantation Centre in Kosice, 438 met the inclusion criteria and were asked to participate. Of these, 74 patients (16.9%) declined to participate and an additional 33 returned incomplete data (7.5%), resulting in 331 patients (response rate 75.6%) who provided their data at baseline. There were no significant differences between respondents and nonrespondents regarding age and sex. The local Ethics Committee approved the study. All participants were provided with information about the study and signed an informed consent statement before the study. Participation in the study was fully voluntary and anonymous, with no incentives provided for participation (Figure 1).

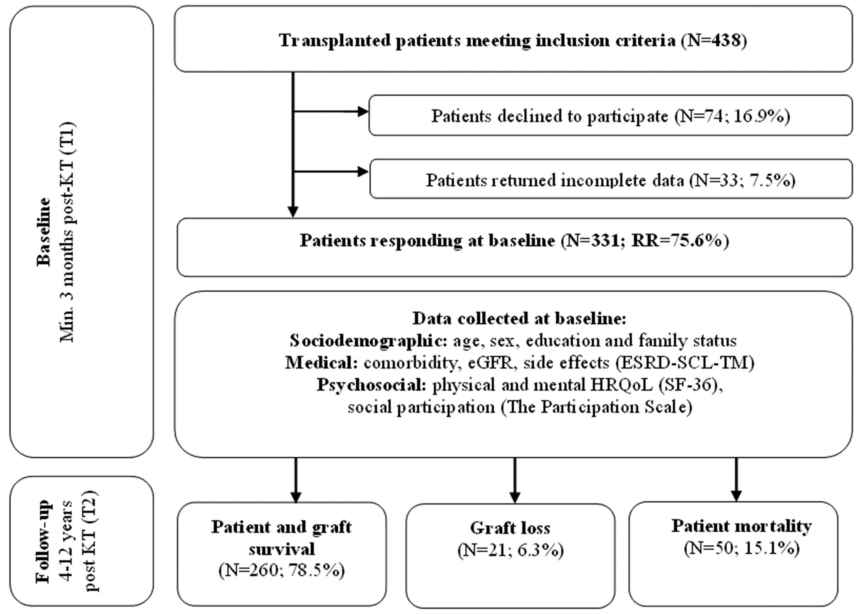

FIGURE 1. Flow-chart diagram of the participants. eGFR, estimated glomerular filtration rate; ESRD-SCL-TM, end-stage renal disease symptom checklist-transplantation module; SF-36, Short Form Health Survey.

Measures

Sociodemographic Data

The sociodemographic variables—age, sex, education, average income, and marital status—were obtained in a structured interview by a trained interviewer. Educational background was categorized into three groups: primary, secondary, and university education, depending on the level of education completed. Average income was first evaluated by dividing the household budget by the number of persons in the household and then categorized based on the legal minimum wage in the Slovak Republic as follows: low (lower than 1.5 times the minimum wage), average (1.5 times to 2 times the minimum wage), and high (higher than 2 times the minimum wage). Family status was represented by two options: living alone (single, divorced, and widowed) and cohabitating (married/living in a cohabitating relationship). All of the sociodemographic variables were used for group comparison; however, only sex, education and marital status were used in the analysis.

Medical Data

Information about kidney function was taken from patient medical records. The estimated glomerular filtration rate (eGFR) to asses kidney function at baseline was calculated using the Chronic Kidney Disease Epidemiology Collaboration formula (CKD-EPI) (ml/min/1.73 m^2).[26,27]

Comorbidity was assessed using the Charlson Comorbidity Index (CCI),[28] which uses a simple weighted scoring system based on the presence or absence of 19 comorbid conditions. Each comorbid condition is assigned a score ranging from 1 to 6 depending on the risk of dying associated with it. Scores are then summed to provide a total score. The CCI has been validated as a predictor of survival and health status in numerous patient groups, including the chronic kidney disease population.[29]

All-Cause Graft Loss and All-Cause Mortality

At follow-up in 2013 (4–10 years after the first data collection), information about all-cause mortality and all-cause graft loss were obtained from medical records. No patients were retransplanted during the follow-up period.

Side Effects

To assess the perceived side effects of immunosuppressive treatment at baseline, patients completed the ESRD SCL-TM.[30] This questionnaire was developed to assess disease-specific distress and consists of six subscales: (1) limited physical capacity, (2) limited cognitive capacity, (3) cardiac and renal dysfunction, (4) side effects of corticosteroids, (5) increased growth of gum and hair, and (6) transplantation-associated psychologic distress. The number of items for each subscale varies from 5 to 10, and for each item, patients estimated the severity of the symptom on a scale from 0 (not at all) to 5 (extremely). Afterward, a severity index for each symptom and the whole scale is computed by dividing the severity index score by the number of items in the subscales.[30] In our sample, the coefficient of internal consistency reliability, Cronbach's α, was 0.96 for the total scale and ranged from 0.89 (limited physical capacity) to 0.81 (side effects of corticosteroids) for the subscales.

Health-Related Quality of Life

Health-Related Quality of Life was evaluated using the Short Form Health Survey-36, which consists of 8 subscales: physical functioning (PF), role limitation attributable to physical problems (RP), bodily pain, perception

of general health, social functioning, vitality, role limitation attributable to emotional problems, and mental health. The first four subscales (PF, RP, bodily pain, perception of general health) comprise the physical component summary (PCS), and the other four subscales (social functioning, vitality, role limitation attributable to emotional problems, and mental health) comprise the mental component summary (MCS).[31] The component summary scores are normalized to a general population mean of 50 and a standard deviation of 10, where higher scores indicate better health status.[32] In this study, the summary component scores were used. The validity and reliability of the Short Form Health Survey-36 have been confirmed in patients after KT.[33,34] In our sample, the coefficient of internal consistency reliability, Cronbach's α, ranged from 0.83 (RP) to 0.90 (PF) for the subscales, and for PCS and MCS Cronbach's α was 0.90 and 0.91, respectively.

Social Participation

Social participation was assessed by the number of hours of work per week and by completing the Participation Scale.[23] Information on the number of hours of work per week was obtained in a structured interview by a trained interviewer. Patients who were full-time or part-time students were considered to be full-time or part-time working, and for patients who were retired, the hours of housework were recorded instead.

The Participation Scale was developed according to the International Classification of Functioning, Disability and Health[5] and was validated for the Slovak population.[35] This scale consists of 18 items for which respondents are asked to identify whether or not they perceive themselves to have the same opportunities as their healthy peers to take part in life situations related to mobility, self-care, domestic life, community life, and so on. Once the areas of perceived restrictions are identified, the extent to which they see each restriction as a problem in their life is indicated on a scale from 1 (no problem) to 5 (large problem). Depending on the total score, patients were split in 4 groups: SP1 "no restrictions" (0–12), SP2 "mild restrictions",[13-22] SP3 "moderate restrictions",[23-32] and SP4 "high restrictions" (over 33).[23] In this study, the latter three groups were combined because of the low number of patients in groups SP3 and SP4. In our sample the coefficient of internal consistency reliability, Cronbach's α, was 0.93.

Statistics

Frequencies, means, and standard deviations were calculated for the sample description. The Mann-Whitney *U* test and chi-square test were used to examine the differences between respondents and nonrespondents as well as between the SP groups. Then, binary logistical regression analysis was performed to identify the determinants of restrictions in SP (SP2-4). "Restrictions in SP" was set as a dependent variable, with the "no restrictions" group set as a reference. The following variables were entered in the analysis: sociodemographic variables (age, sex, family status, education), medical variables (eGFR, CCI, time since KT), side effects of immunosuppressive treatment (ESRD-SCL-TM subscales), physical and mental HRQoL (PCS, MCS) and work hours per week. Finally, two Cox regression analyses were performed to determine the association between SP and graft loss and mortality. The following variables were entered in the analysis: sociodemographic variables (age, sex, family status, and education), medical variables (eGFR, CCI, and time since KT), SP, and work hours. IBM SPSS 20 for Windows was used to analyse the data (IBM Company, Chicago, IL).

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